LACNEM2015
VI Latin-American Conference on Networked Electronic Media
23-25 September 2015

Facultad de Minas, Universidad Nacional de Colombia
Medellín-Colombia

Day 1	**Industry and Health Applications (23th Sept)**
08:00-08:30	Registration
08:30-09:00	**Opening Ceremony**
09:00-10:00	**Plenary Talk: Prof Aggelos Katsaggelos.** AT&T Research Professor of Electrical Engineering and Computer Science Northwestern University, USA:*Learning for Future Video*
10:00-10:30	Coffee Break
10:30-11:00	**Oral Presentations**
10:30-10:45	P01 Automatic Classification of Non-informative Frames in Colonoscopy Videos: *Cristian Ballesteros, Maria Trujillo, Claudia Mazo* (Universidad del Valle, Colombia)
10:45-11:00	P02 Digital Preoperative Planning of Total Hip Arthroplasty: *Giancarlo Quevedo, Sebastian Scotti and Maria Trujillo* (Universidad del Valle, Colombia)
11:00-12:00	**Plenary Talk: Dr Eduardo Romero.** Director Centro de Telemedicina Universidad Nacional de Colombia, Colombia *Towards Finding Complex Patterns in Medical Images*
12:00-14:00	**Lunch - Poster Session**
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PT2	DWT-based Feature Extraction for Motor Imagery Classification: *Laura Vega-Escobar, Andrés Eduardo Castro-Ospina, Leonardo Duque-Muñoz* (Instituto Tecnológico Metropolitano Medellín, Universidad de Antioquia, Colombia)
PT3	Car Detection Methodology in Outdoor Environment Based on Histogram of Oriented Gradient (HOG) and Support Vector Machine (SVM): *Sebastián Guzmán, Alexander Gómez, Germán Diez, David Fernández* (Universidad de Antioquia, Medellín, Colombia)
PT4	Extracción Automática de frames informativos en video de colonoscopia: *Arcila Díaz Juan Carlos, Mejía Cabrera Heber Ivan, Tuesta Monteza Victor, Trujillo Maria* (Universidad Señor de Sipán,

Perú; Universidad del Valle, Colombia)

PT5 Georreferenciacion y factibilidad de radioenlaces para 800 establecimientos educativos del proyecto EMCALI - Kioscos Vive Digital: *Delia Karina Riascos Vallecilla, Dimas Fernando Castro Portilla, Joan Samir Rosales Cadena, Juan Camilo Fernandez Lopez* (Universidad de Santiago de Cali, Colombia)

PT6 Transferable Belief Model for the Semantic Web: *Cesar Pantoja, Ebroul Izquierdo* (Queen Mary University of London, UK)

PT7 Detection of Mycobcaterium tuberculosis in microscopic images of Ziehl-Neelsen-stained sputum smears: *Mateo Rico García, Augusto Enrique Salazar Jiménez, Carlos Andres Madrigal Gonzalez, Luis Javier Morantes Guzman, Fabian Cortes Mancera* ((Instituto Tecnológico Metropolitano Medellín, Universidad de Antioquia, Colombia))

PT8 Implementation of a long-distance WiFi link embedded routing devices based on free software for transmission of voice over IP protocol: *Carlos Linares* (Universidad INCCA de Colombia, Colombia)

14:00-15:00		**Oral Presentations**
14:00-14:15	P03	Characterisation of the spatial sensitivity of classifiers in pedestrian detection: *Daniel Quinteros, Sergio A Velastin, Gonzalo Acuña* (Universidad de Santiago de Chile, Chile; Universidad Carlos III de Madrid, Spain)
14:15-14:30	P04	Automatic Segmentation of Coral Reefs Implementing Textures Analysis and Colour Features with Gaussian Mixtures Models: *Juan Pérez, Alexander Gómez, Jhony Giraldo, Sebastián Guzmán, David Fernández* (Universidad de Antioquia, Colombia)
14:45-15:00	P05	Modelamiento Formal de una Arquitectura Básica SDN basada en CPN Jerárquicas: *Sebastian Castrillón* (Universidad de Antioquia, Colombia)
15:00-15:30		Coffee break and Posters (see above for list)
15:30-17:30		**Round Table of Industrialists** Chair: Dr. Jairo Espinosa Panel: Prof. Aggelos Katsaggelos, Prof. Sergio A. Velastin, Prof. Ebroul Izquierdo, Dr. Domingo Mery, Dr. Luciana Nedel
17:30-18:30		Tutorial Course: Dr Germán Castellanos
Day 2		**Computer Vision (24th Sept)**
08:00-08:30		Registration
08:30-09:00		**IET Latin America and Caribbean, Neriza Murrell**
09:00-10:00		**Plenary Talk: Prof Sergio A Velastin.** Universidad de Santiago de Chile and Universidad Carlos III de Madrid, Spain *The potential of fusion in computer vision applications*
10:00-10:30		Coffee Break and Posters (see above for full list)
10:30-11:00		**Oral Presentations**
10:30-10:45	P06	Diseño e implementación de una Herramienta de Síntesis de Texturas

