RECPAD 2018

24th PORTUGUESE CONFERENCE ON PATTERN RECOGNITION

Book of Abstracts

October 26, 2018
Coimbra, Portugal

UNIVERSITY OF COIMBRA

APRP

UNIVERSIDADE D COIMBRA

Contents

RECPAD 2018

RECPAD is the annual Portuguese Conference on Pattern Recognition, sponsored by APRP (Portuguese Association for Pattern Recognition). It is a one-day conference with an invited keynote speaker and poster sessions along the day.
This year, RECPAD2018 will be held at the Centro Cultural D. Dinis, in the heart of the UNESCO World Heritage site of the University of Coimbra , on October 26th, 2018.

Please feel extremelly welcome!

Conference Topics

RECPAD 2018 aims to promote the collaboration between the Portuguese scientific community in the fields of Pattern Recognition, Image Analysis and Processing, Soft Computing, and related areas, including, but not limited to:

- Biometrics
- Character recognition
- Classification clustering ensembles and multi-classifiers
- Data mining and big data
- Feature extraction, discretization and selection
- Fuzzy logic and fuzzy image processing
- Gesture recognition
- Hybrid methods
- Image description and registration
- Image enhancement and restoration
- Image segmentation
- Deep Learning
- Image understanding
- Information theory
- Intelligent systems
- Machine vision
- Neural network architectures
- Object recognition
- Pattern recognition applications
- Sensors and sensor fusion
- Soft computing techniques
- Statistical methods
- Syntactical methods
- Transfer Learning

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Message from the General Chair

Welcome to the 24^{th} Portuguese Conference on Pattern Recognition (RECPAD2018) held at the University of Coimbra on 26th October. RECPAD is the annual Portuguese Conference on Pattern Recognition, sponsored by Portuguese Association for Pattern Recognition (APRP).
RECPAD2018 will be held at the Centro Cultural D. Dinis, in the heart of the UNESCO World Heritage site of the University of Coimbra, on October 26th, 2018. It is a one-day conference including an Invited Talk and Poster Sessions presentation.
This year, we are honoured with the presence of Prof Vincenzo Piuri a notable invited keynote speaker who will present a talk entitled "Advanced Biometric Technologies". The Conference has received about 45 papers overall distributed by sessions along the day. According to the thematic topics the papers were organised in 3 Sessions:

Session 1: Deep Learning and Health
Session 2: Genome/Drugs, Physical/HW Systems and Methods
Session 3: Computer Vision, Forecast, Social and Music Applications

Our Association APRP aims at the promotion of progress and knowledge in the area of pattern recognition, stimulating interdisciplinary interactions in various fields of science, technology, research and teaching. RECPAD is an initiative that contributes to the development and enhancement of the area of pattern recognition and its strengthening and densification at national level. We believe that papers to be presented at the conference fulfil in part the goals of our association contributing to widen the national capabilities in the areas and to also to foster informal networking among academics and researchers.
I would like to thank everyone who collaborated with the Organization. A special word of gratitude to the members of the Technical Programme Committee for the thorough and timely review of submitted manuscripts, and also to sponsors for the invaluable support. Recognition and a deep thank must also go to the members of the Organizing Committee who worked hard for the success of this conference.
I welcome all participants and I hope you enjoy RECPAD2018 and your stay in Coimbra.

Bernardete Ribeiro,
General Chair

General Information

Venue

Centro Cultural D. Dinis
Largo Marquês de Pombal, 272
3000 - Coimbra, Portugal

Getting to Centro Cultural D. Dinis

Centro Cultural D. Dinis is in the Campus I of the University of Coimbra, which is located right in the city centre and easily accessible by public transportation. If you are driving, use the map for directions in the next page.

