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ABSTRACTS

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ABSTRACTS

Track Signal and Image Technology (SIT)

SIT-S1: Video Processing and Coding

33 **Adapting the Streaming Video Based on the Estimated Position of the Region of Interest**

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Keywords: streaming video, region of interest, sum of absolute differences, mean opinion scores

Abstract Streaming real time video over wireless networks cannot guarantee that all the frames could meet their deadlines. Wireless networks may suffer from bandwidth limitations. To reduce the streaming data over wireless networks, we propose a technique to identify, and extract the Region Of Interest (ROI), and drop the non-ROI from the frames that are between the reference frames. The Sum of Absolute Differences (SAD) will compute the consecutive video frames to identify the ROI as it considered the most motion and important region. The reconstruction mechanism to the non-ROI is performed on the mobile side by applying linear interpolation between the reference frames. We evaluate the proposed approach by using Mean Opinion Score (MOS) measurements. MOS are used to evaluate the two scenarios with equivalent encoding size, where the users observe the first scenario with a low bit rate for the original videos, while for the second scenario the users observe our proposed approach. The results show that our technique significantly reduces the amount of data, while the reconstruction mechanism provides acceptable video quality to the mobile viewers. (Page 1)

42 **Exploiting Visual Cues in Non-Scripted Lecture Videos for Multi-modal Action Recognition**

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Keywords: visual actions, action classification, recognition, multi-modal analysis, lecture videos

Abstract The usage of non-scripted lecture videos as a part of learning material is becoming an everyday activity in most of higher education institutions due to the growing interest in flexible and blended education. Generally these videos are delivered as part of Learning Objects (LO) through various Learning Management Systems (LMS). Currently creating these video learning objects (VLO) is a cumbersome process. Because it requires thorough analyses of the lecture content for meta-data extraction and the extraction of the structural information for indexing and retrieval purposes. Current e-learning systems and libraries (such as libSCORM) lack the functionally for exploiting semantic content for automatic segmentation. Without the additional meta-data and structural information lecture videos thus do not provide the required level of interactivity required for flexible education. As a result, they fail to captivate students' attention for long time and thus their effective use remains a challenge. Exploiting visual actions present in non-scripted lecture videos can be useful for automatically segmenting and extracting the structure of these videos. Such visual cues help identify possible key frames, index points, key events and relevant meta-data useful for e-learning systems, video surrogates and video skims. We therefore, propose a multi-model action classification system for four predefined actions performed by instructor in lecture videos. These actions are writing, erasing, speaking and being idle. The proposed approach is based on human shape and motion analysis using motion history images (MHI) at different temporal resolutions allowing robust action classification. Additionally, it augments the visual features classification based on audio analysis which is shown to improve the overall action classification performance. The initial experimental results using recorded lecture videos gave an overall classification accuracy of 89.06\%. We evaluated the performance of our approch to template matching using correlation and similitude and found nearly 30\% improvement over it. These are very encouraging results that prove the validity of the approach and its potential in extracting structural information from instructional videos. (Page 8)

120 **Video Error Concealment of P-frame Using Packets of the Following Frames**

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Keywords: Error concealment, following frame packets, H.264/AVC

Abstract For real-time video streaming over unreliable networks, the losses or delay of the video packets may deteriorate the video quality at the receiver side. The traditional temporal error concealment methods try to guess the lost motion vectors (MVs) of the lost

macro blocks (MBs) by exploiting the received motion information of the neighboring macroblocks, and that of the co-located macro block in the previous frames. The accuracy of this motion vector will affect the performance of the error concealment method. In this paper, instead of only exploiting the motion information in the current and previous frames, we also use the motion information in the following frames. In this case, more accurate estimation of the motion vector could be achieved, This leads to better concealment performance. Experimental results demonstrate that the proposed method can improve the performance in comparison with the traditional error concealment methods, for instance, the gain could be up to 0.6 dB for the "Foreman" video sequence. (Page 15)

16 LORD: LOw-complexity, Rate-controlled, Distributed Video Coding System

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Keywords: Bayer format, distributed video coding, endoscopy videos, motion extrapolation, wyner-ziv coding

Abstract Distributed Video Coding (DVC) is an emerging coding scheme that employs principles of source coding with side information (SI) at the decoder. In this paper, we present a new DVC encoder, named LORD (LOw-complexity, Rate-controlled, Distributed video coding system). No feedback channel is used in our encoder, and an adaptive noise model that varies both spatially and temporally is employed. The SI is created using motion extrapolation, resulting in a low delay encoding process. We extend LORD for encoding videos acquired by Bayer sensors in endoscopy, in which only partial information of the colors in each pixel is known. This special video format has not been addressed yet in the DVC framework. We show that, using LORD, a significant improvement in performance is achieved over a standard intra-coding method with a similar complexity, on a set of examined videos. (Page 21)

SIT-S2: Depth Camera Image Processing

1 Efficient Depth Image Compression Using Accurate Depth Discontinuity Detection and Prediction

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Keywords: 3D video compression, depth-image compression, predictive coding, segmentation

Abstract This paper presents a novel depth image compression algorithm for both 3D Television (3DTV) and Free Viewpoint Television (FVTV) services. The proposed scheme adopts the K-means clustering algorithm to segment the depth image into K segments. The resulting segmented image is losslessly compressed and transmitted to the decoder. The depth image is then compressed using a bi-modal block encoder, where the smooth blocks are predicted using direct spatial prediction. On the other hand, blocks containing depth discontinuities are approximated using a novel depth discontinuity predictor. The residual information is then compressed using a lossy compression strategy and transmitted to the receiver. Simulation results indicate that the proposed scheme outperforms the state of the art spatial video coding systems available today such as JPEG and H.264/AVC Intra. Moreover, the proposed scheme manages to outperform specialized depth image compression algorithms such as the one proposed by Zanuttigh and Cortelazzo. (Page 29)

73 3D Reconstruction of Urban Environments Based on Fisheye Stereovision

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Keywords: fisheye, spherical, stereovision, 3D, epipolar, urban

Abstract In this paper, we show some results about 3D urban scenes reconstruction using a fisheye stereovision setup. We propose an analytical analysis of epipolar geometry of the system and an analytical description of tools to compute a 3D point cloud from matched pixels. The novelty is that we do not rectify the images and that we match points along 3D or 2D epipolar curves. The matching process is based on a global dynamic programming algorithm that we adapt to take into account continuous epipolar curve equation. We show 3D point cloud in the case of synthetic images. (Page 36)

165 An RGB-D Database Using Microsoft's Kinect for Windows for Face Detection

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Keywords: RGB-D face database, face detection, face recognition, Kinect

Abstract The very first step in many facial analysis systems is face detection. Though face detection has been studied for many years, there is not still a benchmark public database to be widely accepted among researchers for which both color and depth information are obtained by the same sensor. Most of the available 3d databases have already automatically or manually detected the face images and they are therefore mostly used for face recognition not detection. This paper purposes an RGB-D database containing 1581 images (and their depth counterparts) taken from 31 persons in 17 different poses and facial expressions using a Kinect device. The faces in the images are not extracted neither in the RGB images nor in the depth hereof, therefore they can be used for both detection and recognition. The proposed database has been used in a face detection algorithm which is based on the depth information of the images. The challenges and merits of the database have been highlighted through experimental results. (Page 42)

257 **Temporal Denoising of Kinect Depth Data**

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Keywords: temporal denoising, Kinect, depth instability, smoothing depth data, adaptive gain

Abstract The release of the Microsoft Kinect has attracted the attention of researchers in a variety of computer science domains. Even though this device is still relatively new, its recent applications have shown some promising results in terms of replacing current conventional methods like the stereo-camera for robotics navigation, multi-camera system for motion detection and laser scanner for 3D reconstruction. While most work around the Kinect is on how to take full advantage of its capabilities, so far only a few studies have been carried out on the limitations of this device and fewer that provide solutions to enhance the precision of its measurements. In this paper, we review and analyse current work in this area, and present and evaluate a temporal denoising algorithm to reduce the instability of the depth measurements provided by the Kinect over different distances. (Page 47)

SIT-S3: Enhancement

2 **Edge-Based Automatic Parameter Selection for Sub-Optimal Image Despeckling Using Kuan Filter**

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Keywords: Denoising, filtering, Kuan, multiplicative noise, speckle

Abstract Multiplicative speckle noise is a common problem found in several imaging applications, mainly in SAR and ultrasound imaging. This paper targets the Kuan despeckling filter and seeks to optimize its output without the need for several runs of the filter with the parameters adjusted each time. The proposed solution estimates the optimal filter parameter value, which results in near-optimal performance, where the PSNR loss does not exceed 0.1 dB most of the time, compared to the best possible filter output. (Page 53)

109 **Removal of Salt and Pepper Noise Using Sparse Representation**

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Keywords: salt and pepper noise, Sparse Representation, Dictionaries

Abstract This paper proposes a new method to remove salt and pepper noise in gray scale images as well as color images. This is done in two stages. In the first stage impulse noise detection scheme is employed to detect the noisy pixel. This filter uses the morphological noise detector to classify the pixels as either corrupted or uncorrupted. In the second stage we treat the noisy pixel as a missing pixel in the image and apply in painting based on the sparse representations of the pixels that are identified as corrupted pixels in the first stage. Our experimental results show that the proposed method outperforms other best known denoising techniques used for the removal of salt and pepper noise, both visually and quantitatively. Extensive experiments have been carried out on different images to validate the efficiency of the proposed method. (Page 58)

110 **Design and Application of a New Multiscale Multidirectional Non-subsampled Filter Bank**

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Keywords: Multiscale Filter Bank, Multidirectional Filter, Denoising

Abstract We propose a new method for design of computationally ef- ficient nonsubsampled multiscale multidirectional filter bank with perfect reconstruction (PR). This filter bank is composed of two nonsubsampled filter banks, for multiscale decomposition and for directional expansion. For multiscale decomposition, we transform the 1-D equivalent subband filters directly into 2-D equivalent subband filters. The computational cost is considerably reduced by avoiding the computation of 2-D convolutions. The multidirectional decomposition utilizes fan filters. A new method for design of 2-D zero phase FIR fan filter transformation function is developed. This method also aids the transformation of a 1-D filter bank to a 2-D multidirectional filter bank. The potential application of the proposed filter bank is illustrated by comparing the image denoising performance of the proposed filter bank with other design method that exist in available literature. (Page 64)

168 **Visibility Enhancement Based Real-Time Retinex for Diverse Environments**

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Keywords: defog, Retinex algorithm, image enhancement

Abstract This paper proposes a modified structure of Retinex algorithm for the image enhancement method. The proposed algorithm performs robustly and stably on various environments, particularly in bad weather and night vision. Especially, Retinex algorithm tends to show outstanding results as compared with other approaches, and also shows advantages at night vision. However, the Retinex algorithm has problems such as the halo effect and the color distortion. In this paper, the proposed algorithm has a simple idea to

remove above problems that combines a reflectance and a luminance image with some constant factors respectively. Since the result includes the luminance component, it works on diverse environment such as not only foggy image but also night vision image. Furthermore, this algorithm has proper structure for real time processing. Results on a variety of images show the effectiveness of this approach. (Page 72)

SIT-S4: Face Recognition

15 Compressed Sensing Face Recognition Method in Heterogeneous Database with Small Sample Size Problem

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Keywords: Face recognition, Nomad Biometric Authentication (NOBA), small sample size, compressed sensing, sparse representation

Abstract Face recognition is one important task in Nomad Biometric Authentication (NOBA) project. However, as many other face databases, it will easily produce the Small Sample Size (SSS) problem in some applications with NOBA data. Thus this paper uses the Compressed Sensing (CS) algorithm to solve the SSS problem in NOBA face database. Some experiments can prove the feasibility and validity of this solution. (Page 80)

86 Face Recognition Using Multiscale and Spatially Enhanced Weber Law Descriptor

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Keywords: Face recognition, Weber local descriptor, FERET, Fisher score

Abstract The paper introduces multiscale spatial Weber local descriptor (MSWLD) for robust face recognition system. In the proposed method, WLD is calculated in different neighborhood (multiscale) and WLD histograms are obtained from blocks of an image to preserve spatial information. WLD histograms from different blocks are then concatenated to produce the final feature set of a face image. Fisher ratio is applied to extract the dominant bins from the final WLD histogram. The MSWLD is evaluated on FERET and AT&T databases. In the experiments, the proposed method outperformed two state of the art techniques, namely, principal component analysis and local binary pattern. (Page 85)

89 An Effective Face Detection Algorithm Based on Skin Color Information

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Keywords: skin color detection, color spaces, morohplogical operations, self organizing maps

Abstract Face detection approach is presented in this paper combines skin color detection and neural network. The first motivation for our paper is to decide which color space is the best in order to build efficient skin color detector can be embedded in the overall face detection system. The proposed skin detection approach uses a chrominance distribution model of skin-color information in the input image in order to detect skin pixels over the entire image. Next, morphological operations are used in order to smooth the detected skin region and generate, finally, face candidates for face-base applications. Finally, neural network is used in order to verify these face candidates. Many experiments using color images gathered from the Internet and from our own database are conducted and give encouraging results. It is expected to combine the proposed face detector with face recognition approach to be embedded later in human computer interaction applications. (Page 90)

106 Who Said That? The Crossmodal Matching Identity for Inferring Unfamiliar Faces from Voices

Escoto Sotelo E.A., Tomoaki Nakamura, Takayuki Nagai, Escamilla Hernandez E.