		para Aplicaciones con Imágenes Digitales: *Juan Pablo Garcia, Daniel Serna Bustamante, David Stephen Fernández* (Universidad de Antioquia, Colombia)
10:45-11:00	P07	Flexibilización del método de umbralización de entropía: *Manuel G. Forero, Linda M. Guio* (Universidad de Ibagué, Colombia)
11:00-12:00		**Plenary Talk: Dr Domingo Mery.** Director of Research and Innovation, School of Engineering, Pontificia Universidad Católica de Chile *Computer Vision for X-Ray Testing*
12:00-14:00		**Lunch - Posters (see above for details)**
14:00-15:00		**Oral Presentations**
14:00-14:15	P08	Non--Referenced Quality Assessment of Image Processing Methods in Infrared Non--Destructive Testing based in Higher Order Statistics: *T. J. Ramirez-Rozo* (Instituto Tecnológico Metropolitano, Colombia)
14:15-14:30	P09	Clasificación Automática de Residuos Como Una Aplicación de Visión Artificial en la Educación Básica secundaria Colombiana: *Juan Carlos Briñez, Alejandro Rengifo, Manuel Escobar* (Universidad Nacional de Colombia; Institución Educativa Andrés Bello, Colombia)
14:30-14:45	P10	Automatic classification of nutritional deficiencies in coffee plants: *Diego Monsalve, María Trujillo, Deisy Chaves* (Universidad del Valle, Colombia)
14:45-15:00	P11	Estudio Comparativo de Técnicas de Balanceo de Datos en el Aprendizaje de Múltiples Instancias: *Jose Arrieta, Carlos Mera* (Universidad Nacional de Colombia, Colombia)
15:00-15:30		**Coffee break and Posters (see above for full list)**
15:30-17:30		**Tutorial course: Dr. Domingo Mery** *Balu: A Matlab Toolbox for computer vision, pattern recognition and image processing*
17:30-18:30		Tutorial Course: Dr Germán Castellanos
Day 3		**Multimedia and Entertainment Technology (25th Sept)**
08:00-09:00		Registration
08:45-09:45		**Plenary Talk: Prof Ebroul Izquierdo.** Professor of Multimedia and Computer Vision Queen Mary, University of London, UK *Face Recognition: from forensics and machine vision to understanding the visual system of human super-recognizers*
09:45-10:15		Coffee Break and Posters (see above for full list)
10:15-11:00		**Oral Presentations**
10:15-10:30	P12	A Push Scheduling Algorithm with Network Coding for Peer-to-Peer Live Streaming: *Shenglan Huang, Ebroul Izquierdo, Pengwei Hao* (Queen Mary University of London, UK)
10:30-10:45	P13	Mejora en el algoritmo de construcción de esqueletos 3D y algoritmos de adelgazamiento de eje medio: *Manuel G. Forero, Camilo A. Murillo* (Universidad de Ibagué, Colombia)
10:45-11:00	P14	Evaluation Framework for Crowd Behaviour Simulation and Analysis based on Real Videos and Scene Reconstruction: *Konrad Jablonski,*

	Vasileios Argyriou, Darrel Greenhill, Sergio A. Velastin (Kingston University, UK; Universidad Carlos III de Madrid, Spain)
11:00-12:00	**Plenary Talk: Dr Luciana Nedel.** Associate Professor Universidade Federal do Rio Grande do Sul, Brazil *Towards "calm interfaces" using a network of sensors and actuators*
12:00-14:00	Lunch - Poster Session (see above for full details)
14:00-15:00	**Award Presentations**: Best paper, Best oral presentation and Best poster
15:00-15:30	Coffee break
15:30-17:30	**Tutorial course: Prof. Ebroul Izquierdo** *Image processing in security applications*
17:30-18:30	Tutorial Course: Dr Germán Castellanos
18:30-19:00	**Closing Ceremony**

Local organisation:

Day 1   **Industry and Health Applications (23th Sept)**

Plenary Talk: Prof Aggelos Katsaggelos. AT&T Research Professor of Electrical Engineering and Computer Science Northwestern University, USA:*Learning for Future Video*

Prof. Aggelos K. Katsaggelos received the Diploma degree in electrical and mechanical engineering from the Aristotelian University of Thessaloniki, Greece, in 1979, and the M.S. and Ph.D. degrees in Electrical Engineering from the Georgia Institute of Technology, in 1981 and 1985, respectively. In 1985, he joined the Department of Electrical Engineering and Computer Science at Northwestern University, where he is currently a Professor holder of the AT&T chair. He was previously the holder of the Ameritech Chair of Information Technology (1997-2003). He is also the Director of the Motorola Center for Seamless Communications, a member of the Academic Staff, NorthShore University Health System, an affiliated faculty at the Department of Linguistics and he has an appointment with the Argonne National Laboratory. He has published extensively in the areas of multimedia signal processing and communications (over 250 journal papers, 500 conference papers and 40 book chapters) and he is the holder of 25 international patents. He is the co-author of Rate-Distortion Based Video Compression (Kluwer, 1997), Super-Resolution for Images and Video (Claypool, 2007), Joint Source-Channel Video Transmission (Claypool, 2007), and Machine Learning, Optimization, and Sparsity (Cambridge University Press, forthcoming). He has supervised 50 Ph.D. theses so far. Among his many professional activities Prof. Katsaggelos was Editor-in-Chief of the IEEE Signal Processing Magazine (1997-2002), a BOG Member of the IEEE Signal Processing Society (1999-2001), a member of the Publication Board of the IEEE Proceedings (2003-2007), and he is currently a Member of the Award Board of the IEEE Signal Processing Society. He is a Fellow of the IEEE (1998) and SPIE (2009) and the recipient of the IEEE Third Millennium Medal (2000), the IEEE Signal Processing Society Meritorious Service Award (2001), the IEEE Signal Processing Society Technical Achievement Award (2010), an IEEE Signal Processing Society Best Paper Award (2001), an IEEE ICME Paper Award (2006), an IEEE ICIP Paper Award (2007), an ISPA Paper Award (2009), and a EUSIPCO paper award (2013). He was a Distinguished Lecturer of the IEEE Signal Processing Society (2007-2008).