Conference Site and Lunch

Suggested path

Science Museum

Program Sessions

Friday October 26th 2018		
Registration	Salas dos Escritores	09:00-10:00
FRI1 - Opening Session - Member of the Rectory of the University of Coimbra - Bernardete Ribeiro, RECPAD2018 General Chair, University of Coimbra	Sala da Lareira	10:00-10:15
FRI2 - Plenary Session Keynote Speaker: **Vincenzo Piuri** "Advanced Biometric Technologies" *Chair:Bernardete Ribeiro*	Sala da Lareira	10:15-11:15
Coffee Break	Salas dos Escritores	11:15-11:45
FRI3 - Poster Session **Poster Session 1 - Deep Learning and Health** *Chair: César Teixeira* (*Papers: 4, 5, 11, 13, 15, 16, 21, 26, 29, 31, 32, 33, 36, 37, 45*)	Galeria	11:45-12:45

Lunch Break	Sala da Lareira	12:45-14:15
FRI4 - Poster Session **Poster Session 2 - Genome/Drugs, Physical/HW Systems and Methods** *Chair: Joel Arrais* (*Papers: 2, 3, 14, 18, 22, 23, 24, 27, 28, 30, 34, 35, 40, 42, 46*)	Galeria	14:15-15:15
Coffee Break	Salas dos Escritores	15:15-15:45
FRI5 - Poster Session **Poster Session 3 - Computer Vision, Forecast, Social and Music Applications** *Chair: Catarina Silva* (*Papers: 1, 6, 7, 8, 9, 10, 12, 17, 19, 20, 25, 38, 41, 43, 44*)	Galeria	15:45-16:45
FRI6 - Closing Session - APRP Direction - Bernardete Ribeiro, RECPAD2018 General Chair, University of Coimbra	Sala da Lareira	16:45-17:00
FRI7 - Visit **Visit to Science Museum** *Chair: Joana Costa*	Science Museum	17:00-18:00

Invited Speaker

Vincenzo Piuri

Università degli Studi di Milano
Friday, 26th October, 2018
FRI2 – Plenary Session
10:15-11:15
(Centro Cultural D. Dinis)
Chair: Bernardete Ribeiro

Bio: Vincenzo Piuri has received his Ph.D. in computer engineering at Politecnico di Milano, Italy (1989). He is Full Professor in computer engineering at the Università degli Studi di Milano, Italy (since 2000). He has been Associate Professor at Politecnico di Milano, Italy and Visiting Professor at the University of Texas at Austin and at George Mason University, USA.
His main research interests are: intelligent systems, signal and image processing, machine learning, pattern analysis and recognition, theory and industrial applications of neural networks, biometrics, intelligent measurement systems, industrial applications, fault tolerance, digital processing architectures, and cloud computing infrastructures. Original results have been published in more than 400 papers in international journals, proceedings of international conferences, books, and book chapters.
He is Fellow of the IEEE, Distinguished Scientist of ACM, and Senior Member of INNS. He has been IEEE Vice President for Technical Activities (2015), IEEE Director, President of the IEEE Computational Intelligence Society, Vice President for Education of the IEEE Biometrics Council, Vice President for Publications of the IEEE Instrumentation and Measurement Society and the IEEE Systems Council, and Vice President for Membership of the IEEE Computational Intelligence Society. He is Editor-in-Chief of the IEEE Systems Journal (2013-19), and Associate Editor of the IEEE Transactions on Computers and the IEEE Transactions on Cloud Computing, and has been Associate Editor of the IEEE Transactions on Neural Networks and the IEEE Transactions on Instrumentation and Measurement.
He received the IEEE Instrumentation and Measurement Society Technical Award (2002). He is Honorary Professor at Obuda University, Budapest, Hungary, Guangdong University of Petrochemical Technology, China, Muroran Institute of Technology, Japan, and the Amity University, India.