Keywords: Gaussian Mixture Models, EM Algorithm, Pseudo 2-D Hidden Markov Model, Audio-Visual Integration Crossmodal Matching Identity System

Abstract This paper proposes a method for matching unfamiliar person's face to unfamiliar voice. The idea behind this is crossmodal perception of human including many illusions such as the McGurk effect, ventriloquist illusion, and so on. Especially, we focus on recent psychological evidence suggesting human can do matching between unfamiliar faces and unfamiliar voices to some extent. The aim of this paper is to mimic this ability on a computer. In order to realize the matching of an unfamiliar person's face to an unfamiliar voice, a dataset of pairs of facial images and corresponding voices are used as knowledge. It means that the unfamiliar voice is matched to the closest known speaker model. Since the database contains corresponding facial image, the system can estimate a closest known face from the unfamiliar voice. Finally each unfamiliar face is matched to the estimated known face and the final recognition result is obtained. To this end, we first implement a speaker recognition system based on Mel Frequency Cepstral Coefficients as the speech feature and Gaussian mixtures models as the classifier. We also use a two-dimensional HMM-based face recognizer and propose a statistical integration of audio/visual recognition results. To show the possibility of the proposed system, unfamiliar speaker recognition experiments are carried out using 60 sentences from the ATR-503 sentences uttered by 20 university students. (Page 97)

108 Face Recognition Based on Sparse Representation Classifier with Gabor-Edge Components Histogram

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Keywords: face recognition, face descriptor, facial feature, Gabor wavelet, edge components histogram

Abstract We describe a new method for recognizing humans by their face, which is robust to the variations of facial imaging conditions, with high accuracy. The human face recognition system consists of three components: i) a new face descriptor based on edge component histogram and its variance between pixels, ii) Gab or-edge components histogram for facial image representation, combining the Gab or wavelet and the proposed edge components histogram, iii) a sparse representation classifier for the face recognition. The effective and robust face recognition with high accuracy is achieved by the Gab or-edge components histogram and the sparse representation classifier. In experiments, higher face recognition performances, which are 99.45% on ETRI database and 99.41% on XM2VTS database, have been achieved. (Page 105)

SIT-S5: Medical Imaging , Biometrics

28 Measuring the Quality of IRIS Segmentation for Improved IRIS Recognition Performance

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Keywords: segmentation quality, iris authentication, OSIRIS, EER, execution time, GMM

Abstract In this paper, we present three versions of an open source software for biometric iris recognition called OSIRIS_V2, OSIRIS_V3, OSIRIS_V4 which correspond to different implementations of J. Daugman's approach. The experimental results on the database ICE2005 show that OSIRIS_V4 is the most reliable on difficult images while OSIRIS_V2 is the fastest. So, we propose a novel strategy for iris recognition using OSIRIS_V2 for good quality images and OSIRIS_V4 when the quality of the segmentation of OSIRIS_V2 is not sufficient to ensure good performance. To this end, we measure the quality of an iris segmentation thanks to a GMM model trained on good quality iris texture and we use a threshold on this quality value to shift between the 2 versions of OSIRIS. We show on ICE2005 database how the choice of this threshold value allows compromising between performance and processing speed of the complete process. (Page 110)

101 Biometrics Information Protection Using Fuzzy Vault Scheme

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Keywords: Biometrics, Fuzzy Fingerprint Vault, Cancellable Biometrics

Abstract Biometric based authentication can provide strong security for identifying the users. In addition, the security of biometric data is important, because most biometric data is not changeable in a lifetime. However, cancellable biometrics can stores a non-invertible transformed version of the biometric data. Namely, the biometric data is safely remained even if the storage is compromised. The cryptographic construction, called fuzzy vault, has recently been proposed. The fuzzy vault aims to secure critical data with the biometric template in a way that only the authorized user can access the secret by providing the valid biometric. In this paper, we propose three solutions for fuzzy fingerprint vault. First is more efficient fuzzy fingerprint vault with automatic alignment. Second solution can be resistant to correlation attack. Third is fuzzy fingerprint vault for OTP (One Time Template). (Page 124)

113 A Model Based Approach for Vessel Caliber Measurement in Retinal Images

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Keywords: Ophthalmology, Retinal image analysis, Retinal blood vessels, Width measurement, Model fitting

Abstract The diagnostic signature of many microvasculature diseases like diabetes mellitus, hypertension and arteriosclerosis includes the changes incurred in the diameter of retinal blood vessels. Therefore estimation of precise vascular widths is a critical and demanding process in automated retinal image analysis. This paper proposes an automated system to measure the vessel caliber in the retinal images of multi-ethnic school children. The diameter measurement is based on the detection of the centerline pixels from a vessel probability map image, determining the vessel orientation at these pixels, extracting the vessel segments and later using a two dimensional model, which is optimized to fit various types of intensity profiles of vessel segments. The width is then estimated from parameters of the optimized model. The method is also used to explore the relationship between the average vessel width and the background pigmentation of the retinal image by analyzing monochromatic representations of different color spaces. (Page 129)

193 Accurate Segmentation of Breast Tumors in Ultrasound Images Using a Custom-Made Active Contour Model and Signal-to-Noise Ratio Variations

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Keywords: Ultrasound imaging, tumor segmentation, active contour models, signal-to-noise ratio, computer-aided diagnosis tools, cancer detection

Abstract Outlining tumors in ultrasound B-mode images is an important process in many diagnostic procedures, but manual tumor segmentation is usually a time-consuming and challenging task. This paper presents a custom-made active contour model that is specifically designed for segmenting tumors in ultrasound images. The algorithm starts by drawing a circular contour around a manually selected point inside the tumor. The vertices of the circular contour are iteratively moved from the interior of the tumor to the tumor boundary. The motion of the vertices is controlled using an ultrasound-based statistical parameter, called the envelope signal-to-noise ratio (SNR), that is sensitive to variations in tissue anatomy. The proposed algorithm has been used to outline breast tumors in 10 ultrasound B-mode images. When compared to tumor outlines delineated by a human expert, the outlines obtained using the proposed algorithm achieved sensitivity values as high as 96.98%. The proposed algorithm provides a simple and accurate method for tumor segmentation in ultrasound images. (Page 137)

67 Guided Gabor Filter for Finger Vein Pattern Extraction

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Keywords: finger vein, guided gabor filter, vein pattern extraction, enhancement

Abstract In this paper, a novel explicit image filter, called Guided Gabor filter, is proposed to extract the finger vein pattern without any segmentation processing, and lower performance reduction for poor quality images which result from low contrast, illumination, or noise effects, etc. The proposed filter is contributed for finger vein enhancement, noise reduction, and haze removal without being affected by the brightness of the vein. It performs well not only on ridge detection like the Gabor filter, but on image enhancement as an edge-preserving smoothing operator without the gradient reversal artifacts. The experimental results show that the proposed method is able to get vein pattern more clearly and faster than the existing methods, and improve the matching performance with higher recognition rate. (Page 118)

68 A Comparison of Different Gabor Features for Mass Classification in Mammography

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Keywords: Mass Classification, Gabor Filter Bank, Directional features, Mammography, SEL weighted SVM, PCA, LDA

Abstract Masses are among the early signs of breast cancer, which is the second major cause of death in women. For mass detection, a mammogram is segmented into regions of interest (ROIs) that contain masses as well as suspicious normal tissues, which lead to false positives. The problem is to reduce the false positives by classifying ROIs as masses and normal tissues. Further, the detected masses are needed to be discriminated as benign and malignant. We investigate the performance of six different Gabor feature extraction approaches for these mass classification problems. These techniques employ Gabor filter banks for extracting multiscale and multiorientation texture features which represent structural properties of masses and normal dense tissues in mammograms. The feature extraction approaches are evaluated over the ROIs extracted from MIAS database. Successive Enhancement Learning based weighted Support Vector Machine (SELwSVM) is used to efficiently classify the generated unbalanced datasets. The best performance in terms of area under ROC curve (Az = 1.0) is obtained by the Gabor features extracted using first order statistics of the Gabor responses and LDA. (Page 142)

SIT-S6: Image Segmentation

32 Hough Transformed Based Ship Segmentation Using Centerline Extraction and Feature Angles

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Keywords: Ship Segmentation, Hough Transform, Edge Detection

Abstract Image segmentation is a very important step in order to accomplish automatic tasks, such as classification, being continuously demanded by our society. However, the particular case of naval images entails issues that may exacerbate the conditions for segmentation. Specifically due to water reflections the gray distribution might be very disperse throughout the image and waves produce a large amount of edges. They differ from one image to another too and thus, patterns of color or brightness are difficult to be found. Nevertheless, in this paper we take advantage of these negative characteristics by applying a Hough Transform based technique that enhances the shape of the ship. First, the ship centerline is extracted and the desired feature angles are applied based on this value. The preliminary results are further processed to obtain higher accuracy. The set of parameters is presented and discussed, as well as the non-maximal suppression step and the voting strategy employed. The results reach a higher level of detail compared to previous suggested techniques for this kind of images. (Page 149)

48 Cursive Handwritten Segmentation and Recognition for Instructional Videos

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Keywords: cursive handwriting, text segmentation, text recognition, character classification, instructional videos

Abstract In this paper, we address the issues pertaining to segmentation and recognition of cursive handwritten text from chalkboard lecture videos. Recognizing handwritten text is a challenging problem in instructor-led lecture video. The task gets even tougher with varying handwriting styles and blackboard type. Unlike handwritten text on whiteboard and electronic boards, chalkboard represents serious challenges such as, lack of uniform edge density, weak chalk contrast against blackboard and leftover chalk dust noise as a result of erasing- and many others. Moreover, the varying color of boards and the illumination changes within the video makes it impossible to use trivial thresholding techniques, for the extraction of content. Many universities throughout the world still heavily rely on chalkboard as a mode of instruction. Therefore, recognizing these lecture content will not only aid in indexing and retrieval applications but will also help understand high level video semantics, useful for Multi-media Learning Objects (MLO). In order to encounter those adversaries, we here propose a system for segmentation and recognition of cursive handwritten text from chalkboard lecture videos. We first create a foreground model to segment background blackboard. We then segment the text characters using one-dimensional vertical histogram. Later, we extract gradient based features and classify those characters using an SVM classifier. We obtained an encouraging accuracy of 86.28% on 5-fold cross validation. (Page 155)

70 Real-time Object Detection by Road Plane Segmentation Technique for ADAS

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Keywords: Object detection, Road plane segmentation, ADAS

Abstract Advanced Driver Assistance Systems (ADAS) are used for assisting the drivers by providing advice and warnings when necessary. CTA (Cross Traffic Alert) systems are a subset of ADAS used for detecting objects (viz., cars, trucks, pedestrians, static objects etc) by using one or more moving cameras, mounted on a vehicle. Usually, CTA systems can detect moving objects within region of interest (ROI). These systems have limitations in detecting static objects present in the RoI and often they fail to detect the objects in shadow regions. Moreover, such systems sometimes detect shadows as the objects. This paper presents a histogram back-projection based road-plane segmentation technique. Histogram back-projections' are applied on saturation and value channels of the video, to detect moving and non moving objects in the ROI. Robustness to the shadow is achieved by applying a logical operation on the back-projections of the saturation and the value channels of the video. Effectiveness of the technique is evaluated by applying the technique on several videos, captured under different scenarios, and by measuring true negatives and false positives for the objects. The technique is suitable for real time applications and can be employed in automatic back-up assistance during the host vehicle parking, blind spot detection, pedestrian detection, and other camera applications for the detection of the objects. (Page 161)

119 Edge-Enhancing of Color Segmented Images

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Keywords: color images, segmentation, edge-preserving smoothing filter

Abstract This paper introduces a new approach to edge-preserving smoothing of color segmented images. It is well suited for an efficient reduction of the texture contours in colored images that is an essential step in applications such as image classification or image retrieval. The algorithm reduces the artifacts in the homogeneous areas, but preserves all image structures like edges or corners. Our procedure uses mean-shift algorithm to obtain a colored segmented images. The filtering algorithm is not only applicable to color images segmented using mean-shift, but can be applied to any segmented images too. It is formalized through the definition of a morphological window and a homogeneity measure on this window. The adaptive filter presented here tries to overcome some of the disadvantages of existing smoothing filters and is conceived as an extension of the morphological profiles filtering. The experimental results over Berkeley database images show that the proposed method is well suited for textured image scenes. (Page 168)

151 Recursive-TFR Algorithm for Segmentation of Remotely Sensed Images

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Keywords: image segmentation, texture, remote sensing

Abstract Segmentation of remote sensing images is challenging task not only for the intrinsic complexity of imaged scenes but also for their multiple-scale interpretation. Hierarchical techniques, which provide a sequence of nested segmentation maps for the scene at different scales are therefore very promising. The Texture fragmentation and reconstruction technique (TFR) carries out a hierarchical image segmentation based mainly on textural image properties. In this work we consider its improved version, Recursive-TFR, based on recursive binary segmentation, assess its performance experimentally on a suitable segmentation benchmark, prove its potential for remore-sensing imagery and point out promising developments. (Page 174)

SIT-S7: Watermarking, Image Compression

41 Auto White Balance Using the Coincidence of Chromaticity Histograms

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Keywords: auto white balance, chromaticity, histogram, coincidence, overlap

Abstract This paper presents a simple and robust auto white balance algorithm using the coincidence of chromaticity histograms. After analyzing the relationship between the coincidence of the color histogram and color constancy, the overlap area of chromaticity histograms that keep chromaticity of color images but not the effect of luminance existing in the color histogram is employed to estimate the correct illuminant in scenes. When the overlap reaches the maximum, correspondingly the respective gain coefficients of color channels can be derived to achieve the white balance of the camera. Through numerous experiments and evaluations based on the processing of real world images, the proposed coincidence of chromaticity histograms algorithm achieves the outstanding performance comparing to other algorithms. Furthermore, the simplicity, easy implementation and robustness to the luminance make it flexibly apply to the vision system of the autonomous robot running outdoor. (Page 201)

200 Yamagushi Decomposition Based on the Compact Polarimetry Mode Using RADARSAT2 Data

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Keywords: Compact polarimety, SAR, four component, decomposition

Abstract Recently, dual-mode partially polarimetric SAR modes (DP) called compact polarimetry have been proposed. In these polarimetric configurations, only one transmit/receive cycle is required instead of two in a full quad-pol system, reducing the pulse repetition frequency and data rates by a factor of two for a given swath width. Souyris et al. introduced the n/4 compact polarimetric mode, in which the transmitted polarization is the superposition of linear horizontal and vertical polarizations H + V, resulting in a linear polarization oriented at 45' with respect to the horizontal. The radar receives returns in horizontal and vertical polarizations. Another hybrid dual-pol mode is the circular transmit, linear receive (CTLR) mode. In these new polarimetric modes, an equivalent covariance or coherency matrix may be reconstructed to produce the so-called pseudo quad-pol data that accurately reproduces the full quad-pol data. The compact polarimetry was proposed to assess various architecture designs that could be implemented on low-cost/low-mass. In that context, the comparison between full polarimetry (fp) versus dual polarimetry (dp) is a subject of most importance. This paper provides a comparison of the information content of full quad-pol data and the pseudo quad-pol data derived from compact polarimetric SAR modes. Both the polarimetric signatures based on the kennaugh matrix and the Four component decomposition in the context of this compact polarimetry mode are explored. We illustrate our results by using the polarimetric SAR images of Algiers city in Algeria acquired by the RadarSAT2 in C-band. (Page 209)

34 Tiled Image Container for Web Compatible Compound Image Compression

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Keywords: Compression algorithms, Web and internet services, Image quality

Abstract Encoding images containing mixed content in web compatible formats like PNG, GIF and JPEG poses challenges in maintaining the quality along with good compression. In this paper, we describe a method for improving the compression of web compatible compound images while retaining high quality. The proposed method is based on the principle that the compression ratio of a given image depends upon both the image content and the compression algorithm used. Therefore, encoding various tiled regions in a given image with the algorithm appropriate to the content in the region improves the overall compression of the image. Further optimizations like sharing of indexed colors between the various tiles in the same image and removal of duplicate tiles improve the compression. This method would support both lossy and loss less compression. The resulting encoded data can be rendered by a web browser supporting CSS background-cropping or HTML5 canvas APIs. (Page 182)

37 Modulation in the HVS Domain for Hardcopy Watermarking of Color Documents

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Keywords: Hardcopy Color Watermarking, Information and Document Security

Abstract This paper describes a novel color hardcopy watermarking embedding. The proposed color embedding provides high transparency by modulating the watermark into the value and saturation color components of the document. After the color document is printed and distributed, the message is decoded by scanning the document and applying the proposed post processing based on a Laplacian of Gaussian whitening filter. The decoding is performed in the frequency domain for speed and the optimal pattern detection threshold is determined by the analysis provided. An error correction code approach is proposed and the probabilities of false positives and false negatives for the embedding patterns are provided in the experiments for some printer and scanner devices. The examples illustrate the message coding using a combinatorial encoding and time division modulation to achieve with our error correction code approach a message payload of 168 bytes in a color image of about 2400 x 3200 pixels and estimated decoding probability per message

of 1.3E-7 for inkjet printer and 2.6E-10 for laser printer. The proposed modulation provides a very high perceived transparency. The objective resulting quality is contrasted with the perceived quality of the embedding by employing 3 objective metrics: PSNR, SSIM on the RGB and on HVS color models. For the proposed modulation, the SSIM on the HVS is the metric with best correspondence with the perceived quality by the human visual system. (Page 188)

133 Enhancement of Error-Correction Coding of Spatial Watermarks for JPEG Compression

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Keywords: Digital watermark, spatial domain, JPEG DCT compression, error-correction coding, Gray code