Learning for Future Video: Learning has made it possible to unleash the power of data. We have moved away from the detailed modeling of a system or a phenomenon of interest thanks to the abundance of data as well as the huge improvements in processing power. With approaches like dictionary learning we can discover linear relationships between the input and output. On the other hand, recent advancements in deep learning have made it possible to discover non-linear relationships. As one of the examples in this talk we discuss the application of dictionary and deep learning to the video super-resolution problem. We describe a multiple-frame algorithm based on dictionary learning and motion estimation. We further describe the use of a convolutional neural network that is trained on both the spatial and temporal dimensions of videos to enhance their resolution. We demonstrate experimentally the effectiveness of these approaches. We finally discuss future research directions on the topic of learning.

10:30-11:00   **Oral Presentations**

10:30-10:45   P01 Automatic Classification of Non-informative Frames in Colonoscopy Videos: *Cristian Ballesteros, Maria Trujillo, Claudia Mazo* (Universidad del Valle, Colombia)

Colonoscopy is the most recommended test for prevention of colorectal cancer. Nowadays, digital videos are recorded during colonoscopy procedures and used for training machine learning algorithms. Machine learning algorithms are used for automatically recognizing lesions based on supervised learning. Moreover, annotation of lesions is a difficult and time-consuming process that is manually made by gastroenterologists. Those annotations may contain frames that have not useful information, called Non-Informative frames. The presence of Non-Informative frames in a group of frames labelled as lesion affects the accuracy of machine learning algorithms. In this paper, a method based on edge detection is proposed to automatically classify a frame -- from a colonoscopy video -- into either Informative and Non-Informative. Non-Informative Frames usually do not contain many edges. However, brightness regions produce false edges. Therefore, the proposed method includes a technique for brightness segmentation to identify false edges. The proposed method is evaluated using videos annotated by gastroenterologists. Elimination of Non-Informative frames may reduce significantly the number of frames to be annotated by gastroenterologists and may improve the accuracy of machine learning algorithms. Experimental evaluation showed that the accuracy and the precision of the proposed method are over 95%.

10:45-11:00   P02 Digital Preoperative Planning of Total Hip Arthroplasty: *Giancarlo Quevedo, Sebastian Scotti and Maria Trujillo* (Universidad del Valle, Colombia)

Preoperative templating of total hip arthroplasty consists of determining the magnification of the hip on a radiograph and applying identical magnification to the radiograph and the template. The traditional planning relies on visually comparing acetate templates and analogue radiographs over a white light-box. When it is done manually, a template may be inaccurately selected and it must be corrected in the operation theatre, in this case a new prosthesis have to be ordered mean- while the patient is under anaesthesia. Preoperative planning of total hip arthroplasty may be supported by computer technology in order to reduce the planning errors. The automation of arthroplasty requires a precise calibration for adjusting to the real dimensions in order to use templates in PDF format. In this paper, HipOrtho a digital preoperative planning of total hip arthroplasty is presented, as an open source plugin on OsiriX. HipOrtho Pluging is developed using OsiriX viewer as a tool that uses multiple libraries for rendering, DICOM management and plugins. The plugin architecture is expanded to other orthopaedic plugins, such as Osteotomy and Knee Replacement. Preliminary evaluations have been conducted using Exactech templates and

digital radiographs obtained from patients at the Imbanaco Medical Centre. Currently, the plugin is under evaluation by a group of orthopaedists at the Imbanaco Medical Centre in Cali.

Plenary Talk: Dr Eduardo Romero. Director Centro de Telemedicina Universidad Nacional de Colombia, Colombia
Towards Finding Complex Patterns in Medical Images

Towards Finding Complex Patterns in Medical Images: In this information era, many new analysis techniques have changed our understanding of many complex problems. This lecture is about different computational approaches addressed to find out hidden knowledge in three use cases, namely computational anatomy for discovering patterns in neurodegenerative diseases, motion analysis and development of gait models to understand motion patterns in Parkinson disease and construction of analysis tools in digital pathology.

Posters

PT1 Reconocimiento de Gestos para la Enseñanza de los Números a Párvulos Usando Sensor Kinect: *Sindy T. Fuentes Gutiérrez, Jhonatan E. Ríos Meza, Carlos A. Madrigal* (Instituto Tecnológico Metropolitano Medellín, Colombia)

Este artículo presenta una aplicación para la enseñanza de números a párvulos usando imágenes de profundidad obtenidas con el Sensor Kinect. La metodología propuesta consiste en localizar la mano y utilizar algoritmos de segmentación que permitan aislar la mano del niño del resto del cuerpo y de los objetos presentes en la escena, además son extraídas 14 características que fueron seleccionadas con la ayuda del toolbox Balu. Finalmente, mediante el clasificador LDA se reconocen de manera precisa y eficiente los ademanes realizados por los niños. En las pruebas realizadas se pudo evidenciar que el algoritmo de clasificación permite reconocer los gestos en un 95% de los casos. Como interface con el Kinect se utilizó la librería OpenNI y para el procesamiento de las imágenes se utilizan las librerías OpenCV y cvblobslib.