“Advanced Biometric Technologies”

Biometrics concerns the study of automated methods for identifying an individual or recognizing an individual among many people by measuring one or more physical or behavioral features. Certain physical human features or behaviors are characteristics that are specific and can be uniquely associated to one person. Retinas, iris, DNA, fingerprint, palm print, or pattern of finger lengths are typical physical features that are specific to individuals. Also the voice print, gait, or handwriting can be used to this purpose.
Nowadays biometrics is rapidly evolving. This science is getting more and more accurate in recognizing and identifying persons and behaviors. Consequently, these technologies become more and more attractive and effective in critical applications, such as to create safe personal IDs, to control the access to personal information or physical areas, to recognize terrorists or criminals, to study the movements of people, to monitor the human behavior, and to create adaptive environments. The use of biometrics in the real life often requires very complex signal and image processing and scene analysis, for example encompassing biometric feature extraction and identification, individual tracking, face tracking, eye tracking, liveness/anti-spoofing tests, and facial expression recognition. This talk will review the main biometric traits and analyze the opportunities offered by biometric technologies and applications to support a broad variety of applications. Attention will be given to the current trends in research and applications.

Abstracts

Friday October 26th 2018
Poster Session 1 - Deep Learning and Health
Papers: 4, 5, 11, 13, 15, 16, 21, 26, 29, 31, 32, 33, 36, 37, 45
Chair: César Teixeira

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FRI3
Galeria
11:45-12:45

Generalization Performance of Convolutional Neural Networks for Heart Sound Segmentation

Renna, F.
Oliveira, J.
Coimbra, M.

In this paper, deep convolutional neural networks are used to segment heart sounds into their main components. The proposed method is based on the adoption of a deep convolutional neural network architecture, which is inspired by similar approaches used for image segmentation. A further post-processing step is applied to the output of the proposed neural network, which induces the output state sequence to be consistent with the natural sequence of states within a heart sound signal (S1, systole, S2, diastole). The generalization performance of the proposed approach is assessed by training the algorithm on the the publicly available PhysioNet dataset and testing it on the DigiScope dataset. The proposed solution achieves an average sensitivity of 73% and an average positive predictive value of 82.5% in detecting S1 and S2 sounds.

5 **FRI3**

Galeria
11:45-12:45

Transfer Learning of ImageNet Neural Network for Pigmented Skin Lesion Detection

Pereira, P.
Fonseca-Pinto, R.
Paiva, R.
Tavora, L.
Assuncao, P.
Faria, S.

Traditional Artificial Neural Networks (ANN) have been investigated in the past for skin lesion classification and nowadays their performance is already quite useful to assist in medical diagnosis and decision processes. In the field of visual object recognition, recent developments of such networks (Deep Convolutional Neural Networks) are currently the winners of the ImageNet competition. This work extends the use of CNN for classification of pigmented skin lesions, by investigating a training methodology based on transfer learning on pre-trained networks.

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Galeria
11:45-12:45

Prediction of Healing Deformities After Breast Conserving Surgery

Bessa, S.
Oliveira, H.
Cardoso, J.
Oliveira, S.
Zolfagharnasab, H.

Breast conserving surgery (BCS) has become the preferred method to treat breast cancer for most of the patients. Although it has lower aesthetic impact than mastectomy, the outcome can still be unappealing for most women. The prediction of breast healing deformities caused by BCS is important to both patients and surgeons and can be a determining factor in the decision process. In this work, a methodology based on Random Forests (RF) trained with adaptive weights is proposed to predict breast surface displacements caused by BCS, one year after surgery.

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FRI3
Galeria
11:45-12:45

Improving ECG-Based Biometric Identification Using End-to-End Convolutional Networks

Pinto, J.
Cardoso, J.
Lourenço, A.

Using Convolutional Neural Networks (CNNs), this work studies how the integration of all processes needed for biometric recognition on a single model improves ECG-based subject identification. An end-to-end unidimensional CNN is proposed, which receives raw blindly-segmented ECG signals and outputs an identification, after being optimised, as a whole, during training. The proposed method was evaluated on the UofTDB collection, offering 96.1% identification rate (IDR), and on the PTB database, attaining 98.6% IDR. When compared with implemented state-of-the-art methods and results reported in the literature, the network showed improved performance and enhanced robustness to the increased noise and variability of off-the-person signals, even with larger sets of subjects.