Abstract This paper demonstrates how channel coding can improve the robustness of spatial image watermarks against JPEG DCT-based compression. Two error-correction coding (ECC) schemes are used here. One scheme, referred to as the vertical ECC (VECC), is to encode information bits in pixel levels by error-correction coding where the Gray code is used to improve the performance. The other scheme, referred to as the horizontal ECC (HECC), is to encode information bits in an image plane by error-correction coding. VECC is also used to encode the code bits of HECC in pixels. Simple single-error-correcting block codes are used in VECC and HECC. Several experiments of these schemes were conducted on test images. The result demonstrates that the error-correcting performance of HECC depends on that of VECC, and accordingly, HECC enhances the capability of VECC. Consequently, HECC with appropriate codes can achieve stronger robustness to JPEG-caused distortions than non-channel-coding watermarking schemes. (Page 195)

SIT-S8: Learning, Classification

75 Robust PCA-GMM-SVM System for Speaker Verification Task

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Keywords: Speaker verification, Noisy environment, PCA, MFCC, GMM-SVM

Abstract This paper presents an automatic speaker verification system based on the hybrid GMM-SVM model working in real environment. An important step in speaker verification is extracting features that best characterized the speaker. Mel-Frequency Cepstral Coefficients (MFCC) and their firt and second derivatives are commonly used as acoustic features for speaker verification. To reduce the high dimensionality required for training the feature vectors, we use a dimension reduction method called Principal Component Analysis (PCA) in front-end step. Performance evaluations are conducted using the AURORA database and the robustness of the performed systems was evaluated under different noisy environments. The experimental results show that PCA dimensionality reduction improves significantly the recognition accuracy in speaker verification task, especially in noisy environments. (Page 214)

44 Group-Based Fast Mode Decision Algorithm for Intra Prediction in HEVC

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Keywords: HEVC, intra prediction, mode decision

Abstract High Efficiency Video Coding (HEVC), also known as H.265, is the next generation video compression standard beyond H.264. 35 intra prediction modes(IPM) are defined in HEVC to improve coding efficiency. But so many modes also result in the dramatically increased encoding complexity. In this paper, a novel fast intra mode decision algorithm is proposed to speed up the original intra coding in HEVC. Different from previous algorithms, we analyzed the statistics generated by rough mode decision (RMD) process which is adopted in HEVC. First, we found that the modes generated by RMD are usually adjacent to each other, thus representing roughly a same direction. We merged adjacent modes into same groups. Furthermore, early termination and pixel-based edge detection methods are employed to make accurate prediction by heuristically reducing the number of candidates for rate distortion optimization (RDO) process. Experimental results show that our proposed fast intra mode decision algorithm can obtain almost 23.52% time savings in all intra low complexity cases on average with negligible performance loss compared to the original HEVC intra coding in HM7.0. Meanwhile, the results are especially favorable when it comes to high resolution test sequences with up to 0.4% bit-rate increment and 21.81% time savings. (Page 225)

50 Improving SURF Image Matching Using Supervised Learning

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Keywords: SURF, Image Matching, Classification

Abstract Key points-based image matching algorithms have proven very successful in recent years. However, their execution time makes them unsuitable for online applications. Indeed, identifying similar key points requires comparing a large number of high dimensional descriptor vectors. Previous work has shown that matching could be still accurately performed when only considering a few highly significant key points. In this paper, we investigate reducing the number of generated SURF features to speed up image matching while maintaining the matching recall at a high level. We propose a machine learning approach that uses a binary classifier to identify key points that are useful for the matching process. Furthermore, we compare the proposed approach to another method for

key point pruning based on saliency maps. The two approaches are evaluated using ground truth datasets. The evaluation shows that the proposed classification-based approach outperforms the adversary in terms of the trade-off between the matching recall and the percentage of reduced key points. Additionally, the evaluation demonstrates the ability of the proposed approach of effectively reducing the matching runtime. (Page 230)

173 Definition and Performance Evaluation of a Robust SVM Based Fall Detection Solution

Imen Charfi, Johel Miteran, Julien Dubois, Mohamed Atri, Rached Tourki

Keywords:

Abstract We propose an automatic approach to detect falls in home environment. A Support Vector Machine based classifier is fed by a set of selected features extracted from human body silhouette tracking. The classifier is followed by filtering operations taking into account the temporal nature of a video. The features are based on height and width of human body bounding box, the user's trajectory with her/his orientation, Projection Histograms and moments of order 0, 1 and 2. We study several combinations of usual transformations of the features (Fourier Transform, Wavelet transform, first and second derivatives), and we show experimentally that it is possible to achieve high performance using a single camera.We evaluated the robustness of our method using a realistic dataset. Experiments show that the best tradeoff between classification performance and time processing result is obtained combining the original data with their first derivative. The global error rate is lower than 1%, and the recall, specificity and precision are high (respectively 0.98, 0.996 and 0.942). The resulting system can therefore be used in a real environment. Hence, we also evaluated the robustness of our system regarding location changes. We proposed a realistic and pragmatic protocol which enables performance to be improved by updating the training in the current location, with normal activities records. (Page 218)

122 Statistical Structure Modeling and Optimal Combined Strategy Based Chinese Components Recognition

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Keywords: Chinese component recognition, statistical structure modeling, neighbor selection, optimal combined strategy

Abstract Extracting perceptually meaningful components plays an essential role in Chinese character studying process. This paper proposes an improved statistical structure modeling method to pick up all meaningful components in one character. Each stroke is represented by the distribution of the feature points both in model component and input character. The stroke relations are effectively reflected by the statistical dependency. The mutual information among strokes can be calculated to measure the importance of relationships. Considering the local features of components' difference from the whole character recognition, this paper proposes a method based on local feature to select local components rather than the whole character. At last, we adopt optimal combined strategy to select the best component recognition result. By this method, all the components in one character can be achieved. (Page 238)

SIT-S9: Image Analysis I

127 Analysing Micro- and Macro-Structures in Textures

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Keywords: texture, LBP, filtering, highpass, lowpass

Abstract Analysing micro- and macro-structures within images confers ability to include scale in texture analysis. Filtering allows for selection of texture structures at different scales, revealing the micro- and macro-structures which would otherwise be concealed. The new approach to texture segmentation uses low- and high-pass filters to achieve this scale-based analysis. Segmentation is performed using Local Binary Patterns as an example of the type of feature vector that can be used with the new process. These are generated for the original image and each of the filtered images. A two stage training process is used to learn the optimum filter sizes and to produce model histograms for each known texture class. These are used in the supervised segmentation of texture mosaics generated from the VisTex database. The results demonstrate the superiority of the new combined approach compared to the best multi-resolution LBP configuration and analysis only using low pass filters. Noise analysis has also confirmed the advantageous properties of low- and high-pass filtering, and confirms that it is optimal to combine the two forms in texture segmentation. (Page 246)

132 Quality Measurement of Image Segmentation Evaluation Methods

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Keywords: segmentation, evaluation, comparison

Abstract Segmentation of images plays a significant role in image processing. For evaluating the quality of segmentation, several methods based on different approaches have been proposed. The essential question, therefore, arises how the quality of these evaluation methods can be compared. In this paper, we evaluate the quality of some published methods using a new methodology. We also present the results of such a comparison. (Page 254)

123 **Comparative Evaluation of Various Fractal Dimension Estimation Methods**

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Keywords: Fractal dimension estimation, image analysis, box-counting, area measurement, fractional Brownian motion (fBm)

Abstract The fractal dimension (FD) is an indicator of the complexity of form, shape or texture of images. Several fractal dimension estimation methods which lead to different results are developed. This paper draws up a survey on FD estimation methods and presents a comparative evaluation between eleven FD estimation techniques belonging to three different approaches namely box-counting, area measurement and fractional Brownian motion. (Page 259)

63 **A Clustering Algorithm of Trajectories for Behaviour Understanding Based on String Kernels**

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Keywords: clustering, trajectories analysis, string kernel

Abstract This work aims to identify abnormal behaviors from the analysis of humans or vehicles' trajectories. A set of normal trajectories' prototypes is extracted by means of a novel unsupervised learning technique: the scene is adaptively partitioned into zones by using the distribution of the training set and each trajectory is represented as a sequence of symbols by taking into account positional information (the zones crossed in the scene), speed and shape. The main novelties of this work are the following: first, the similarity between trajectories is evaluated by means of a kernel-based approach. Furthermore, we define a novel and efficient kernel-based clustering algorithm, aimed at obtaining groups of normal trajectories. The proposed approach has been compared with state-of-the-art methods and it clearly outperforms all the other considered techniques. (Page 267)

84 **Finding the Correspondence Points in Images of Multi-Views**

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Keywords: matching method, correspondence points, discriminative features, geometric constraint

Abstract There are many approaches being proposed to find the correspondence points between two images. They generally perform when used to find the correspondences between two images of the same object, such as in a video sequence or in a stereo camera. However, they fail if the number of true matches between two images was small compared to all the potential correspondence points found, which could happen if both scenes vary significantly, such as when the objects are not the same but of the same class. In this paper, we proposed an approach which uses both the geometric and appearance features to find the true correspondence points even if the number of true matches was small portion compared to all the correspondence points found. The experimental results show that the proposed method also stabilizes very fast compared to the other approaches in the literature. (Page 275)

SIT-S10: Image Analysis 2

76 **Stroke-Based Chinese Character Completion**

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Keywords: image completion, stroke extraction, partial match, character recovery

Abstract In this paper, we propose a method for completing the Chinese character in the image of Inscription rubbings or Chinese calligraphy that is corrupted by fissure and dirt. The method aim at completing the Chinese character from single image based only on the information the image contains. In our approach, for completing the corrupted image with Chinese characters, the structure of the Chinese characters is analyzed firstly using a modified stroke extraction method. All the contours of undamaged Chinese characters in the image are extracted and decomposed into a plausible set of strokes for reducing the problems by the strokes crossing or touching. Then, the structure of the characters in the missing regions is recovered by finding the similarity characters or similarity strokes though a partial contour matching method. Finally, we complete the image use the method with structure propagation, but the curves are not specified by user and are the contour of damaged characters we have recovered. (Page 281)

125 **Semantic Bag-of-Words Models for Visual Concept Detection and Annotation**

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Keywords: multi-model, Multiple Kernel Learning, Word-Net

Abstract This paper presents a novel method for building textual feature defined on semantic distance and describes multi-model approach for Visual Concept Detection and Annotation(VCDA). Nowadays, the tags associated with images have been popularly used in the VCDA task, because they contain valuable information about image content that can hardly be described by low-level visual features. Traditionally the term frequencies model is used to capture this useful text information. However, the shortcoming in the term frequencies model lies that the valuable semantic information can not be captured. To solve this problem, we propose the semantic bag-of-words(BoW) model which use WordNet-based distance to construct the codebook and assign the tags. The advantages

of this approach are two-fold: (1) It can capture tags semantic information that is hardly described by the term frequencies model. (2) It solves the high dimensionality issue of the codebook vocabulary construction, reducing the size of the tags representation. Furthermore, we employ a strong Multiple Kernel Learning (MKL) classifier to fuse the visual model and the text model. The experimental results on the Image CLEF 2011 show that our approach effectively improves the recognition accuracy. (Page 289)

149 A Novel Approach of Skew Normalization for Handwritten Text Lines and Words

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Keywords: normalization, skew, preprocessing, Handwritten text Recognition

Abstract Handwritten text recognition is an active research area for many years. Handwritten text recognition needs to perform some preprocessing steps for better recognition. Initially, we find binary image of given handwritten text document and then after performing the line segmentation task on handwritten text document, we have to normalize to the segmented lines. There are various normalization task we have to perform as skew normalization, slant normalization and size normalization. This paper, focuses on the skew normalization of handwritten text lines and we propose a new skew normalization approach which is based on orthogonal projection of the segmented line with respect to x-axis. The algorithm detects the exact skew angle, and corrects it efficiently. The method has been experimented on various text document images and achieves more than 98% accuracy. A comparative study has been reported to provide a detailed analysis of the proposed method together with some other existing methods in the literature. (Page 296)

158 Improving Barcode Detection with Combination of Simple Detectors

Péter Bodnár, László G. Nyúl

Keywords: barcode detection, computer vision, clustering, feature extraction, morphological filters, distance transformation, Hough transformation

Abstract Barcode detection is required in a wide range of real-life applications. Imaging conditions and techniques vary considerably and each application has its own requirements for detection speed and accuracy. In our earlier works we built barcode detectors using morphological operations and uniform partitioning with several approaches and showed their behaviour on a set of test images. In this work, we examine ensemble efficiency of those simple detectors using various aggregation methods. Using a combination of several simple features localization performance improves significantly. (Page 300)

182 A Novel Method for Accurate and Efficient Barcode Detection with Morphological Operations

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Keywords: barcode detection, computer vision, mathematical morphology, bottom-hat filter

Abstract Barcode technology is the pillar of automatic identification, that is used in a wide range of real-time applications with various types of codes. The different types of codes and applications impose special problems, so there is a continuous need for solutions with improved effectiveness. There are several methods for barcode localization, that are well characterized by accuracy and speed. Particularly, high-speed processing places need automatic barcode localization, e.g. conveyor belts, automated production, where missed detections cause loss of profit. In this paper, we mainly deal with segmentation of images with 1D barcode, but also analyze the operation of different methods for 2D barcode images as well. Our goal is to detect automatically, rapidly and accurately the barcode location by the help of extracted features. We compare some published method from the literature, which basically rely on the contrast between the background and the shape that represent the code. We also propose a novel algorithm, that outperforms the others in both accuracy and efficiency in detecting 1D codes. (Page 307)

SIT-S11: Efficient Image Processing

154 GPU Real-Time Medium Model for Artistic Temporally Coherent Rendering

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Keywords: Expressive Rendring, GPU, Medium Generation, Fractal

Abstract We present a consistent model for artistic medium reproduction in 3D scene renderings and animations. Computer generated stylized animations should reproduce the medium used by the artists while avoiding the artifacts present in hand-drawn animations. In our model, for each scene object, we create a surface grain according to the object geometry and apply it as additional material properties. Our system aims to make these additional material properties remain consistent to the scene / objects animation while avoiding the shower door and popping effects. Moreover, in contrast with existing methods in which coherence is primarily maintained during walkthroughs, our strategy consists in maintaining the grain attachment for any object rotations and non z-axis (i.e. depth) displacements and refining the grain density according to z-axis displacements. Furthermore to prevent this artifact, we propose to select salient additional material properties and reconstruct it for the whole image through a fractal surface reconstruction process. Our model is fully implemented on GPU, results are obtained without any adaptation of the original 3D scene or objects and the rendering process is real-time. (Page 319)

174 **An FPGA-based Real-time Background Identification Circuit for 1080p Video**

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Keywords: Field programmable gate arrays, real time systems, Object detection, High definition video

Abstract The paper proposes an improved hardware implementation of the OpenCV version of the Gaussian Mixture Model (GMM) algorithm. Truncated binary multipliers and a ROM compression technique are employed to reduce hardware complexity while increasing circuit processing capability. The OpenCV GMM algorithm is adapted to allow the FPGA implementation while providing a minimal impact on the quality of the processed videos. When implemented on Virtex5 FPGA the proposed circuit is able to process High Definition (HD) video sequences at 30 frame per second (fps) improving the performances with respect to previously proposed implementations (-7.6% in area and +12.6% in speed). (Page 330)

71 **An Effective Method to Enhance the RDO Performance for H.264/AVC Video Coding**

Wenshuo Zhou, Chun Yuan

Keywords: H.264/AVC, rate distortion optimization (RDO), prediction error, synthetic prediction picture