PT2 DWT-based Feature Extraction for Motor Imagery Classification: *Laura Vega-Escobar, Andrés Eduardo Castro-Ospina, Leonardo Duque-Muñoz* (Instituto Tecnológico Metropolitano Medellín, Universidad de Antioquia, Colombia)

Brain computer systems interface (BCI) is a continuing and growing field in evolution. During the last decades, many laboratories have begun to explore technologies BCI as a new communication option for people with neuromuscular disabilities that prevent them from using conventional augmentative communication methods. In this work is presented a methodology for the classification of motor imagination, using features extracted from power spectral density (PSD) as feature extraction technique. Two approaches are evaluated, first computing PSD features from the raw data and the second, performing a decomposition by means of the discrete wavelet transform (DWT). Obtained classification results show that features obtained through PSD with DWT achieves an accuracy of 85%, a sensitivity of 90% and a specificity of 80% while the results obtained with PSD over the raw data has a precision of 70%, one sensitivity 60% and specificity of 80%. Demonstrating that the performance of the classifier with the proposed pre-processing stage was improved.

PT3 Car Detection Methodology in Outdoor Environment Based on Histogram of Oriented Gradient (HOG) and Support Vector Machine (SVM): *Sebastián Guzmán, Alexander Gómez, Germán Diez, David Fernández* (Universidad de Antioquia, Medellín, Colombia)

In this paper a methodology for car detection in outdoor environments is presented, based on HOG an SVM extensive experiments were did changing SVM parameters reaching a 99% of successful in classification, a new database with multiple environment noise and hard conditions was develop and put online for comparison.

PT4 Extracción Automática de frames informativos en video de colonoscopia: *Arcila Díaz Juan Carlos, Mejía Cabrera Heber Ivan, Tuesta Monteza Victor, Trujillo Maria* (Universidad Señor de Sipán, Perú; Universidad del Valle, Colombia)

Durante un procedimiento de diagnóstico médico a través de colonoscopia, una pequeña cámara incluida en la punta del endoscopio genera una señal de vídeo que se almacena para el respectivo análisis por parte del médico. Los inconvenientes presentados en estos videos de colonoscopia es que están compuestos por secuencias que poseen frames No-Informativos, estos frames no muestran información significativa, se encuentran borrosos, debido a que los endoscopios están equipados con una cámara que posee un solo lente angular y como consecuencia de la grabación en zonas poco favorables mucho frames son ilegibles; el objetivo es entonces excluir dichos frames no Informativos permitiendo de esta manera que el médico experto realice su trabajo en un menor tiempo. En este documento se proponen dos nuevos métodos de visión artificial que permiten la extracción automática de los frames informativos basándose en las características que posee cada frame, el primer método permite la clasificación de fotogramas entre informativos y no informativos basándose en la cantidad de contornos que posee cada frame; mientras que el segundo método utiliza flujo óptico denso para obtener el porcentaje de movimiento que tiene cada frame y agruparlos en informativos y no-informativos utilizando clustering con K-Means. Ambos métodos procesan el video de colonoscopia y muestran como resultado un nuevo video que incluye solo los frames informativos.

PT5 Georreferenciacion y factibilidad de radioenlaces para 800 establecimientos educativos del proyecto EMCALI - Kioscos Vive Digital: *Delia Karina Riascos Vallecilla, Dimas Fernando Castro Portilla, Joan Samir Rosales Cadena, Juan Camilo Fernandez Lopez* (Universidad de Santiago de Cali, Colombia)

Initially, a study of the geographic positioning of registered educational centers in the VIVE DIGITAL KIOSK project through GOOGLE EARTH software and Geographic Information System raises the educational system (SIGEO), in order to present the feasibility of the mass of Internet use in these rural areas and inaccessible. Moreover, the software MOBILE RADIO is used as a key element in the simulation of the radio link between the towers used by EMCALI and the schools to which they are providing the service. Together, a prospective study was carried out near the positioning of existing towers and the possibility of mounting new towers and install new antennas for communication with educational venues. Finally, a technical study of IPTV Technology managed by EMCALI -TELCO is performed, as IPTV or Internet TV, as it is also known, more and more because it offers a better alternative to conventional television.

PT6 Transferable Belief Model for the Semantic Web: *Cesar Pantoja, Ebroul Izquierdo* (Queen Mary University of London, UK)

For all the potential and actual benefits of the Semantic Web, it "remains largely unrealized", as stated by Tim Berners-Lee. Apart from practical issues that still must be tackled by the community, there are theoretical issues still present in the Semantic Web standards. One of such theoretical issues is the representation and reasoning using imprecise or uncertain information. The fundation of the Semantic Web is the assertion relations between entities, but these relations usually don't carry a degree or level of relationship. The relations either are or aren't. Using a simple subject-predicate-object tuple we can say that Alice (subject) likes (predicate) Rock music (object), but we can't say she does so with a confidence of 80%. This is important because representing and reasoning with imprecise information is essential to dealing with real world information. We propose the Transferable Belief Model (TBM), an elaboration of the Dempster-Shafer Theory, as a way to achieve this. It will be particularly applied to the visual surveillance domain. This is relevant because computer algorithms to detect objects on scenes are not 100% reliable, and representing this unreliability in the system is desirable. Exhaustive testing must be performed on the system, but early empirical tests show the feasibility of using the TBM as a model for reasoning with uncertainty in the semantic web.