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FRI3
Galeria
11:45-12:45

Rotation Equivariant Convolutional Layers in Deep Neural Networks

Castro, E.
Pereira, J.
Cardoso, J.

One of the key ideas in the design of Convolutional Neural Networks is the parameter sharing property of its convolutional layers. Due to this property, the response of a convolutional layer is equivariant to input translations which is a good prior in most image recognition tasks. Other types of equivariance priors can be encoded in the architecture of CNNs. In this work we extend the parameter sharing property to accommodate for rotations of the input. We show that this prior can lead to better generalization when encoded in the early layers of CNNs even in tasks where the input data is not symmetric to rotation.

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Radio-Pathomics Approach for Breast Tumor Signature: an overview

Oliveira, S.
Cardoso, M.
Cardoso, J.
Oliveira, H.

The use of medical imaging to support clinical diagnosis in breast cancer is well-established. However, the fully characterization of the tumor is still challenging due to the partial information that each image modality provides. When radiological image-based quantitative features extracted in approaches known as radiomics are combined with clinical reports data and features from other image modalities, they can empower clinical decision support models. In particular, since histopathology images are used to characterize the tumor subtype, the combination of radiological and histopathology information has the potential to enable a more detailed diagnose. In this paper the common pipeline of radiomics and pathomics research is presented, as well as some examples of approaches to tackle each task and the main aspects to take into account.

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FRI3

Galeria
11:45-12:45

On modifying the temporal modeling of HSMMs for pediatric heart sound segmentation

Oliveira, J.
Renna, F.
Mantadelis, T.
Gomes, P.
Coimbra, M.

In this paper, we use a real life dataset in order to compare the performance of a hidden Markov model and several hidden semi Markov models that used the Poisson, Gaussian, Gamma distributions, as well as a non-parametric probability mass function to model the sojourn time. Using a subject dependent approach, a model that uses the Poisson distribution as an approximation for the sojourn time is shown to outperform all other models.

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An Expression-specific Deep Neural Network for Emotion Recognition

Ferreira, P.
Marques, F.
Cardoso, J.
Rebelo, A.

Facial expression recognition (FER) is currently one of the most active research topics due to its wide range of applications in the human-computer interaction field. An important part of the recent success of automatic FER was achieved thanks to the emergence of deep learning approaches. However, training deep networks for FER is still a very challenging task, since most of the available FER datasets are relatively small. In this regard, we propose a novel deep neural network architecture along with a well-designed loss function that explicitly models both informative local facial regions and expression recognition. The result is a model that is able to jointly learn facial relevance maps and expression-specific features for a proper recognition. Experimental results demonstrate the effectiveness of the proposed model in both lab-controlled and wild environments.

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Segmentation and Classification of Skin Lesions Based on Texture and YIQ Color Space Features

Ribeiro, A.
Sousa, P.
Almeida, S.
Vasconcelos, V.
Lopes, F.

In this paper, we propose a successful approach for automatic segmentation and classification of skin lesions in two classes: melanoma and non-melanoma. Initially, skin images obtained in a clinical environment are pre-processed to remove unwanted hair and reduce noise. A region growing segmentation technique using automatic initialization of seed points is then applied, in order to isolate the lesion areas for further processing. Subsequently, the extracted lesion areas are represented by a set of color and texture features. Using a Support Vector Machine (SVM) classifier, the features extracted from each segmented lesion are organized in a feature vector that is further used to discriminate the lesions between melanoma and non melanoma. The classifier performance was evaluated using a stratified holdout approach to measure its sensitivity, specificity and accuracy. The best results for accuracy were obtained with the Gaussian kernel and are in the order of 85%.

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Speckle Noise Reduction in Medical Ultrasound RF Raw Images

Santo, V.
Monteiro, F.