Abstract Rate-distortion optimization (RDO) plays quite an important role in today's video coding scheme. This approach seeks a balance between the coding rate and distortion of the picture. The rate of video sequences is negatively related to the distortion between the original pictures and the reconstructed frames in traditionally opinions, for both of them are greatly affected by the quantization parameter (QP) - the larger QP means the greater quantization error, which leads to less bit-rate and more distortion. However, the deduced conclusion maintains the feature that the more precise prediction may benefit both the performance of the rate and that of distortion, with other conditions unchanged. The proposed scheme derives a theoretical estimation an effective algorithm to generate the reference data with least mean square error (MSE) is raised afterwards , which can effectively reduce the prediction error both in IPPPP sequence mode and in IBBBB style. Experimental results provide evidence for substantial improvements (about 0.3-0.5 dB gain) than JM18.3 (the most recent H.264/AVC reference software). (Page 315)

192 **Fast Image and Video Segmentation Based on Alpha-tree Multiscale Representation**

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Keywords: alpha-tree, Multiscale Representation, Image Segmentation, Video Matting

Abstract In this paper, we propose to rely on a recent image representation model, namely the alpha-tree, to achieve efficient segmentation of images and videos. The alpha-tree is a multiscale representation of an image, based on its quasi-flat zones. An in-depth study of this tree reveals some interesting features of image pixels and regions. These features are then used in the design of both automatic and interactive segmentation algorithms. Interactivity is achieved thanks to a new and efficient implementation scheme. Experiments on the Berkeley Segmentation Dataset lead to very promising results. (Page 336)

SIT-S12: Image Sequence Processing, Motion

194 **Error Propagation in Multi-Camera Tracking**

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Keywords: Multi-camera, tracking

Abstract Multi-camera tracking often involve the projection of image data onto a ground plane. In this paper, we analyze the propagation of object tracking errors after trajectory transformation from multiple views onto the ground plane. In particular, we contrast a deterministic and a probabilistic algorithm and present an empirical study of their multiple object tracking results on dataset of 18000 frames. By measuring tracking accuracy, we highlight the processes that generate the most significant errors and how these errors impact the estimation of the final object location. Ultimately, the propagation of these errors from the image plane to the ground plane trajectories gives insights for future enhancement of the algorithms employed. (Page 343)

85 **Unsupervised Mask Patterns Generation for Extracting Action Specific Motion Features**

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Keywords: action recognition, CHLAC feature, motion feature, mask pattern

Abstract This paper presents unsupervised mask patterns generation for extracting action specific motion features. Cubic Higher-order Local Auto-Correlation (CHLAC) feature is robust to position changes of human actions in a video, and it is effective for action recognition. However, the mask patterns for extracting features are fixed. In other words, the mask patterns are independent of action classes. This is a merit but the features extracted from those mask patterns are not specialized for each action. Thus, we make mask patterns automatically for extracting action specific features by clustering of local spatio-temporal regions in each action. Since how to

extract features by the proposed mask patterns is the same as CHLAC, our method also has shift invariance property. By the experiments using the KTH dataset, the effectiveness of our method is shown. (Page 351)

117 **Fingertip's Speed Analysis for Touch Detection Using a Smart Phone**

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Keywords: Touch Detection, Fingertip Speed, Smart Phone

Abstract Though small size touch based displays have recently been very common, there is still much to do to make them affordable for larger sizes. One of the ways for doing so, which has be studied for the last decade, is to use camera based approaches in which one or more cameras are connected to a computer to use the processing power of the computer to provide touch features for a third device. This paper purposes such a system for providing touch features for a normal LCD monitor in which the only available processing power is the one provided by an android smart phone which is connected to the monitor. To recognize the actual touches this paper introduces the speed analysis of the fingertip which has been proven through experimental results to be effective and robust. (Page 359)

189 **Self-adaptive Feature Extraction Scheme for Mobile Image Retrieval of Flowers**

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Keywords: Self-adaptive, feature extraction, image retrieval, CBIR, segmentation, mobile

Abstract This paper proposes a new self-adaptive feature extraction scheme to improve retrieval precision for Content-based Image Retrieval (CBIR) systems on mobile phones such that users can search similar pictures for a query image taken from their mobile phones. The proposed methods employ a newly modified extraction method using the Canny edge-based Edge Histogram Descriptor (CEHD), Color Layout Descriptor (CLD) and the Curvature Scale Space (CSS) shape-based descriptor. To obtain object shapes, salient regions are detected by means of a multi-scale self-developed segmentation model. Experiments were conducted using flower images as image data in order to verify the most pertinent feature extraction methods in designing a domain knowledge-driven self-adaptive feature extraction scheme. Test results prove that the CSS descriptor is useful to determine prominent features of a flower image before employing additional extraction techniques. By that means, the system can enhance retrieval precision and avoid unnecessarily extracting insignificant features. (Page 366)

170 **First Steps Toward Spatio-Temporal Rheims Reconstruction Using Old Postcards**

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Keywords: Sparse data, Spatio-temporal 3D reconstruction, Image matching, Homography, Epipolar Geometry, Old postcards, Rheims

Abstract We address the problem of the 3D reconstruction of Rheims (France) using sparse data. We consider an old postcard dataset embodying the period from the beginning to the middle of the 20th century. Our reconstruction have to take into account spatial and temporal aspects that are implicitly characterizing our dataset. Indeed Rheims was destroyed during the first World War, we dispose of postcards taken before, during and after the war. The first steps of our work consists in determining the best way to match different views of the same place. This study reports on performance comparison of state-of-the-art couple of detectors-descriptors that are most robust and reliable in the context of our application. (Page 374)

SIT-S13: Image Analysis 3

159 **Image Segmentation through a Hierarchy of Minimum Spanning Trees**

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Keywords: Image Segmentation, Minimum Spanning Tree

Abstract Many approaches have been adopted to solve the problem of image segmentation. Among them a noticeable part is based on graph theory casting the pixels as nodes in a graph. This paper proposes an algorithm to select clusters in the images (corresponding to relevant segments in the image) corresponding to the areas induced in the images through the search of the Minimum Spanning Tree (MST). In particular it is based on a clustering algorithm that extracts clusters computing a hierarchy of Minimum Spanning Trees. The main drawback of this previous algorithm is that the dimension of the cluster is not predictable and a relevant portion of found clusters can be composed by micro-clusters that are useless in the segments computation. A new algorithm and a new metric are proposed to select the exact number of clusters and avoid unmeaningful clusters. (Page 381)

180 An Approach to Correcting Image Distortion by Self Calibration Stereoscopic Scene from Multiple Views

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Keywords: epipolar geometry, fundamental matrix, stereovision, distortion, projective rectification

Abstract An important step in the analysis and interpretation of video scenes for recognizing scenario is the aberration corrections introduced during the image acquisition in order to provide and correct real image data. This paper presents an approach on distortion correction based on stereoscopic self-calibration from images sequences by using a multi-camera system of vision (network cameras). This approach for correcting image distortion brings an elegant and robust technique with good accuracy. Without any knowledge of shooting conditions, the camera's parameters will be estimated. For this, the image key points of interest are extracted from different overlapping views of multi-camera system by local descriptor, matching is realized between the images, and then the fundamental matrix is estimated and rectified if necessary. It is finally possible to calculate the camera's extrinsic and intrinsic parameters. These geometric information of the camera are used as parameter's models of the distortion correction. (Page 389)

78 Copy-Move Image Forgery Detection Using Multi-Resolution Weber Descriptors

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Keywords: image forgery detection, Weber local descriptors, copy-move image forgery

Abstract Due to the maturing of digital image processing techniques, there are many tools, which can edit an image easily without leaving obvious traces to the human eyes. So the authentication of digital images is an important issue in our life. In this paper, multi-resolution Weber law descriptors (WLD) based method that detects copy-move image forgery is introduced. The proposed multi-resolution WLD extracts the features from chrominance components, which can give more information that the human eyes cannot notice. A support vector machine is used for classification purpose. The experiments are conducted on a large image database designed for forgery detection. The experimental results show that the accuracy rate of the proposed method can reach up to 91 % with multi-resolution WLD descriptor on the chrominance space of the images. (Page 395)

148 A Versatile Demosaicing Algorithm for Performing Image Zooming

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Keywords: Image demosaicing, image zooming, image resizing, color filter array

Abstract Recently, there has been an explosion in the design of color filter arrays (CFA). While CFAs used to be based on red, green and blue primary colors, there is also a trend for the design of CFAs that use non-RGB colors. Also, some demosaicing algorithms are now proposed that not only work for the popular Bayer CFA, but also for various types of CFAs. In this paper, we propose an approach for performing image resizing by using the generic demosaicing algorithm of Horé et al. The experimental results show that our approach is reliable and the performances in image resizing are better than some joint demosaicing and zooming algorithms as well as some popular resizing algorithms such as the Bilinear algorithm. (Page 402)

SIT-S14: Theory and Methods

12 A Fuzzy-Logic Based Non Cooperative Target Recognition

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Keywords: NCTR, KNN, HRR, RADAR, CLASSIFICATION, RECOGNITION, FUZZY LOGIC

Abstract In this paper, we present the problem of Non Cooperative Target Recognition (NCTR) as a supervised classification problem. After a brief presentation on the radar acquisition system of range profiles and the problem of recognition, we use a Fuzzy-Logic based algorithm to do this classification maximizing the recognition rate while controling the error rate. Unlike classical NCTR algorithms, this new algorithm allows to control error rate under a fixed value and maximize the recognition rate. (Page 410)

36 Multinomial Bayesian Kernel Logistic Discriminant Based Method for Skin Detection

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Keywords: Color skin detection, Logistic regression, Kernel Fisher's discriminant, Bayesian estimation

Abstract This paper deals with the detection of skin pixels in color images containing different ethnic groups' skins. These images are subject to any form of distortion such as the variation of illumination and the variety of capture devices. We have used combination scheme of linear classifiers where each one is devoted to a specific ethnic group. We used kernel Bayesian logistic regression because it outperforms many existing linear classifiers. It is shown that our scheme outperforms some existing skin detection methods that provide high classification scores. (Page 420)

43 **Local Multi-Modal SIFT Features in Co-registered Range and Intensity Images**

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Keywords: 2.5D feature extraction, 2.5D SIFT, range image, local features, range features

Abstract SIFT features have known limitations for matching features under changes in 3D pose of the object. We investigate the use of multimodal information from the range and intensity domains as an approach to mitigating the effects of changes in view point. In this investigation we outline an experimental procedure applied to range and intensity images of real-world objects captured using a stereo camera pair and calibrated turntable setup offering reliable ground truth for the 3D motion of surface locations. From our investigation we propose a novel surface descriptor, EC-SIFT, which shows a significant improvement on state of the art performance in the experiments we present. (Page 426)

30 **Methodology for the Construction and Enhancement of Risk-Parity Portfolios**

Donnacha Daly, Sebastiano Rossi, Florian Herzog

Keywords: Financial-Engineering? Risk-Management

Abstract The investment capital of a Risk-Parity (RP) portfolio is allocated in such a way that all portfolio constituents should contribute equally to the total “risk” of the portfolio. This is in contrast to more conventional asset management, such as equally weighted funds, in which capital (rather than risk) is distributed equally. While the RP concept is straight-forward, the implementation is less so, and is described here in detail. The economic rationale behind Risk-Parity is to enforce diversification, with the goal of increasing risk adjusted return on capital invested. Our RP construction, when applied to a managed futures portfolio, demonstrates improvement upon equal weighted allocation and other suitable benchmarks. Performance can be significantly enhanced by the overlay of market views on the asset allocator, a key innovation over conventional RP-Funds, which we name Active Risk-Parity (ARP). (Page 416)

Track Internet Based Computing and Systems (IBCS)

IBCS-S1: Web-Centric Systems

107 **Inference of an XML Schema with the Knowledge of XML Operations**

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Keywords: XQuery, XML schema, inference

Abstract Recently, plenty of methods dealing with automatic inference of XML schema have been developed, however, most of them utilize XML documents as their only input. In this paper, we focus on extending inference by incorporating XML operations, in particular XQuery queries. We discuss how can XQuery queries help in improving the inference process and we propose an algorithm based on chosen improvements, extending an existing method of a key discovery. Experimental results are a part of the paper. (Page 433)

260 **Generalizing and Improving SQL/XML Query Evaluation**

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Keywords: SQL/XML, XML compression, XML generation from relational databases for internet-based systems

Abstract SQL/XML has gained increasing interest whenever relational data has to be transformed to XML data, which is transferred, stored, or further processed in internet-based systems. However, SQL/XML is not supported by all relational database systems and SQL/XML query processing may become a bottleneck when large amounts of XML data are generated by SQL/XML queries. We have developed a technique to generalize and to improve the evaluation of SQL/XML queries in comparison to the SQL/XML query evaluation techniques provided by the database systems Oracle 11g and DB2. Our generalization supports the SQL/XML transformation of relational data into XML for all relational database systems, including those that up to now support only SQL, but not SQL/XML, and it allows generating compressed or uncompressed XML. The improvement is that our approach does this faster than Oracle 11g and than DB2 in most cases. (Page 441)

10 Service-oriented Communities: Models and Concepts Towards Fractal Social Organizations

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Keywords: Socio-technical systems, social organizations, collective adaptive systems, holarchies, fractal organizations

Abstract It is described an abstract model for the definition and the dynamic evolution of “communities of actants” originating from a given reference society of roles. Multiple representations are provided, showing how communities evolve with respect to their reference societies. In particular we show how such representations are self-similar and factorisable into “prime” constituents. An operating model is then introduced that describes the life-cycle of the communities of actants. After this a software component is presented --the service-oriented community-- and its features are described in terms of the above mentioned models. Finally it is shown how such component can constitute the building block of a novel architecture for the design of fractal social organizations. (Page 450)

87 Ontology Change Estimation Based on Axiomatic Semantic and Entropy Measure

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Keywords: Change Satisfiability, Ontology, Ripple Effects, Axiomatic Semantic, Entropy, Probability, Lexicon

Abstract Ontology is by definition explicit and shared conceptualization of a domain, its life cycle is then marked by sequences of change operations in order to adapt changes in the renewal of the domain. Each operation leading to a state of inconsistency on a target component is therefore susceptible to change the status of other components and therefore the state of the ontology at the macroscopic level through the effect of disorder induced on components as a tendency to the disorganization of the ontological system also called entropy. In this paper, by using an approach combining entropy measure of Shannon and previous work on ontology change operations satisfiability, we propose a methodology for measuring entropy issued from a change operation. The essential issue is how to measure the average information provided by the knowledge of the state of a component after change operation resulting in change impacts on the overall consistency of the ontology. (Page 458)

203 A Service Oriented Information System: A Model Driven Approach

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Keywords: Information system, Service Oriented Architecture, business process, model driven architecture, BPMN language, transformation rules, Component oriented architecture

Abstract Generally the information system development is designing the systems with the use of visual design tools and takes the target modelling artefact as a basis to manually define the software application code. The process of mapping business requirements to the application code involves several parts that make the whole development process again very sensitive to errors. In this paper, we present a model-driven approach to overcome the gap between business requirements on one hand and service oriented architecture on the other. For this, we focus on the development of service oriented information system (SOIS) and a set of model transformation rules. Different ways of transforming a model into another exist. The choice of a target model differs according to quality criteria and is determined on the basis of specific requirements. The development process proposed is based on a BPMN meta-model, SOAML meta-model and a component meta-model. The approach leading elements are: the meta-modelling and automated mapping rules. Finally, we illustrate our proposal with a case study. (Page 466)

150 A Fine-Grained Image Access Control Model

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Keywords:

Abstract Sharing and publishing images and photos have become the trend of nowadays (social networks, messengers, etc.). Providing appropriate techniques to preserve privacy and protect content of sensitive and private images is an essential need. In this paper, we present a novel security model for image content protection. In our model, we provide dynamic security rules based on first order logic to express constraints that can be applied to contextual information as well as low level features of images. We finally discuss a set of experiments and studies carried out to evaluate the proposed approach. (Page 603)

IBCS-S2: Advanced Information Systems

161 Improving Accuracy and Interpretability of Clinical Decision Support Systems through Possibilistic Constrained Evolutionary Optimization