PT7 Detection of Mycobcaterium tuberculosis in microscopic images of Ziehl-Neelsen-stained sputum smears: *Mateo Rico García, Augusto Enrique Salazar Jiménez, Carlos Andres Madrigal Gonzalez, Luis Javier Morantes Guzman, Fabian Cortes Mancera* (Instituto Tecnológico Metropolitano Medellín, Universidad de Antioquia, Colombia)

Tuberculosis is a disease with a high mortality rate worldwide, but early recognition highly increases the chances of survival. Through the counting of bacilli present in sputum it is possible to detect the disease. This procedure requires time and a specialist with a well-trained eye, thus making it prone to error. This paper presents a methodology for detecting bacilli in sputum smear images, implementing adaptive k-mean segmentation clustering, and using artificial neural networks. The results of the experiments show that the proposed methodology is effective, since it can accurately identify the bacilli in the smear images.

PT8 Implementation of a long-distance WiFi link embedded routing devices based on free software for transmission of voice over IP protocol: *Carlos Linares* (Universidad INCCA de Colombia, Colombia)

The implementation of long distance and low cost wireless links based on embedded devices routing and use of free software can be a technological alternative for the implementation of rural telephony networks. To achieve this goal is very important to get quality parameters (QoS) on IP channel management and appropriate bandwidth. This work has the purpose to deepen those aspects by conducting specific tests to demonstrate the approach of the real parameters obtained in the results of the field tests proposed link with the theoretical parameters studied.

14:00-15:00	**Oral Presentations**
14:00-14:15	P03 Characterisation of the spatial sensitivity of classifiers in pedestrian detection: Daniel Quinteros, Sergio A Velastin, Gonzalo Acuña (Universidad de Santiago de Chile, Chile; Universidad Carlos III de Madrid, Spain)

In this paper, a study of the spatial sensitivity in the pedestrian detection context is carried out by a comparison of two descriptor-classifier combinations, using the well-known sliding window approach and looking for a well-tuned response of the detector. By well-tuned, we mean that multiple detections are minimised so as to facilitate the usual non-maximal suppression stage. So, to guide the evaluation we introduce the concept of spatial sensitivity so that a pedestrian detection algorithm with good spatial sensitivity can reduce the number of classifications in the pedestrian neighbourhood, ideally to one. To characterise spatial sensitivity we propose and use a new metric to measure it. Finally we carry out a statistical analysis (ANOVA) to validate the results.

14:15-14:30   P04 Automatic Segmentation of Coral Reefs Implementing Textures Analysis and Colour Features with Gaussian Mixtures Models: *Juan Pérez, Alexander Gómez, Jhony Giraldo, Sebastián Guzmán, David Fernández* (Universidad de Antioquia, Colombia)

The applications of digital image processing techniques over coral reefs are an emerging research field for the coral reefs importance in marine ecosystems. One important section in analysis of coral reefs using digital image processing is the segmentation stage. Few automatic segmentation techniques in corals have been used to solve this problem, which is why in this paper we propose a texture segmentation algorithm with applications to coral reefs segmentation. Our goal was reached using a combination of Gabor Filters, Contrast Limited Adaptive Histogram Equalization, and Gaussian Mixture Model, varying the parameters for each one. The results show that automatic segmentations of corals is possible, in most of the cases the corals were correctly segmented, even in a real environment the images are successfully segmented.

14:45-15:00   P05 Modelamiento Formal de una Arquitectura Básica SDN basada en CPN Jerárquicas: *Sebastian Castrillón* (Universidad de Antioquia, Colombia)

Las redes definidas por software (SDN) definen un cambio sustancial en la forma como se administran las redes de datos actuales. SDN separa el plano de control y el plano de administración, lo cual se logra adicionando características de software simples a los dispositivos de red actuales. Conjuntamente con SDN fue desarrollado el protocolo OpenFlow para permitir la comunicación entre los dos planos y lograr la administración centralizada de la red. Los sistemas centralizados son fáciles de administrar, pero también existe la probabilidad de errores de implementación, diseño y operación; limitando la escalabilidad y el rendimiento de la red. Este artículo es un primer paso para desarrollar una herramienta de simulación que permita dimensionar y probar la capacidad de expansión óptima de las redes basadas en SDN. Se define una topología de red básica SDN basada en redes de Petri Coloreadas Jerárquicas (HCPN) como técnica formal de modelamiento y análisis del switch y el controlador OpenFlow, el modelo es validado formalmente mediante el análisis del espacio de estados y sus propiedades. Este modelo podrá usado como base para realizar simulaciones de algoritmos de optimización que permitan mejorar el rendimiento de los controladores actuales con tráficos sensibles como el vídeo y la voz.

Day 2   **Computer Vision (24th Sept)**

Plenary Talk: Prof Sergio A Velastin. Universidad de Santiago de Chile and Universidad Carlos III de Madrid, Spain *The potential of fusion in computer vision applications*

Prof. Sergio A Velastin is a research professor at the University of Santiago de Chile. He was also recently is a holder of a Chair of Excellence in the Applied Artificial Intelligence Research Group at the Universidad Carlos III in Madrid. He trained and worked most of his life in the UK where he became Professor in Applied Computer Vision at Kingston University and where he was also director of the Digital Imaging Research Centre. He is also a Fellow of the Institution of Engineering and Technology (IET) and Senior Member of the IEEE where he was member of the Board of Governors of the Intelligent Transportation Society (IEEE-ITSS). Sergio has worked for many years in the field of artificial vision and its application to improve public safety especially in public transport systems. He co-founded Ipsotek Ltd and has worked, on projects with transport authorities in London, Rome, Paris etc in several EU Framework Programme projects.