Ultrasonography is the commonly used imaging modality for the examination of several pathologies due to its non-invasiveness, affordability and easiness of use. However, ultrasound images are degraded by an intrinsic artifact called 'speckle', which is the result of the constructive and destructive coherent summation of ultrasound echoes. This paper aims to generate B-mode images out of radiofrequency (RF) data following standard procedures, a series of steps such as envelope detection, log-compression and scan conversion. The best set of parameters of this pipeline will be selected in order to achieve B-mode images with high quality.

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Deep Learning versus Classical Machine Learning in Landmine Detection from IR images

Guerra, I.
Silva, J.
Bioucas-Dias, J.

This work explores the detection of landmines using multispectral images acquired in military context. Two methods are proposed, one using traditional classifiers and the other using Deep Learning methods, namely a Convolutional Neuronal Network (CNN). A quantitative analysis shows that using traditional classifiers gives overall accuracy (OA) above 97% in indoor and outdoor environments for the detection of land mines up to a given depth tested, whereas the adopted deep learning methods present an increase in these values for larger mines and a decrease for smaller ones. These experimental results shed light into the factors that influence the detection of mines and into the merits and demerits of CNN based classification compared with classical methods.

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Pyramid Spatial Pooling Convolutional Network for whole liver segmentation

Delmoral, J.
Faria, D.
Costa, D.
Tavares, J.

Segmentation of the liver in Computer Tomography (CT) images allows the extraction of three-dimensional (3D) structure of the liver structure. The adequate receptive field for the segmentation of such a big organ in CT images, from the remaining neighboring organs was very successfully improved by the use of the state-of-the-art Convolutional Neural Networks (CNN) algorithms, however, certain issue still arise and are highly dependent of pre- or post- processing methods to refine the final segmentations. Here, an Encoder-Decoder Dilated Poling Convolutional Network (EDDP) is proposed, composed of an Encoder, a Dilation and a Decoder modules. The introduction of a dilation module has produced allowed the concatenation of feature maps with a richer contextual information. The hierarchical learning process of such feature maps, allows the decoder module of the model to have an improved capacity to analyze more internal pixel areas of the liver, with additional contextual information, given by different dilation convolutional layers. Experiments on the MICCAI Lits challenge dataset are described achieving segmentations with a mean Jaccard coefficient of 95.7%, using a total number 70 CT test volumes.

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Camera Adaptation for Deep Depth from Light Fields

Portela, D.
Monteiro, N.
Gaspar, J.

Plenoptic cameras image a 3D point by discriminating light rays contributions towards various viewpoints. They allow developing depth estimation methods, such as depth from focus as found in the deep neural network DDFFNet by Hazirbas et al. The training of the DDFFNet has implicit a specific camera geometry, defined by the microlens array and the configuration (zoom and focusing) of the main lens. In this paper we augment the network application range by accepting larger input disparity ranges that can be obtained by different configurations or cameras. The proposed methodology involves converting a field of view and a depth range into the settings where the DDFFNet has been trained. The conversion of the input data is based in the estimation of gradients (structure tensor) on the light field. Results show that depth estimation is possible for various cameras while using the originally trained DDFFNet.

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An Acquisition System for Electrodermal Activity Signals Used to Identify Skin Conductance Patterns Associated with Human Emotional States

Lopes, F.
Fonseca, I.
Azevedo, A.
Gomes, V.

This paper describes an Acquisition System for signals representing the human ElectroDermal Activity (EDA). The developed system is composed of a hardware component and a software interface that allow to acquire, process and save a voltage signal representing the Skin Conductance Response (SCR) of a human subject. A specific design objective was the ability to use the standard soundcard input of a personal computer and thus avoid extra complexity for the acquisition hardware. The EDA is controlled by the autonomic nervous system in the human body. This organ property can be measured by variations in the conductance of the skin, which can in turn be related to the psychological and emotional state of the person [1]. We tested our acquisition system using a small set of five subjects when viewing relaxing videos interrupted by unexpected horror and accident scenes. Our final objective is to be able to monitor the evolution of the emotional state in the educational environment and act to maximize the study efficiency. For this purpose, the software must evolve to classify typical response patterns. This paper focus on the first part - the hardware and software acquisition system.