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Keywords: Clinical Decision Support Systems, Possibility Theory, Constrained Evolutionary Optimization

Abstract In this paper we propose a computable approach to represent medical rules by means of Fuzzy Clinical Decision Support Systems by preserving both accuracy and interpretability. Usually, prediction accuracy of these systems goes to overlook their linguistic interpretability and, in order to simultaneously optimize those conflicting properties, multi-objective evolutionary algorithms are adopted. Differently, our proposal relies on the alternative assumption that the interpretability-accuracy tradeoff problem can be approached as a single-objective constrained optimization problem. In this spirit, a Differential Evolution algorithm, with a selection operator suitably adapted to the aim, is used for membership function tuning by maximizing accuracy and fulfilling several constraints for linguistic distinguish ability degree --a semantic property of fuzzy sets with notable relevance for interpretability of fuzzy models-- evaluated through Possibility measure. The proposed approach has been tested on the Vertebral Column Data set, a recent medical database publicly available, with results that confirm the effectiveness of our method. (Page 474)

64 Extracting Touristic Information from Online Image Collections

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Keywords: Flickr, Geotagging, Tourism, Geographic Information Retrieval, GIS, Google Maps

Abstract In this paper, we present a Geographical Information Retrieval system, which aims to automatically extract and analyze touristic information from photos of online image collections (in our case of study Flickr). Our system collect all the photos, and the related information, that are associated to a specific city. We then use Google Maps service to geolocate the retrieved photos, and finally we analyze geo-referenced data to obtain our goals: 1) determining and locating the most interesting places of the city, i.e. the most visited locations, and 2) reconstructing touristic routes of the users visiting the city. Information is filtered by using a set of constraints, which we apply to select only the users that reasonably are tourists visiting the city. Tests were performed on an Italian city, Palermo, that is rich in artistic and touristic attractions, but preliminary tests showed that our technique could successfully be applied to any city in the world with a reasonable number of touristic landmarks. (Page 482)

177 A Knowledge-based Method for Verifying the Reliability of Clinical DSSs

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Keywords: Clinical Guidelines, Rule Verification, Rule-based Formalisms, Knowledge-based Decision Support Systems

Abstract Recently, the usage of innovative decision support systems (DSSs) for monitoring the subject's health status in the daily living is becoming a common practice to provide real aid in chronic patients' management. Rule-based implementations of such DSSs simulate the decision-making process described in clinical guidelines by also allowing new/existing rules to be directly and dynamically added/edited by the physicians. However, this task is error-prone and can generate different kinds of anomalies that compromise the effectiveness and correctness of the final DSSs. In order to face such an issue, this paper presents a novel algorithm for verifying the reliability of clinical guidelines, encoded in the form of complex rules with also statistical or trend patterns in their conditions, so as to determine two categories of potential structural anomalies, i.e. inconsistency or redundancy. Moreover, in order to provide a deep insight about the verification outcome, the method has been enriched with a taxonomy for classifying the detected anomalies. The algorithm has been evaluated on different rule bases in terms of time-processing, proving its efficiency. This research work has been developed within the EU IST CHRONIOUS Project, devoted to define a generic platform for remotely monitoring the health status of chronic patients. (Page 489)

162 Interpolating Probability Values or Fuzzy Set Values for Uncertain Spatiotemporal Objects

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Keywords: Interpolation, Spatio-temporal uncertainty, Tetrahedralization

Abstract This paper looks at ways of quickly interpolating probability values or fuzzy set values for uncertain spatiotemporal objects that may change continuously over time. The paper starts with presenting a way to compute a tetrahedralization of an uncertain spatiotemporal object and using that to compute consistent interpolations. This approach also turns out to be able to create fairly good interpolations of the shape of the spatiotemporal object without needing an extra algorithm for this purpose. However, a naive use of any tetrahedralization turns out to create interpolation artifacts in those objects that become significantly more or less uncertain with time. The paper then presents a way to overcome this issue at the cost of more processing. (Page 496)

24 Versioning of Conventional Schema in the τXSchema Framework

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Keywords: ôXSchema, Schema versioning, Schema change management, XML Schema language, Temporal databases

Abstract Schema versioning is an indispensable feature for applications using temporal databases and requiring an entire history of data and schema. τXSchema [7] is an infrastructure for constructing and validating temporal XML documents, but any explicit support for XML schema versioning is offered. A τXSchema schema is composed of a conventional XML Schema document annotated with

physical and logical annotations. All components of a τXSchema schema can change over time to reflect changes in user requirements or in reference world of the database. In a previous work [10], we deal with versioning of logical and physical annotations. In this work, we study versioning of τXSchema conventional schema: we propose a complete set of low-level primitives for changing such a schema and define their operational semantics. (Page 510)

190 **Linguistically Aware Semantic Network for Automated Information Tracking**

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Keywords: semantic networks, WiSENet, sentiment vectors, sentiment analysis, Natural Language Processing

Abstract The paper presents the result of an ongoing research into extending the WiSENet semantic network by adding an extra tier of data, which could be applied in a number of text processing tasks. It was envisaged that this new tier of data could provide a more detailed description of adjectives and adverbs contained in the semantic network. This detailed description was centrally concerned with the construction of sentiment vectors that convey data on whether a given term of interest is positive, negative or neutral. To this end, an experiment was carried out which made it possible to build such sentiment vectors. In the building phase a corpus of over 12000 documents containing opinions on hotels, books and movies along with corresponding satisfaction scores was used.. In order to check if sentiment vectors are a useful instrument for performing text processing tasks, a test case was proposed to help prepare the satisfaction level prognosis for the tested documents. In the course of the research it became apparent that not all sentiment vectors were eligible for use in the prognosis. In order to uncover plausible reasons for the ineligibility a linguistic analysis was carried out. Finally, an experiment designed to evaluate the usefulness of sentiment vectors and the level of accuracy of the prognosis based on them was performed. It had a success rate of 61.33%, which is highly satisfactory in comparison to other studies. (Page 503)

IBCS-S3: Multimedia & QoS

195 **Quality of Experience as a Selection Criterion for Web Services**

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Keywords: Web Services, QoS, QoE, composition

Abstract QoS indicators are commonly used when selecting Web Services (WSs) between different providers. However, typical QoS parameters do not reflect the subjective `performance' perceived by the end-users of the service, commonly called the Quality of Experience (QoE) of the service. In this paper, we describe a novel approach for using the QoE as a criterion for WS selection, including an analysis of the different influence factors affecting the perceived quality and a methodology for measuring QoE and establishing a correlation model between QoS/QoE. Furthermore, some real experiments with a set of end-users have been performed and interesting results illustrated. (Page 519)

93 **QoS-MONaaS: A Portable Architecture for QoS Monitoring in the Cloud**

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Keywords: Quality of Service (QoS), Cloud Computing, Business Process Monitoring, Content Based Routing, Complex Event Processing

Abstract The advent of cloud-based services stimulates dynamic interaction/composition of various enterprise applications. In this context, Quality of Service (QoS) monitoring is key, since assessing the actual quality of what service users are paying for has become a mission-critical business practice requirement, and it will be even more so in the future. QoS-MONaaS (QoS MONitoring as a Service) is a portable architecture that implements a dependable (i.e. unbiased, reliable, and timely) facility for monitoring the QoS being delivered at the Business Process level on top of a generic cloud platform. The architecture is portable in the sense that it can be ported from one platform to another with minimal modifications. The facility is made available to all applications running on top of a cloud platform according to the “as a Service” paradigm. This paper describes QoS-MONaaS conceptual architecture, and its implementation on top of the SRT-15 cloud platform, i.e. the cloud platform being developed within the context of the SRT-15 project (http://www.srt-15.eu/). (Page 527)

136 **QoS-Enhanced Broker for Composite Web Service Selection**

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Keywords: web service, service selection, service composition, quality of service

Abstract The paper proposes a layered system for web service composition. The input for the system is the specification of the desired service, including both functional and non-functional requirements. The composition operation takes as input a generic composition graph defined based on the functional requirements. Then, the set of potential compositions is identified based on "hard" non-functional requirements. This set is represented in terms of an extended version of the composition graph that permits to take into account the different BPEL constructors. Finally, best composition(s) are identified by solving a biobjective shortest path problem on the transformed composition graph. (Page 533)

3 **Multimodal Approach for Emotion Recognition Using an Algebraic Representation of Emotional States**

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Keywords: multimodal approach, emotion recognition, algebraic representation, multidimensional model

Abstract Emotions play a key role in human-computer interaction. They are generally expressed through several ways (e.g. facial expressions, speech, body postures and gestures, etc). In this paper, we present a multimodal approach for the emotion recognition that integrates information coming from different cues and modalities. It is based on a formal multidimensional model using an algebraic representation of emotional states. This multidimensional model provides to represent infinity of emotions and provide powerful mathematical tools for the analysis and the processing of these emotions. It permits to estimate the human emotional state through combining information from different modalities (e.g. facial expressions, speech, body postures and gestures, etc) in order to allow more reliable estimation of emotional states. Our proposal permits to recognize not only the basic emotions (e.g., anger, sadness, fear) but also different types of complex emotions like simulated and masked emotions. Experimental results show how the proposed approach increase the recognition rates in comparison with the unimodal approach. (Page 541)

207 **Towards Digital Image Accessibility for Blind Users Via Vibrating Touch Screen: A Feasibility Test Protocol**

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Keywords: Visual impairment, data and image accessibility, tactile image, vibrating touch screen, paper embossing, experimental evaluation protocol

Abstract The World Health Organization (WHO) estimates at 285 million the number of people affected by visual deficiencies, among which 39 millions are totally blind. In our modern society saturated with visual media tools and applications (images, videos, web pages, etc.), accessing visual information becomes a central need for all kinds of tasks and users, including the visually impaired. In this context, various adapted tools of assistance (screen readers, Braille terminals, screen magnification, etc.), have been increasingly helping persons suffering from a visual incapacity to access and manipulate information. While effective with textual contents, nonetheless, existing solutions remain very limited when it comes to accessing and understanding visual contents. The goal of our work is to provide a computerized solution, investigating the use of the vibrating touch screen technology in providing a contour-based presentation of simple images for visually impaired users. This could prove very useful in allowing blind people to access geographic maps, to navigate autonomously inside and outside buildings, as well as to access graphs and mathematical charts (for visually impaired students). To achieve this, we develop a detailed experimental protocol, EVIAC, testing a blind user's capacity in learning, understanding, distinguishing and identifying basic geometric objects using a vibrating touch screen. Preliminary tests on blindfolded candidates show promising results with respect to traditional paper embossing. (Page 547)

103 **Evaluation of Voice-driven Web Application Architecture**

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Keywords: Voice based web, IVR application, Web voice quality attributes, Voice driven web evaluation, voice driven architecture

Abstract This paper quantifies the implications and trade-offs of three different architectures for voice driven web application, architectures are implemented as prototypes. The prototypes differ from each other by either using recording, or Text To Speech (TTS) as server based, or TTS as client based to process output speech. A typical application used in this paper, is the most dynamic weather information source which is presented as web feeds or Really Simple Syndication (RSS) feeds. The evaluated quality attributes are performance, maintainability, and development effort. The empirical results show that, each system's architecture has a different quality profile, for instance, one architecture has the lowest development time but the highest maintainability cost, and another has the lowest bandwidth requirements but the highest development cost. Finally, suggestions about optimal choice of system architecture according to the quality requirements of the final system are drawn. (Page 555)

IBCS-S 4: Cooperative & Distributed Systems

166 **Open Source Platforms for Internet Monitoring and Measurement**

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Keywords: Plab, D-ITG, UANM, Hynetd, TIE, Hobbit, BISmark, Traffic traces

Abstract Understanding the ever-changing scenario of computer networks and how they operate in the real world implies measuring and analyzing their characteristics. This in turn requires a set of advanced tools and methodologies to be shared among researches, along with the data derived from such activities. In this paper we first present some of the main issues and challenges in the field of Internet Monitoring and Measurement, then we present several open source platforms we have developed in the last 10 years for monitoring heterogeneous and large scale networks. Finally, we describe some of the data sets we made publicly available to the research community. (Page 563)

157 **Towards an Open and Interoperable Platform for Real Time Decision Making in Intelligent Cities**

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Keywords: Mobile information systems, Decision support systems, Semantic web

Abstract Current navigation systems help urban mobility and logistics by using average traffic information, although such operations are facilitated if paths to destination are chosen taking into account current traffic flows and weather conditions. Also, personal and social data dealing with the current user status/task and citizen preferences should be taken into account by the navigation software to suggest the most appropriate paths. Real time decision support systems (DSSs) may help even better the mobile users if they integrate all the information available at urban scale to provide effectively the services required by the users and if they are accessed through an open platform, i.e., by any type of mobiles. To this aim, the paper proposes a DSS based on a semantic layer put on the top of the proprietary datasets so that the suggested paths may take into account all the city datasets. Also, an open platform based on JQMobile and Flash Builder frameworks is illustrated to support the users independently on the mobile used. (Page 571)

65 **An Intrusion and Fault Tolerant Forensic Storage for a SIEM System**

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Keywords: Forensic Storage, Threshold Cryptography, Critical Infrastructure Protection, Fault- and Intrusion-Tolerant Architecture

Abstract Current Security Information and Events Management (SIEM) solutions lack a data storage facility which is secure enough - i.e. stored events related to security incidents cannot be forged and are always available - that it can be used for forensic purposes. Forensic storage used by current SIEM solutions uses traditional RSA algorithm to sign the security events. In this paper we have analyzed the limits of current forensic storages, and we have proposed an architecture for forensic storage, implementing a threshold-based variant of the RSA algorithm, that outperforms state of the art SIEM solutions in terms of intrusion- and fault-tolerance. We show by experiments that our forensic storage works correctly even in the presence of cyber-attacks, although with a performance penalty. We also conduct an experimental campaign to evaluate the performance cost of the proposed scheme as a function of the threshold. (Page 579)

167 **Static Verification of Wireless Sensor Networks with Formal Methods**

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Keywords: Reasoning, Formal Methods, Testing, Static Verification, Wireless Sensor Network

Abstract Wireless Sensor Networks (WSNs) are widely recognized as a solution to build monitoring systems, even in critical environments. WSNs, however, are subjected to faults due to several causes (i.e. rain, EMF radiations, vibrations, etc..) and tools and methodologies for the design of dependable WSN-based systems are needed. Formal methods partially meet such needs by assessing the degree of correctness of design models and identifying potential system bottlenecks. The aim of this paper is to define a methodology for the static verification of WSN based systems using a formal language (Event Calculus). In particular we show how the formal specification can be used to verify the design of a WSN in terms of its dependability properties. To this aim, we define a set of correctness specifications that apply to a generic WSN, coupled with specific structural specifications describing the target network topology to evaluate. Finally, after having presented an automatic tool, designed to support the designer, we adopt this methodology to a case study. (Page 587)

39 **Well Formed PetriNet for Reachablility**

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Keywords: PetriNet, CSP, WFPN, Reachability

Abstract Whenever we give model description for simulation purpose, we always face to a problem how to describe behaviors correctly in terms of objects. Clearly sophisticated diagram approach would facilitate matters greatly. PetriNet is one of the nice vehicles for discrete modeling. In this investigation, we introduce Well-Formed PetriNet (WFPN) and to propose how to construct reachable PetriNet models by means of editors. We examine our approach by means of experimental systems. (Page 595)

Workshop Paper

Workshop on Situation Aware Computing

W-SACOM-S1

92 Modeless Japanese Input Method Using Multiple Character Sequence Features

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Keywords: modeless Japanese input, multiple character sequence features, multilingual text, n-gram