The potential of fusion in computer vision applications: There are many computer vision applications that can benefit from the fusion of data and information at various levels of processing. For example, even for a monocular image it is possible to extract different image features such as edges, local neighborhood histograms, texture, transforms (Fourier, wavelet, â€¦), etc. and it is important to define how these heterogeneous features could be combined to aid image interpretation. In the context of multiple cameras (possibly of different image modalities such as visible light, infrared, 3D) providing different views of the same phenomena, we need methods to relate the data obtained from each sensor into common frames of reference (registration) and then to combine such data in ways that take into account sensor characteristics and noise levels. Typical scenarios in computer vision include multimodal medical diagnosis, multicamera visual surveillance and multisensor ambient intelligence applications. The talk will give a number of examples of how fusion is being used in computer vision by various research teams in different parts of the world.

10:30-11:00	**Oral Presentations**

10:30-10:45   P06 Diseño e implementación de una Herramienta de Síntesis de Texturas para Aplicaciones con Imágenes Digitales: Juan Pablo Garcia, Daniel Serna Bustamante, David Stephen Fernández (Universidad de Antioquia, Colombia)

En el desarrollo de este trabajo se creó un algoritmo de síntesis de textura basada en pixeles teniendo en cuenta el trabajo previo de Li-Yi Wey y Mark Levoy sobre este tema. Se explicará brevemente que es la síntesis de textura y sus posibles aplicaciones, a su vez se explicará el funcionamiento del algoritmo. Finalmente se mostrarán ejemplos de diferentes resultados de síntesis realizadas con su respectiva comparación con trabajos previos.

10:45-11:00   P07 Flexibilización del método de umbralización de entropía: *Manuel G. Forero, Linda M. Guio* (Universidad de Ibagué, Colombia)

'Thresholding is one of the most popular segmentation techniques in image processing. Many techniques have been developed, extended and modified. In this paper, a new optimization criterion is introduced based on the entropy method Kapur and statistical thresholding (Li). The Kapur method is briefly reviewed, its limitations for image segmentation are discussed and the new optimization criterion is introduced. The results allow to understand how the criterion respond to synthetic histograms with specific characteristics and reference images were used for the analysis.

: **Dr Domingo Mery.** Director of Research and Innovation, School of Engineering, Pontificia Universidad Católica de Chile
Computer Vision for X-Ray Testing

Computer Vision for X-Ray Testing: X-ray imaging has been developed not only for its use in medical imaging for human beings, but also for materials or objects, where the aim is to analyze -non-destructively- those inner parts that are undetectable to the naked eye. Thus, X-ray testing is used to determine if a test object deviates from a given set of specifications. Typical applications are analysis of food products, screening of baggage, inspection of automotive parts, and quality control of welds. In order to achieve efficient and effective X-ray testing, automated and semi-automated systems are being developed to execute this task. This talk presents an introduction to computer vision algorithms for industrially-relevant applications of X-ray testing. There are some application areas -like casting inspection- where automated systems are very effective, and other application areas -such as baggage screening- where human inspection is still used; there are certain application areas -like weld and cargo inspections- where the process is semi-automatic; and there is some research in areas -including food analysis- where processes are beginning to be characterized by the use of X-ray imaging. We will provide supporting material available on-line, including a database of X-ray images and a Matlab toolbox for use with some examples.

14:00-15:00	**Oral Presentations**
14:00-14:15	P08 Non--Referenced Quality Assessment of Image Processing Methods in Infrared Non--Destructive Testing based in Higher Order Statistics: T. J. Ramirez-Rozo (Instituto Tecnológico Metropolitano, Colombia)

Infrared Non-Destructive Testing (IRNDT) inspects the defects in a material by evaluation of a thermal image sequence, acquired from the material being heated. Current image processing techniques require all images of the sequence to enhance the defect's visibility in materials, thus the best-quality image must be found exhaustively from the whole sequence. In this work, we study the appropriateness of implementation of higher order statistics as a technique for IRNDT, where a single enhanced image is produced by sequence, avoiding the best-quality image search. For validation purposes, we compare the performance of IR Thermography processing based in High-Order Statistics (IRTHOS) among the common techniques used for IRNDT: Thermal Signal Reconstruction (TSR), First and Second Derivative, Normalized Thermal Contrast (NTC), Filtered NTC, Pulsed Phase Thermography (PPT) and Filtered PPT. The comparison is carried out by quality assessment of processed images by the considered techniques. We use a Non-Referenced (NR) measure for Image Quality Assessment (IQA), giving as a result that IRTHOS achieves a 4.68% higher quality for TSR first derivative, than the best--quality image found. However, the image processed by the proposed technique exhibits singularities due to net structure and geometry of the material.