Abstract Recently, the rapid growth of globalization requires writing a large number of multilingual texts. However, Japanese PC users need to switch the input mode between Japanese and the Latin alphabet on conventional Japanese input method. That is cumbersome. Meanwhile, the solution system using a dictionary is hard to maintain because new words are created every year with high frequency. This paper proposes a modeless Japanese input method which automatically switches the input mode without using a dictionary. Using the model called "gmultiple character sequence features", this method discriminates whether to convert alphabet into Kana or not. There are multiple character sequence features, namely, character surface features and character type features both based on n-gram. These model features are learned by a Support Vector Machine from corpora especially from those of a large number of living words on Web. The evaluation of this method showed that the statistical accuracy by F-measure for both chatting texts and news texts was over 90% (mostly over 99%). (Page 613)

226 Context-based Reflection Support Counseling Agent

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Keywords: context, counseling agent, ontology, reflection, self-awareness

Abstract The success rate of IT system development projects has remained as low as 30 %, resulting in that more than 60 % of workers have suffered from problems. This paper proposes a software agent to replace rudimentary-level human counselors. The agent uses a counseling knowledge whose domain is limited to IT workers or students. Counseling differs from learning support whose problems are clear and well-understood by teachers. Furthermore, teachers fundamentally know their solutions. It also differs from psychotherapy whose problems as well as solutions are less clear and much more general (i.e., not domain-specific). Utilizing domain knowledge focused on IT related counseling, our proposed counseling agent can: 1) support identification of the client's problem by building up mutual trust and empathy, and 2) promote the client's further clarification of their problems towards self-awareness of solutions by means of reflection solicited by ELIZA-like but context-dependent dialogue. Exploiting the context as well as the limited domain of problems makes the counseling software agent easily realized without acquiring and managing a tremendous amount of knowledge. The preliminary experimental results for six students showed that the agent can replace rudimentary-level human counselors. Namely, though incorporated with just limited knowledge, it can promote clients to enable more self-reflection e.g. by continuing 3 times longer dialogue than ELIZA and more self-awareness e.g. according to questionnaires, sufficient in the proposed agent but insufficient in ELIZA. (Page 619)

19 An Adaptive System for Optimal Matches between Human Needs and Offers

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Keywords: Human Centered Systems Matching Technology Adaptive Self-Learning Systems

Abstract The paper presents a very general technique to represent human needs and offers along with a technology to find optimal matches. Moreover, the system is able to learn from its use by collecting user feedback and changing its parameters accordingly. This way, the system adjusts itself to the human expectations and desires and even follows the trend of these desires and expectations. (Page 629)

240 Towards a Collaborative Innovation Catalyst

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Keywords: Open Innovation, Collaborative Innovation, Ambient Intelligence, Pervasive Systems, Situation Awareness, Context-based Reasoning, Recommender Systems

Abstract This position paper is aimed at highlighting the potential connection between Pervasive Systems and Collaborative Innovation. In particular, we discuss the architectural structure of an Innovation Catalyst supporting a collaboration methodology based on the Open Innovation paradigm. Our system is conceived for stimulating the collaborative dynamics of a team, exploiting all the information

produced in the collaborative environment, including situational context, communication in team interactions, and personal behaviours. The results of our work can contribute to a more general understanding of the elements that catalyse collaborative innovation. (Page 637)

179 Effective and Efficient Filtering of Retrieved Images Based on JPEG Header Information

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Keywords: information retrieval, image retrieval, JPEG, Huffman table, quantisation table

Abstract Visual information on the web, in particular in form of images, is increasing at a rapid rate. Consequently, efficient and effective techniques to retrieve visual information are sought after, especially as it can be usefully employed to augment textual information. Since users rarely annotate images, this proves to be a challenging task, however much progress has been reported in the area of content-based image retrieval which is based on visual features extracted from images for retrieval purposes. In this paper, we present two strategies for very fast image retrieval which use solely information contained in the header of JPEG compressed files. One is based on the tables that are responsible for the lossy quantisation step in JPEG, while the other is related to the Huffman tables used for entropy coding. In both cases, we employ the tables directly as image features in the context of online image retrieval. We then utilise them to discard irrelevant images, while a compressed-domain image retrieval technique is used for ranking the remaining image set. Experimental results convincingly show that our algorithms lead to a significant reduction of overall retrieval time while maintaining retrieval accuracy. They could thus be integrated into web-based recommender systems to augment and improve search results. (Page 644)

227 Image and Text Fusion for Context-aware Recommendation

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Keywords: context-aware recommendation, image and text fusion, media fusion

Abstract In this paper, we propose a system that obtains sensor data including multimedia data such as text messages and image data from mobile phones, and extracts information about the user situation from these data to provide situation-oriented web services to users exploiting the extracted context. Based on the situation awareness of the system, it is attained to increase the precision of content-based image matching by combining the partial context obtained there from other types of data such as textual information. (Page 650)

W-SACOM-S2

18 Personalized and Adaptive Curriculum Optimization Based on a Performance Correlation Analysis

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Keywords: Personalized Curriculum Mining, Adaptive Learning Technologgies, Correlation Analysis

Abstract The paper introduces a “lazy” Data Mining technology, which models students’ learning characteristics by considering real data instead of deriving (“guessing”) their characteristics explicitly. In former work, the authors developed a modeling system for university learning processes, which aims at evaluating and refining university curricula to reach an optimal learning success in terms of the best possible grade point average (GPA). This is performed by applying an Educational Data Mining (EDM) technology to former students curricula and their degree of success (GPA) and thus, uncovering golden didactic knowledge for successful education. Here, we introduce a complementary technology to mine course characteristics similarities of former students’ study traces and utilize them to optimize curricula of current students based to their performance traits revealed by their study achievements so far. This way, technology generates suggestions of personalized curricula. Furthermore, this technology is supplemented by an adaptation mechanism, which compares recent data with historical data to ensure that the similarity of mined characteristics follow the dynamic changes affecting curriculum (e.g., revision of course contents and materials, and changes in teachers, etc.). (Page 655)

224 Personalized Video Summarization Based on Behavior of Viewer

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Keywords: Video Summarization, Behavior, remote controller, eye fixation

Abstract Recent progress of video recording hardware such as HDD video recorders or PCs with TV tuner enabled us to store hundreds or even thousands of hours of programs, and view any one of them on demand. In accordance with the growth of the capacity of video storage, efficient scheme of video access is studied, shot or scene boundary detection, content visualization for video browsing, content-based access based on annotation, content-based summarization, etc. Video summarization is one of the promising approaches for effective comprehension of video contents, which is obtained by detecting informative segments of video data and concatenate them to show as one consecutive video. Previous studies on video summarization are focused on detecting informative segments which correspond to attractive and/or impressive scenes based on textual annotation and audio-visual cues which are

correlated to important/informative events. This method works well if we assume that the viewers of the summarized contents have the same purpose in summary viewing and the sense of "importance" is the same regardless of viewers. However, this approach cannot cope with a case where criteria on importance differ depending on viewer. We propose a novel framework of video summarization based on the detection of viewer behavior during watching video contents as a solution for this issue. It captures eye movement and operation of remote controller of video player as the behavior of a viewer while watching a video program. The degree of importance is evaluated based on his/her behavior and video summarization is carried out so that it reflects diversity of viewers preference or interest. (Page 661)

238 **Ensuring XML Integrity Using Watermarking Techniques**

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Keywords: XML watermarking, security, SOAP security

Abstract Today, XML is the most used data interchange format for business-to-business applications. Indeed, an increasing amount of data in XML format is created and published over the Internet every day. Moreover, organizations need more and more to share sets of XML documents usually managed via a common XML repository. XML integrity and authenticity have become strong requirements for applications like web services that exchange messages in such format. XML signature aims to guarantee these properties but it cannot avoid attackers to intercept and change the structure of the XML message. A very common attack to XML Signature called XML Signature Wrapping(XSW) attack represents a big issue in web services security as SOAP messages which are XML signed files-could be corrupted. In this paper, we propose a countermeasure to the XML Signature wrapping attack that makes use of XML watermarking techniques. In our proposal we express constraints on the schema of the XML document and fix its structure using an absolute coordinate system whose values are embedded within the file as a watermark. (Page 668)

229 **Evaluation of Language Pipeline for Awareness Service Platform**

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Keywords: context, context-aware, evaluation, language pipeline

Abstract The evaluation method and result of language pipeline including CxBVR for awareness service platform are described. CxBVR is a formalization of a free text in a rule-based context representation. The CxBVR compiler can generate a set of rules for each XML-based context. The experimental results showed: 1) when contexts were divided, the processing speed was three or four times as fast as when not divided, 2) constraint checking on context-based inference execution enabled situation awareness services more manageable and reliable, 3) loading XML by SAX became two or three times as fast as than DOM. Thus, the (contextual) language pipeline usage for awareness service platform was proved to be fit to situations. (Page 675)

153 **Diversity of Genes, Its Representation and its Use for Creating New Individuals**

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Keywords: Genetic Algorithm (GA), Diversity, Travelling Salesman Problem (TSP)

Abstract The paper presents a metric to express the degree of diversity in a population of genes and proposes a structural representation of a population's similarity respective diversity by a pattern set. However, diversity cannot be understood as the presence of various genotypes only, but also as their quantitative distribution. To quantify the degree of distribution, the entropy of the patterns is used. Based on these metrics, three algorithms are introduced here, namely one for generating a new individual, which differs from all other individuals in the population to a required degree (we call it "exotic" here), an algorithm, which creates a new individual, which improves the entropy measure, and an algorithm, which creates a new individual from the fittest pattern. (Page 681)

230 **A Population Based Rewarding for Reinforcement Learning to Control Genetic Algorithms**

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Keywords: Traveling Salesman Problems (TSP), Reinforcement Learning, Genetic Algorithm (GA), Parameter Control

Abstract The effectiveness of Genetic Algorithms (GA) heavily depends on the appropriate setting of its parameters. Moreover, optimal values for these parameters depend on both the type of GA and the application problem pattern and must be developed for each particular setting one by one. Therefore it requires special expertise and many experiments to validate the parameter setting. In order to solve this problem, a new method called "adaptive parameter control" was proposed, which adaptively controls parameters of an evolutionary algorithm. However, since this method just increases the selection probability of a search operator that generated a well evaluated individual, this is apt to be a shortsighted optimization method. On the contrary, a method is proposed to realize longsighted optimal parameter control of GA using Reinforcement Learning (RL). However, this method does neither consider the calculation cost of search operators nor population search characteristics of GA. Here, we propose a refined RL method for parameter control, in which (1) the reward decision rules are elaborately incorporated under the consideration of GA's population search characteristics and (2) the

calculation cost of the search operator is taken into account. It is expected that this method can efficiently learn parameters to optimally select search operators of GA for approximately solving Traveling Salesman Problems (TSPs). (Page 686)

Workshop on Complex Networks

W-Complex Network-S1

263 Social Network Analysis in Scientometrics

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Keywords: scientometrics, social network analysis, affiliation networks, betweenness, structural motives

Abstract In this paper we report on the results of our current attempt to enhance scientometric measurements by employing social network analysis and mining methods. We begin by recalling of our previous work on the collection of a rich data on the social network of scientific collaboration. Then, we proceed to the description of the enhancements to the dataset. Most importantly, we report on the three separate results obtained from the extended social network. The analysis of the triad closure consensus in the dataset reveals interesting patterns regarding the underlying nature of scientific collaboration. Even more evident are the results of the between ness centrality analysis, where a periodic pattern emerges both in co-authorship and co-participant networks. Finally, we conclude with the introduction of a complex model of scientific career development which uses conditional probability sequential patterns. (Page 692)

216 A Comparative Study of Web Services Composition Networks

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Keywords: Web services, composition, Web services networks, complex networks

Abstract Web services growth makes the composition process a hard task to solve. This numerous interacting elements can be adequately represented by a network. Discovery and composition can benefit from the knowledge of the network structure. In this paper, we investigate the topological properties of two models of syntactic and semantic Web services composition networks: dependency and interaction. Results show that they share a similar organization characterized by the small-world property, a heavy-tailed degree distribution and a low transitivity value. Furthermore, the networks are disassortative. (Page 700)

242 Complex Network of Earthquakes: Universal Law for Waiting Internal Time in Seismicity

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Keywords: seismicity, complex network, event time

Abstract Seismic data are mapped to growing random networks. Vertices and edges of such networks correspond to coarse-grained events and event-event correlations, respectively. This approach turned out to reveal many new aspects of complexity of seismicity. The earthquake networks were found to be complex networks, being scale-free, small-world and hierarchically organized, each of which has its own implication in view of seismology. In studies of seismicity, one can consider two different kinds of time: one is the conventional time, and the other is the internal time. Let {t_1, t_2, ..., t_N} be the conventional occurrence times of N earthquakes contained in the dataset to be analyzed. In this case, the internal time is simply the label n of t_n (n=1, 2, ..., N), which is henceforth referred to as the "event time". Carbone et al. show that "unified scaling law" for conventional waiting times of earthquakes claimed by Bak et al. is actually not universal. We show that, in contrast to the conventional waiting time, the waiting "event time" obeys a power law. This implies the existence of temporal long-range correlations in terms of the event time with no sharp decay of the crossover type. The discovered power-law waiting event-time distribution turns out to be universal in the sense that it takes the same form for seismicities in California, Japan and Iran. In particular, the parameters contained in the distribution take the common values in all these geographical regions. An implication of this result to the procedure of constructing earthquake networks is discussed. (Page 707)

95 Go with the Winner: Optimizing Detection of Modular Organization Differences in Dynamic Functional Brain Networks

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Keywords: Brain networks, Modularity, Community structure, Electroengephalography (EEG), phase synchrony, Non-linear interdependence

Abstract The modular structure of human brain network(s) is well established. Despite numerous and increasing studies that examine brain's modular organization based on various measures of neural synchrony, it is not known yet how to qualify the employed descriptors in terms of the resulting functional community structure. A methodology is introduced here that facilitates the selection of best synchronization measure based on the comparison between two experimental conditions. Our method is presented using data from a multi-trial ERP paradigm (where the same task is performed in an attentive/passive mode) and in a time-varying exploration set up. The functional interactions are quantified at the level of EEG sensors through descriptors that differ regarding the nature of functional dependencies sought (linear vs. nonlinear) and regarding the specific form of the measures employed (amplitude/phase

covariation). The resulting functional connectivity graphs (FCGs) are analyzed with an iterative clustering algorithm, and the emerging modular structures enter an appropriate time-varying discriminant function. Our results show that phase synchrony plays a crucial role in the segregation into distinct functional domains during the attentive condition in the frequency range that includes θ and α1 band (4 - 10 Hz). Finally, by adopting Participation Index (PI), task-specific hub regions can be recognized from the optimally detected functional communities. (Page 710)

232 A Characterization of the Modular Structure of Complex Networks Based on Consensual Communities

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Keywords: Community detection, consensus clustering, community structure

Abstract Understanding the community structure in graphs arising from complex network is an important and difficult problem, both from theoretical and practical points of views. Although a lot of community detection algorithms have been proposed in the last decade, there is still no satisfactory way to determine if a given network possesses or not a community structure, that is, its nodes can be partitioned in well separated clusters. In this paper, we propose a new criterion based on the study of the formation of consensual communities obtained by running several times a non deterministic algorithm. By testing on synthetic benchmarks (with known structure) and on several real world networks, we show that the graphs can be categorized in several classes according to the dynamic of the consensual communities formation process. This result is promising to derive new approaches to characterize the modular structure of graphs. (Page 717)

W-Complex Network-S2

61 Directed Networks of Online Chats: Content-Based Linking and Social Structure

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Keywords: online chat networks, text annotation, message type, emotional arousal

Abstract Online chats are recently shown to result in long term associations among users, represented by a directed weighted network, similar to dialogs in online social networks. We consider the persistent network which emerges from user-to-user communications found in the empirical dataset from IRC Ubuntu channel. The structure of these networks is determined by computing topological centrality measures, link correlations and community detection, and by testing validity of the “social ties” hypothesis. To unravel underlying linking mechanisms, we further study type of messages exchanged among users and users with Web bots, and their emotional content, annotated in the texts of messages. We find that the ranking of the users according to the frequency of their messages obeys Zipf’s law with a unique exponent for each message type. Furthermore, the specific hierarchical structure of the network with a strong core as well as its social organization are shown to be closely related with the most frequently used message types and the amount of emotional arousal in them. (Page 725)

243 On the Structure of Changes in Dynamic Contact Networks

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Keywords: Dynamic networks, Sensor networks, Graph series, Difference graphs, Vertex cover

Abstract We present a methodology to investigate the structure of dynamic networks in terms of concentration of changes in the network. We handle dynamic networks as series of graphs on a fixed set of nodes and consider the changes occurring between two consecutive graphs in the series. We apply our methodology to various dynamic contact networks coming from different contexts and we show that changes in these networks exhibit a non-trivial structure: they are not spread all over the network but are instead concentrated around a small fraction of nodes. We compare our observations on real-world networks to three classical dynamic network models and show that they do not capture this key property. (Page 731)

210 Composite Centrality: A Natural Scale for Complex Networks

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Keywords: complex networks, composite centrality, universal scale, world trade web, statistics, complex network mining

Abstract We propose a composite centrality measure for general weighted and directed complex networks, based on measure standardisation and statistical normalization, whereby the composite measure is expected to follow a standard log-normal distribution. This offers a natural and absolute scale to measure node and edge centralities for complex networks. Considering snapshots of the world trade web, we demonstrate its working and introduce a standard set-up. (Page 739)

228 Accelerated Motif Detection Using Combinatorial Techniques

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Keywords: network motifs, counting motifs, detecting motifs, motif isomorphism, acc-motif

Abstract Network motif algorithms have been a topic of research mainly after the 2002-seminal paper from Milo \emph{et al}, that provided motifs as a way to uncover the basic building blocks of most networks. This article proposes new algorithms to exactly count isomorphic pattern motifs of size~3 and~4 in directed graphs. The algorithms are accelerated by combinatorial techniques. Let $G(V, E)$ be a directed graph with $m=|E|$. We describe an $O({m\sqrt{m}})$ time complexity algorithm to count isomorphic patterns of size~3. To counting isomorphic patterns of size~4, we propose an $O(m^2)$ algorithm. The new algorithms were implemented and compared with Fanmod motif detection tool. The experiments show that our algorithms are expressively faster than Fanmod. We also let our tool to detect motifs, the {\sc acc-MOTIF}, available in the Internet. (Page 744)

261 Renormalization of Spectra for Network Laplacian as Applied to Synchronization

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Keywords: Complex Networks, Hierarchcial Networks, Renormalization Group, Synchronization, Network Spectra

Abstract Renormalization group methods from statistical physics are developed to accurately describe asymptotic properties of complex networks. As a demonstration, the determinant and the lower and upper eigenvalues of the Laplacian matrix for a hierarchical network model are obtained to assess the collective ability to synchronize agents coupled on the network. (Page 754)

209 Efficient Q-matrix Computation for the Visualization of Complex Networks

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Keywords: complex networks, Q-matrix, algorithms

Abstract The Q-matrix representation of a large network graph is a transformation yielding meaningful visualizations which can reveal internal structure, help classify networks according to their application area, and in some cases distinguish and identify real networks from synthetically generated data. However, the issue remains whether computing the Q-matrix is prohibitively expensive for problem sizes encountered in practice. Given an undirected network graph, we describe an efficient near-linear time algorithm for computing its Q-matrix. Besides providing theoretical bounds, we present experimental results showing that application networks with millions of edges and vertices can be processed in seconds on desktop computers. (Page 762)

W-Complex Network-S3

236 Facencounter: Bridging the Gap between Offline and Online Social Networks

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Keywords: multidimensional network, contact, multiplex, online social network, centrality

Abstract Human beings are involved in a broad range of social relationships spanning from real life experiences to online media and social networks. This is leading people to act in a multilayered complex network whose relationships among different layers have still to be analyzed and understood in depth. In this paper, we focus on this problem by comparing and overlapping the online sociality (Facebook network) and the offline sociality (encounter network) of a group of students. First we describe the experiment we performed to trace the encounters, occurring with people both inside and outside the group of experimenters, and to gather information about their online friendships. On the basis of the obtained dataset, we obtain the relevant complex networks, whose separated analysis lead us to observe significant structural differences. Moreover, we study the correlations and overlap between the two interrelated networks, showing how users' centralities change in the two networks. Finally, the information transfer across layers of the unified complex network enables us to obtain results about the effects on paths and centrality. (Page 768)

233 The Role of Distances in the World Trade Web

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Keywords:

Abstract In the economic literature, geographic distances are considered fundamental factors to be included in any theoretical model whose aim is the quantification of the trade between countries. Quantitatively, distances enter into the so-called gravity models that successfully predict the weight of non-zero trade flows. However, it has been recently shown that gravity models fail to reproduce the binary topology of the World Trade Web. In this paper a different approach is presented: the formalism of exponential random graphs is used and the distances are treated as constraints, to be imposed on a previously chosen ensemble of graphs. Then, the information encoded in the geographical distances is used to explain the binary structure of the World Trade Web, by testing it on the degree-degree correlations and the reciprocity structure. This leads to the definition of a novel null model that combines spatial and non-

spatial effects. The effectiveness of spatial constraints is compared to that of nonspatial ones by means of the Akaike Information Criterion and the Bayesian Information Criterion. Even if it is commonly believed that the World Trade Web is strongly dependent on the distances, what emerges from our analysis is that distances do not play a crucial role in shaping the World Trade Web binary structure and that the information encoded into the reciprocity is far more useful in explaining the observed patterns. (Page 784)

249 A Fitness Model for Epidemic Dynamics in Complex Networks

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Keywords: epidemic dynamics, complex networks, fitness model

Abstract This paper describes a new approach to the modeling of epidemic dynamics with complex networks. The infection spreading considers the links of each ill node and the probability to infect healthy nodes. Moreover, a fitness parameter is used for each node of a network to simulate the individual reaction against an infectious process. The dynamics of infection has been evaluated on different kinds of complex networks, allowing to conclude that minimal conditions (in terms of infection probability and individual fitness) are required for infection spreading. According to the results obtained during simulations, we claim that the proposed model can be considered a good candidate to study viral spreading in social networks or in those biological systems with a high individual variability in reaction to infections. (Page 793)

254 Rumor Dynamics with Acceptability Factor and Inoculation of Nodes in Scale Free Networks

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Keywords: Rumor spreading mode, scale free networks, information dynamics, information credibility, random, targeted and neighbor inoculation

Abstract In the social networks, rumors can spread and affect the society. To characterize rumor propagation in scale free networks, we propose a rumor spreading model which uses the acceptability factor to control the rumor. In this model we introduced a new compartment of stifler who rejects the rumor in comparison with existing SIR model. An ignorant can reject the rumor and become stifler when it gets rumor from a spreader. In this proposed rumor spreading model, random, targeted and neighbor inoculation strategies have been applied to control rumor in the scale free networks. The targeted inoculation strategy has been found to be more successful to control the rumor. If there is no global information of the network then targeted inoculation strategy cannot be applied. For this, neighbor inoculation technique is being used in the proposed model. It has been found to be much more efficient than random inoculation but less efficient than targeted inoculation scheme. In this paper the rumor acceptability factor ($1/ \delta $) has been studied for inoculation strategies. It has found that decreasing the acceptability factor with the inoculation strategies is much more efficient in controlling the rumor. (Page 798)

27 Social Psychology Testing Platform Leveraging Facebook and SNA Techniques

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Keywords: Social Network Analysis, Facebook, Psychological testing, Social Psychology, OpenSesame

Abstract In psychology, testing is largely used in order to assess mental constructs, such as cognitive and emotional functioning of individuals. Tests permit researchers to easily reach a large population of subjects. Tests introduce also quantitative aspects to the psychological introspection mechanisms. When conducting sociological researches, it is very important to collect data about subjects' participation and relationship with his social environment. In many studies, Facebook data has been used as a reliable approximation of the social behavior of subjects. This article presents a Facebook application designed to provide additional social information to the tests implemented on Open Sesame platform, an open source platform which provides researches with an advanced and easy to use experiment builder to support their researches. The application presented computes sociological indexes starting from Facebook data and using SNA techniques. It is intended to be an extensible and easy to expand solution to ease the leveraging of Facebook data to perform sociological testing and collect social data. The SNA indexes are meant to integrate the data coming from classical test execution with the Open Sesame platform. The new indexes will enrich test data with social information about the subjects and will permit to perform causal relation researches or verify correlations among different variables. (Page 776)

Workshop on Colour and Multispectral Imaging (COMI)

152 Multi- and Single-output Support Vector Regression for Spectral Reflectance Recovery

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Keywords: Support Vector Regression (SVR), Spectral Reflectance Recovery

Abstract In this paper, we deal with the problem of reflectance recovery from multispectral camera output using Support Vector Regression (SVR). As standard, SVR is unidimensional, the spectral reflectance recovery requires a multi-dimensional output. We propose two ways of adaptation: the transformation of the dataset (camera output) to a scalar-valued composite data model on the one hand, and the adaptation of a recent multi-output SVR on the other hand. We compare both performances to a Wiener-based

reflectance recovery. The results are quite satisfactory and the comparison points out the advantages and drawbacks of each one of the proposed methods. (Page 805)

172 **LED Based Multispectral Film Scanner for Accurate Color Imaging**

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Keywords: LED, multispectral, spectrl, film scanner, color imaging

Abstract LED (Light Emitting Diode) based spectral imaging is advantageous for its fast computer controlled switching ability, availability of many different types of LEDs and cost effectiveness. It has been used in some applications like biometrics and arts, however, it has not been explored in film scanning. Here in this paper, we have proposed a LED based spectral film scanner that allows acquiring spectral data and at the same time producing more accurate digital color images. Such a system, in practice, is constrained by the limit in the number of LEDs to be used. We have studied the performance of the system also, under the influence of the number of LEDs. Simulation experiments show that the system is capable of acquiring accurate color images with a fairly reasonable number of LEDs. We have also investigated the influence of noise on the number of LEDs, and it shows that the noise plays some part on the number of LEDs to be used. (Page 811)

247 **Sharpness Improvement of Warped Document Images for Top View Book Scanners**

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Keywords: 3-D measurements, bilateral filter, book contours, deconvolution, depth of field, modulation transfer function (MTF), Wiener filter

Abstract This paper is aiming at improving the top view book scanner functionalities to the ability of depicting homogeneous sharpness across the output colour image. Typically, the opened book has a curved shape which results in a space-variant blur in the recorded image. A priori calibration filters are computed by taking an advantage of longitudinal chromatic aberration behaviour in the scanners. Hence, the sharpest channel on the focused plane is chosen as an exemplar to compute a restoration filter for the sharpest channel on each of the defocused planes. Assuming strong correlation between the channels, another filter is computed to reflect the sharpness of the restored channel to the other channels. In order to enhance spatial homogeneity of the scanned image, 3-D information is estimated from book contours. Results exhibit the possibility of having visually homogeneous sharpness in the entire scanned images. (Page 818)

116 **Towards an Ontological Approach for Classifying Remote Sensing Images**

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Keywords: ontologies, remote sensing, earth observation, satellite images

Abstract Interpretation of satellite images is a complex issue. Remote sensing experts and the maticians interpret and use information contained in satellite images depending on their knowledge and expertise in a given application domain. This knowledge is usually ambiguous and consequently cannot be used in an automatic process. Formalizing expert knowledge thus appears as a prerequisite toward an automatic semantic interpretation of remote sensing images. In computer sciences, ontologies have proven to be efficient for formally expressing remote sensing expert knowledge. This paper aims to demonstrate how expert knowledge explanation via ontologies can improve automation of satellite image exploitation. We argue that ontologies can be used to link this knowledge with the content of remote sensing images by conceptually describing them. For this purpose, we first built an image ontology for describing image segments based on spectral, pseudo-spectral and textural features. Then we used those concepts to build a remote sensing knowledge ontology describing the way experts identify land cover classes in satellite images. Third, image ontology is also used to describe image facts which populate image ontology. We finally tested a concrete application of our approach using an automatic reasoner for classifying remote sensing images. (Page 825)

202 **Analysis of Multispectral Images of Excised Colon Tissue Samples Based on Genetic Algorithms**

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Keywords: Multispectral imaging, optical biopsy, unconventional colonoscopy technology

Abstract We present in this paper a method to estimate four significant biological parameters of colon tissue. The interaction of light with colon tissue is modeled by two layers parameterized by biological parameters, which describe optical properties of the colon. This model is reversed using an optimization framework based on genetic algorithms. From a multispectral image of colon, we compute biological parameters of the colon, this noninvasive optical biopsy might lead to better diagnosis of cancer. We present in this paper experimental results analyzing multispectral images of excised colon tissue samples. We analyze the following three categories of colonic tissue: healthy tissue, with a polyp and with cancerous cells. (Page 833)

137 **Comparative Study of Clustering Based Colour Image Segmentation Techniques**

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Keywords: Image segmentation, colour representations, colour space analysis, clustering, cluster validation, pattern recognition

Abstract Image segmentation is very essential and critical to image processing and pattern recognition. Various clustering based segmentation methods have been proposed. However, it is very difficult to choose the method best suited to the type of data. Therefore, the objective of this research was to compare the effectiveness of three clustering methods involving RGB, HSV and CIE L*a*b* color spaces and a variety of real color images. The methods were: K-means clustering algorithm, Partitioning Around Medoids method (PAM) and Kohonen's Self-Organizing Maps method (SOM). To evaluate these three techniques, the connectivity(C), the Dunn index (D) and the silhouette width (S) cluster validation techniques were used. For C, a lower value indicates a better technique and for D and S, a higher value indicates a better technique. Clustering algorithms were evaluated on natural images and their performance is compared. Results demonstrate that K-means and SOM were considered to be the most suitable techniques for image segmentation among CIE L*a*b* and HSV colour spaces. (Page 839)

Workshop on Knowledge Acquisition Reuse and Evaluation (KARE)

234 **KROM: An Organizational Meta-Model Oriented to Knowledge: A Case from Ophthalmic Industry**

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Keywords: Knowledge management, Skills management, Knowledge reuse, KROM, Organizational Meta-Model

Abstract Most of the current knowledge management approaches deal with the problems of knowledge identification and formalization. In some case, and especially in the knowledge engineering field, they deal with the problems of knowledge reuse modeling. However there are few researches dealing with both themes of knowledge management and skills management to make the reuse of knowledge easier and more valuable to people. We present in this paper an organizational Meta-Model which aims to highlight the links between these two research themes. Based on our results with an Ophthalmic industry, we will present you our approach to define KROM (Knowledge Reuse Organizational Meta-Model) an organizational model supporting the knowledge reuse. (Page 845)

206 **Multi-Web, Event-Centric Urban Information Integration**

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Keywords: web data matching and classification, urban information integration, smart city view

Abstract In this paper, we present the MI-Search approach for enabling urban users to perform event-centric surfing of a multiplicity of web contents. MI-Search aims at exploiting traditional web sites and spontaneous user comments/posts in an integrated way, by relying on web data extracted from different sources and systems about the events of a selected urban space. The notion of smart city view is introduced in the paper to enforce a tailored exploration of these web contents according to the personal user interests expressed as keywords, geo-location constraints, and user-agenda appointments. (Page 852)