14:15-14:30	P09 Clasificación Automática de Residuos Como Una Aplicación de Visión Artificial en la Educación Básica secundaria Colombiana: *Juan Carlos Briñez, Alejandro Rengifo, Manuel Escobar* (Universidad Nacional de Colombia; Institución Educativa Andrés Bello, Colombia)

La producción de residuos es un problema que afecta a la población en general, es por ello que las estrategias de clasificación y reciclaje son abordadas a nivel educativo. La institución educativa Andrés Bello perteneciente al municipio de Bello-Colombia se ha mostrado interesada en el desarrollo de estrategias tecnológicas que permitan la clasificación automática de los residuos. Para ello, la institución propuso la integración de conceptos y aplicaciones de visión por computador como herramienta tecnológica en la educación básica secundaria. Esto permitió el desarrollo de un prototipo basado en visión por computador que clasifica tres tipos de residuos (Bottellas PET, latas de refresco y cajas de refresco). Sin embargo el desempeño del sistema sólo ha alcanzado el 82% en la clasificación.

14:30-14:45   <u>P10</u> Automatic classification of nutritional deficiencies in coffee plants:
               Diego Monsalve, María Trujillo, Deisy Chaves (Universidad del
               Valle, Colombia)

Classification of nutritional deficiencies, in coffee plants, is a problem for coffee farmers, since they do not have the required knowledge neither receive technical assistance. Moreover, the performance of automatic classification of nutritional deficiencies based on digital image processing is affected by changes in the image appearance such as illumination, noise and acquisition conditions. In addition, some nutritional deficiencies have similar visual symptoms, such as magnesium, manganese and iron, being difficult to distinguish among them. In this paper, Random Forest, a machine learning technique based on decision trees, is used to automatically classify nutritional deficiencies in coffee plants, using local and global features. The SIFT algorithm is used to extract local features. Global features are defined based on shape and color characteristics of nutritional deficiencies. Experimental evaluation was perform using 335 images of coffee leaves with only one nutritional deficiency. The results show that global features have better performance that local features with an accuracy of 67.5%.

14:45-15:00   <u>P11</u> Estudio Comparativo de Técnicas de Balanceo de Datos en el
               Aprendizaje de Múltiples Instancias: *Jose Arrieta, Carlos Mera*
               (Universidad Nacional de Colombia, Colombia)

En el aprendizaje supervisado se considera que un conjunto de entrenamiento de dos clases está desbalanceado cuando el número de muestras de una de las clases (la clase mayoritaria) sobrepasa el número de muestras de la otra (la clase minoritaria). Diferentes estudios han mostrado que el desempeño de la mayoría de algoritmos de clasificación, basados en la teoría de decisión de Bayes, se afecta negativamente cuando estos son entrenados con conjuntos de datos desbalanceados. A pesar de que este problema ha sido ampliamente estudiado en el aprendizaje de una sola instancia (SIL), poca atención se ha prestado a él en el contexto del aprendizaje de múltiples instancias (MIL). Con base en lo anterior, en este trabajo se discute el problema del aprendizaje con clases desbalanceadas en el contexto MIL y se hace un estudio comparativo de algunas de las técnicas clásicas de muestreo para resolver este problema en MIL. La evaluación de los métodos se hace sobre once conjuntos de datos de referencia que presentan diferentes niveles de desbalance entre las clases. Los resultados experimentales muestran que la aplicación directa de estos métodos en conjuntos de datos tipo MIL no es pertinente.

Tutorial course: Dr. Domingo Mery *Balu: A Matlab Toolbox for computer vision, pattern recognition and image processing*

Balu: A Matlab Toolbox for computer vision, pattern recognition and image processing: Considerable research efforts in computer vision applied to several areas have been developed in the last years, however, they have been concentrated on using or developing tailored methods based on visual features that are able to solve a specific task. Nevertheless, today's computer capabilities are giving us new ways to solve complex computer vision problems. Now, we are able to extract, process and test in the same time more image features and classifiers than before. Balu, a general Matlab Toolbox for image processing, pattern recognition and computer vision, is able to design a computer vision system automatically, i.e., it finds -without human interaction- the features and the classifiers for a given application avoiding the classical trial and error methodology commonly used by human designers. In this short course, we will learn how to use Balu with several examples and graphic user interfaces. We will review some image processing techniques; we will extract a large set of features; we will select them and test a bank of classifiers in order to achieve a high performance.

Day 3   **Multimedia and Entertainment Technology (25th Sept)**

Plenary Talk: Prof Ebroul Izquierdo. Professor of Multimedia and Computer Vision Queen Mary, University of London, UK *Face Recognition: from forensics and machine vision to understanding the visual system of human super-recognizers*

Prof. Ebroul Izquierdo PhD, MSc, CEng, FIET, SMIEEE, MBMVA, is Chair of Multimedia and Computer Vision and head of the Multimedia and Vision Group in the school of Electronic Engineering and Computer Science at Queen Mary, University of London. For his thesis on the numerical approximation of algebraic-differential equations, he received the Dr. Rerum Naturalium (PhD) from the Humboldt University, Berlin, Germany. He has been a senior researcher at the Heinrich-Hertz Institute for Communication Technology (HHI), Berlin, Germany, and the Department of Electronic Systems Engineering of the University of Essex.