215 **Towards the Automatic Detection and Correction of Errors in Automatically Constructed Ontologies**

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Keywords: ontology, reasoning, first-order logic, ontology repair

Abstract The Open Information Extraction Project is one of the most ambitious attempts in the area of automatically constructing ontologies by harvesting information from the web. What we will call their Know-It-All Ontology contains about 6 billion items, consisting of triples and rules. The downside of such automatically constructed ontologies is that they contain a vast number of errors: some arising from errors in the original web data and some from errors in extracting the data. In this project we explore whether techniques we have developed in the domain of ontology repair can be used to detect and correct some of these errors. In particular, we explore whether the errors in their ontology can be automatically detected by using a theorem prover. We also present a manual classification of the errors as a preliminary feasibility exploration, and discuss our future work towards automatically correcting the ontology based on the error classification. (Page 860)

258 The Role of a Semantic Approach of Complex Statistical Information System Planning and Management

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Keywords: Statistical information systems, network information systems, tourism information systems, ontological system, Linked Data, SKOS based thesaurus

Abstract Tourism governance is a challenging target, for its implications on a multiplicity of socio-economical processes: in this perspective, the development of a robust informational environments in support of political decisions and social dialogue is in the main institutional agendas. This paper wants to address the problem of harmonizing the different stakeholders languages in the perspective of a shared information system acknowledged by all system actors. (Page 876)

252 Interoperability Knowledge Base for Persistent Identifiers Interoperability Framework

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Keywords: Semantic web, Persistent Identifiers, Interoperability Framework, Interoperability Knowledge Base, SOA

Abstract In this paper, we propose a semantic web based solution to implement the Interoperability Framework (IF) for Persistent Identifiers (PI) developed within the context of APARSEN EU project. The IF provides a comprehensive, semantics-aware solution for interoperability of heterogeneous Persistent Identifier systems. Such a solution aims to provide added-value services built on an Interoperability Knowledge Base. The IF ontology refinement and the related prototype specifics have been designed adopting a bottom-up approach that starts from a)the analysis of metadata provided by Content Providers and b)the collection of functional and semantic requirements of Persistent Identifier Domains (PID to fostering ontology-based metadata translation among different bodies. Conclusions and intended future work close the paper. (Page 868)

Workshop on MultImedia Techniques for Augmented Reality: Presence and Emotion in Virtual EnvironmenT (INTERPRET)

99 Intra-Field Selective Deinterlacing Algorithm Considering the Fine Edge Direction

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Keywords: Deinterlacing, ELA, DOI, Edge detection, Sobel operation, Interpolation

Abstract This paper proposes a selective intra-field deinterlacing algorithm scheme by using a detailed edge direction classification method. It is base on a mixture of different well known approaches: i) M-ELA method to predict the edge and interpolate the missing pixels, ii) Sobel mask for obtaining more accurate edge detection, iii) using the ratio of vertical edge and horizontal edge, the approach selects the most appropriate method among LA method, M-ELA method and DOI method. The experimental results show that this proposed algorithm has outperformed the existing deinterlacing algorithm in terms of both objective and subjective evaluation. (Page 884)

104 Reconstruction of Car Crash Scenes Using a 3D Building and Query Algebra

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Keywords: 3D Languages, 3D Tools, 3D Database

Abstract In this paper, we define a novel 3D building and query algebra for reconstructing car crash scenes. In particular, a low-cost 3D tool based on such algebra is proposed in order to collect and manage the same data set that will be used in the investigation procedures. Once acquired the GPS coordinates of the involved vehicles and scenes details by means of appropriate measurement systems, our tool provides the 3D models of all the scene objects with a set of useful multimedia information and displays them on 3D maps. Preliminary results in the case of a motorway car crash scene are presented and discussed. (Page 891)

126 View-independent Hand Posture Recognition from Single Depth Images Using PCA and Flusser Moments

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Keywords: view-independent hand posture recognition, feature extraction, single depth image, Flusser moments, multi-class classification

Abstract This paper presents a view-independent hand pose recognition system, which allows the recognition of a limited set of predefined postures from single, low resolution depth images in real time on standard hardware in unconstrained environments. The system consists of three modules: hand segmentation and pose compensation, feature extraction and processing, and hand pose recognition. We use principal component analysis to estimate the hand orientation in space and Flusser moment invariants as image

features for visual recognition. The implementation details, classification accuracy and performance measures of the recognition system are reported and discussed. The experimental results show that the system can recognize the pose of two hands at full frame rate with an average total latency lower than 5 ms. (Page 898)

57 Versatile Search Range Adjustment Algorithm for Fast Block-Based Motion Estimation

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Keywords: Motion estimation, bit-wise block matching, search range adjustment (SRA)

Abstract This paper proposes an adaptive search range adjustment algorithm which is particularly suitable for low-bit-depth motion estimation (ME) approaches. Typical low-bit-depth ME approaches such as one-bit transform (1BT), two-bit transform (2BT), and truncated gray-coded bit plane matching (TGCBM) perform FS with low-bit expression but these have significant PSNR drop. Combination of this proposed algorithm and low-bit expression enhance both motion estimation accuracy and time consumption. Experimental results show that low-bit-depth motion estimation approaches using the proposed algorithm perform exceptionally well in contrast to low-bit-depth motion estimation approaches without the proposed algorithm, in terms of both motion estimation accuracy and time consumption. (Page 905)

88 A Cloud Service for Adaptive Digital Music Streaming

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Keywords:

Abstract In this paper we present an adaptive digital music streaming cloud service based on the {\it Amazon Web Services}; the players are applications running on mobile devices connected to the Internet via cellular or via wireless networks. Adaptive streaming means that the data rate is determined dynamically function of the available network bandwidth, as well as power reserves of the mobile device. The service applies lossy compression to high quality audio files stored on the cloud to lower the data rate at a level determined by the resources available. We analyze the results of experiments with real-time data conversion for adaptation to the bandwidth available to mobile devices such as smart phones and tablets. (Page 910)

118 Advanced Hybrid Interpolation Based on Edge Direction Extracted from the DCT Coefficient Distribution

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Keywords: Interpolation, Up-Sampling, Scalable Video Coding, Discrete Cosine Transform

Abstract In these days, video technology has successfully improved creating tremendous results. As video technologies improve, multimedia devices and demands from users are diversified. Therefore, the video codec used in these devices should support various displays with different resolutions. The technology to generate a higher resolution image from the associated low-resolution image is interpolation. The interpolations are generally performed in either the spatial domain or the DCT domain. To use the advantages of both domains, we proposed advanced hybrid interpolation algorithm based on edge direction, which adaptively uses interpolation in both domains. The experimental results demonstrate that our algorithm has good performance in terms of PSNR with reducing blocking artifacts. (Page 918)

Workshop on Methods, Models and Technology for Semantic-driven Knowledge Building (MTSK)

82 Mapping Knowledge Activities with System Operations to Foster Information Systems for Knowledge Work

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Keywords: context, design, information system, knowledge activity, knowledge work

Abstract The (semi-) automatic detection of a user's system activity provides context that can be exploited for information retrieval, for recommendations or for adapting contents and services to this activity and thus improve task-technology-fit. Various approaches automatically detect user activities on the level of system operations. However, the approaches struggle with the challenge how to semantically connect these system operations with high level knowledge activities. Yet, this link is needed to meaningfully support users engaged in knowledge activities. This paper takes up on this challenge and maps a framework of knowledge activities to system operations on the basis of descriptions of work practices gathered from two European companies. The framework is intended to aid the meaningful connection of automatically detected system operations with knowledge activities on varying levels of granularity. (Page 925)

131 A Semantic Approach for Continuous Assessment in Organizations

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Keywords: Competence Assessment, Semantic Web, Knowledge Extraction, Ontology Matching, 360-degree Feedback

Abstract Assessing employees' competences to properly support Competence-based Management processes (e.g. Career Development, Workforce Planning, etc.) in Organizations is a complex task. Difficulties concern with both the right assessment methodology and the most effective tools. Moreover, the assessment process is time-consuming both for assessors and assessees and often it is performed at the wrong time with considerable costs for external resources. This work proposes a novel approach, based on semantic technologies, to enhance competence assessment in Organizations by analysing content produced, tasks completed and professional relationships established by employees in their day by day activities at the workplace. (Page 931)

83 Exploiting Participatory Design in Open Innovation Factories

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Keywords: Open Innovation, Innovation Factory, Collective Knowledge

Abstract In this paper we describe a methodology and a set of tools that support the exploitation of ideas, suggestions and proposals coming from different sources, internal and external to the organization (e.g. customers and employees). Items extracted from incoming message flows are used as a basis of a participatory design process. In this context, we discuss the design principles of an environment we call Open Innovation Factory, supporting collaborative design of new products and services. (Page 937)

97 A Knowledge Discovery Methodology for Semantic Categorization of Unstructured Textual Sources

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Keywords:

Abstract We describe a methodology for identifying characterizing terms from a source text or paper and automatically building an ontology around them, with the purpose of semantically categorizing a paper corpus where documents sharing similar subjects may be subsequently clustered together by means of ontology alignment. We first employ a Natural Language Processing pipeline to extract relevant terms from the source text, and then use a combination of a pattern-based and machine-learning approach to establish semantic relationships among those terms, with some user's feedback required in-between. This methodology for discovering characterizing knowledge from textual sources finds its inception as an extension of PRAISED, our abbreviation discovery framework, in order to enhance its resolution capabilities. By moving from a paper-by-paper, mainly syntactical process to a corpus-based, semantic approach, it was in fact possible to overcome earlier limits of the system related to abbreviations whose explanation could not be found within the same paper they were cited in. At the same time, though, the methodology we present is not tied to this specific task, but is instead of relevance for a variety of contexts, and might therefore be used to build a stand-alone system for advanced knowledge extraction and semantic categorization. (Page 944)

77 Managing Strategies for Cooperative Multi-Agents under Diversity

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Keywords: Multi-agent System, Machine Learning, Game Theory

Abstract In this investigation, we propose a new kind of framework for multiple agents by which the agents take their decisions in a cooperative manner towards em diverse society. Basically, putting importance on observed information, we like to obtain likely consequences consistent with the information sources. To do that, we manage several decisions in terms of best strategy} by using Maximal Likelihood Estimation (MLE) on some probability distributions. We show some experimental results of our approach, and examine how well practical agents play and how well the model captures the situation. (Page 952)

121 Exploiting Semantic Models and Techniques to Evaluate Relevance of Human Resources in Knowledge Intensive Organizations

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Keywords: HRM, knowledge management, competence management, semantic models, semantic social network analysis

Abstract This paper reports the results of the ARISTOTELE methodology for decision support on Human Resource Management and, in particular, of one of the most important tool of the methodology, i.e. the Relevance Analysis. The Relevance Analysis is devoted at providing a systemic way to map human resources on the basis of their relevance in an organization, and take informed decisions. We have defined a model and a methodology to quantify relevance of the human resources with respect to key processes of an organization. Relevance is a combination of two factors: i) Criticality, an attribute to establish the attention degree that the organization must pay to assess the importance of human resource, ii) Influence, an attribute to establish the degree of influence the

human resource can exert in placing limits, indicating rules and regulations in the organization and with other human resources. We will show how exploiting the ARISTOTELE results on the semantic models and semantic Social Network Analysis is possible to quantify the Criticality and Influence of human resources in a knowledge intensive organization. (Page 960)

188 Adult Video Content Detection Using Machine Learning Techniques

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Keywords: machine learning, adult-content detection, camera motion, pattern recognition, SVM, feature, classification

Abstract Automatic adult video detection is a problem of interest to many organizations around the world. The aim is to restrict the easy access of underage youngsters to such potentially harmful material. Most of the existing techniques are mere extensions of image categorization approaches. In this paper we propose a video genre classification technique tuned specifically for adult content detection by considering cinematographic principles. Spatial and temporal simple features are used with machine learning algorithms to perform the classification into two classes: adult and non-offensive video material. Shot duration and camera motion, are the temporal domain features, and skin detection and color histogram are the spatial domain ones. Using two data sets of 7 and 15 hours of video material, our experiments comparing two different SVM classifiers achieved an accuracy of 94.44%. (Page 967)

Workshop on Web based and Distributed Information Systems (WEBDIS)

256 Knowledge Reposiory as Entity Similarity Computing Enabler

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Keywords: ontology server, knowledge repository information retrieval, entities similarity

Abstract With the adoption of Semantic Web technologies, knowledge based applications are nowadays common. They rely on the use of numerous and varied knowledge organization systems. This raises the problem of the interoperability of the underlying models in particular for data integration purpose. We present in this paper an approach based on an ontology server and providing functionalities including ontology matching and change detection. The evaluation of the matching approach using standard measure of recall/precision/F-measure shows results which outperform in certain contexts current available systems which are able to process large data set. (Page 975)

256 Collaborative Incident Reporting with Linked Heterogeneous Information

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Keywords: XML Linkage, incident reporting, mobile apps

Abstract This paper proposes a framework to integrate XML data from heterogeneous sources for querying performance. There are 2 steps to handle the multiple source data. The first step is to establish links between the data sources. Then, the next step is to develop a standard format and data conversions are performed after the collection process. For an illustration of the framework, an incident reporting mobile application is developed. Users can report events or crime incidents using an android phone. The reported information can formulate a query to relevant data sources and extract associated information of the event. The application provides an interactive and real time platform to integrate data and communication with other users. (Page 982)

241 Food Volume Estimation in a Mobile Phone Based Dietary Assessment System

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Keywords: dietary assessment, food records, feature detection, volume estimation, disparity map, depth map, 3D point cloud

Abstract There is now convincing evidence that poor diet, in combination with physical inactivity are key determinants of an individual's risk of developing chronic diseases, such as obesity, cancer, cardiovascular disease or diabetes. Assessing what people eat is fundamental to establishing the link between diet and disease. Food records are considered the best approach for assessing energy intake. However, this method requires literate and highly motivated subjects and adolescents and young adults are the least likely to undertake food records. The ready access of the majority of the population to mobile phones has opened up new opportunities for dietary assessment. In such systems, the camera in the mobile phone is used for capturing images of food consumed and these images are then processed to automatically estimate the nutritional content of the food. A vital step in this process is the estimation of the volume of the food in the image. In this paper we propose a food volume estimation approach which requires only a pair of stereo images to be captured. Our experimental results show that the proposed approach can provide an accurate estimate of the volume of typical food items in a passive manner without the need for manual fitting of 3D models to the food items. (Page 988)

211 A Multi-policy Model for Access Control in Cooperative Information Systems

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Keywords: Cooperative Information Systems, Access Control, Role Based Multi-policies Model

Abstract In the context of cooperative information systems, research focused on the interoperability among data sources, related to schematic and syntactic representations or semantic expression. Security introduces new problems of heterogeneity. In this paper we refer to the different ways to represent authorization and rules in access control policies. Our proposition consists in using a role based multy-policy model to represent heterogeneous policy in the same formalism. We also map the local policies creating access bridges and we propose a set of security controls to filter a global user query. (Page 996)

251 A Conceptual Architecture for Semantic Mash Up Recommender Framework

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Keywords: multi-agent, composition, automatic, service, semantic, recommendation system, ontology, RDF, etc

Abstract In this paper we propose a conceptual semantic based tourism platform that enables users to consume mash up applications by using a multi agent system. We explore different mechanisms for discovery, publishing, composition and querying of services. In particular, we present a methodology for collecting, organizing and searching data distributed in different resources-RDF data sets- and - Application Programming Interface (API) -. As a part of our model, we propose a semantic architecture that defines three main components: i) A mechanism for automatic data collection. ii) A mechanism for automatic service composition. ii) A semantic recommendation module based on user context and social profile. (Page 1002)