Face Recognition: from forensics and machine vision to understanding the visual system of human super-recognizers: Automated face recognition is one of the oldest and probably best understood tasks in computer vision. Due to the plethora of applications, it is also the basis for a fast evolving technology drawing attention from researchers and practitioners in several fields including forensics, biometrics, visual information retrieval, automated surveillance, internet driven social networking and psychologists. Despite its maturity, face recognition is still regarded as one the most challenging tasks in computer vision since in most critical applications it requires extremely high accuracy under very adverse conditions. Indeed, in most cases available input information undergoes significant variations in image quality, scale, orientation, noise and distortions induced by other faces or objects in the same image. This makes an already difficult problem even harder. In this talk important aspects of face recognition and few crucial applications will be presented. Initially, the state of the art in face recognition technology will be outlined. Then, we will refer to essential mathematical and statistical methods used to achieve highly accurate face recognition, as well as, the advantages and disadvantages of available algorithmic solutions. The main still open technical challenges and some important generic aspects of face recognition will be discussed. The focus will be on the lack of robustness under adverse conditions for real-world cases in automated surveillance applications. The usefulness of face recognition, as a tool to help forensic investigators when mining the vast amounts of data in crime solving, will be presented. Furthermore, examples of recent technological developments in two specific application scenarios will be given. The first one relates to recent developments in advanced linear algebra that promise to deliver better higher accuracy in face alignment and recognition technology. The second introduces new discovery's coming from human sciences (psychology), the understanding and use of super-recognizers skills for very robust face recognition.

10:15-11:00	**Oral Presentations**

10:15-10:30   P12 A Push Scheduling Algorithm with Network Coding for Peer-to-Peer Live Streaming: Shenglan Huang, Ebroul Izquierdo, Pengwei Hao (Queen Mary University of London, UK)

Network coding (NC) appears to bring substantial improvements in terms of throughput and delay in collaborative media streaming applications. A key aspect of NC-driven live peer-to-peer streaming is the packet scheduling policy. In previous peer-to-peer network, the buffer-map is widely used to pull or push packets from parent nodes to achieve data transmission. However, it in turn often leads to undesirable long playback delay in live streaming applications. In this paper, we propose a new push scheduling policy to address this problem. In the proposed scheme, the packet scheduling problem is executed at parent client nodes in advance. Then the parent nodes push the network-encoded packets to the children nodes based on the scheduling algorithm as soon as a new video packet is received. As a consequence, the proposed scheme eliminates the processes of buffer updating and packet requesting, which in turn reduces the number of redundant packets and yields to less traffic of redundant video data over the Internet. The simulation results show that the proposed scheme provides significantly better delivery ratio, less control traffic and fewer redundant packets than conventional push-based schemes.

10:30-10:45   P13 Mejora en el algoritmo de construcción de esqueletos 3D y algoritmos de adelgazamiento de eje medio: *Manuel G. Forero, Camilo A. Murillo* (Universidad de Ibagué, Colombia)

Skeletonization is one of the most used techniques in object recognition and tracking; being the one developed by Lee et al. one of the most popular and used. However, this article shows that it does not always produce complete skeletons, finding the causes of the error and presenting a solution allowing to find complete skeletons in all situations.

10:45-11:00 [P14](#) Evaluation Framework for Crowd Behaviour Simulation and Analysis based on Real Videos and Scene Reconstruction: *Konrad Jablonski, Vasileios Argyriou, Darrel Greenhill, Sergio A. Velastin* (Kingston University, UK; Universidad Carlos III de Madrid, Spain)

Crowd simulation has been regarded as an important research topic in computer graphics, computer vision, and related areas. Various approaches have been proposed to simulate real life scenarios. In this paper, a novel framework that evaluates the accuracy and the realism of crowd simulation algorithms is presented. The framework is based on the concept of recreating real video scenes in 3D environments and applying crowd and pedestrian simulation algorithms to the agents using a plug-in architecture. The real videos are compared with recorded videos of the simulated scene and novel Human Visual System (HVS) based similarity features and metrics are introduced in order to compare and evaluate simulation methods. The experiments show that the proposed framework provides efficient methods to evaluate crowd and pedestrian simulation algorithms with high accuracy and low cost.

[**Plenary Talk**](#): **Dr Luciana Nedel.** Associate Professor Universidade Federal do Rio Grande do Sul, Brazil: *Towards "calm interfaces" using a network of sensors and actuators*

Towards "calm interfaces" using a network of sensors and actuators: Better than a friendly and natural human-computer interface is "no interface". Let's imagine the time when computers will anticipate our desires and intentions and help us to solve problems without any explicit command. In this still futuristic scenario, much more than tools, computers will be seen as personal assistants that know their owners, needs and tasks to accomplish. This concept is being explored since the 90's, but we are still far from a good solution. In this talk, we will discuss the idea of "calm interfaces" as well as our filling about its implementation through the use of a network of sensors and actuators. Ambient and personal sensors help the computer to learn about users while actuators are used to communicate to the human. Some preliminary research results will be shown to illustrate our ideas on the future of human-computer interaction.

Tutorial course: **Prof. Ebroul Izquierdo** *Image processing in security applications*

Prof. Ebroul Izquierdo PhD, MSc, CEng, FIET, SMIEEE, MBMVA, Chair of Multimedia and Computer Vision and head of the Multimedia and Vision Group in the school of Electronic Engineering and Computer Science at Queen Mary, University of London.

Image processing in security applications: In this short course relevant image processing tools in forensic and security applications will be discussed. The course will introduce the main challenges of analysing video from real CCTV footage, outline the shortcomings of classic approaches when applied to real use-cases, and provide insight of new methods that promise to overcome the shortcomings of existing technology.