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11:45-12:45

Analysis of Autoencoders for Feature Representation of Protein Sequences

Albuquerque, J.
Pereira, C.
Arrais, J.

Proteins play various biological roles and the ability to predict its function based on its primary structure is a valuable skill in the biological field. Artificial neural networks and deep learning have been successfully used in this context, however it is important to get the optimal representation of features. Is based on that relevance that feature encoding is so central. A good set of features, and its correct encoding, provides the base for dimension reduction, that can be accomplished by autoencoders. In the pathway from feature extraction to dimension reduction, this work intends to study the influence of the different parameters of autoencoders as well as different features sets to achieve a successful representation of the original features by the encoder.

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Papers: 2, 3, 14, 18, 22, 23, 24, 27, 28, 30, 34, 35, 40, 42, 46
Chair: Joel Arrais

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FRI4
Galeria
14:15-15:15

Mobile Human Shape Superimposition using OpenPose: An Initial Approach

Bajireanu, R.
Veiga, R.
Pereira, J.
Sardo, J.
Lam, R.
Cardoso, P.
Rodrigues, J.

To improve user's museum experiences a mobile Augmented Reality (AR) framework is being developed, as a part of the Mobile Five Senses Augmented Reality (M5SAR) system for museums project. This paper presents an initial approach to develop one module of this framework: the human shape detection and content superimposition module. The human body joints information and texture overlapping is used to achieve the goal. OpenPose model was used to detect human body joints. At this point, the initial results and proof-of-concept are presented.

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QBER Compensation due to Polarization Drift using Quantum Machine Learning

Gonçalves, C.
Belo, D.
Almeida, L.
Ramos, M.
Jordão, M.
Georgieva, P.

A major problem of polarization coding in quantum communication systems is the polarization dispersion due to the birefringence effects in the optical fiber link. In order to keep a correlation between the State of Polarization (SOP) at the input and output of a transmission link, some type of polarization stabilization is needed. In this paper we propose a machine learning approach to compensate the polarization drift and recover the quantum states at the receiver. The problem is formulated as an in-verse classification task, where the SOP at the receiver is used to recover the SOP of the encoded photons at the transmitter. Support Vector Machine models using Polynomial and Gaussian Kernels are demonstrated to be efficient alternatives that can avoid additional hardware often applied as active polarization stabilizers. These results represent a step towards ML-based applications in quantum information processing.

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Learning Anticipation Skills for Robot Ball Catching

Carneiro, D.
Silva, F.
Georgieva, P.

In this work we studied the impact of using the information provided by the thrower's motion for improving the success rate of a robotic system catching flying balls. The anticipation mechanism proposed is based on a neural network model that predicts early enough the initial position and velocity of the ball at the moment it is released.

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Sensor-based Activity Recognition on Smartphones: A Simple Approach for Sharing Results with Other Applications

Andrade, R.
Gonçalves, P.
Alves, A.

This work has as main objective, to employ the most recent techniques used for activity recognition based on sensors. In the scope of this study, the work designed was based on common sensors in mobile devices, having been developed two applications for the Android operating system. The main one is able to recognize the activities and send this information to the system, allowing it to be used by any application installed in the device that is prepared for such purpose, while the other is only a proof of concept and aims to receive the information sent by the first one and display it to the user.

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KCentres algorithm in GPU for clustering on many-core architectures: A preliminary approach

Uribe-Hurtado, A.
Orozco-Alzate, M.
Lopes, N.
Ribeiro, B.

Clustering is one of the most common tasks in pattern recognition. In many applications, such as those of the current Big Data era, it is desired that the clustering process is made as fast and efficient as possible. In this paper, we present a first attempt for the parallel implementation of the KCentres clustering algorithm, based on a many-core (GPU) architecture and aimed to speed up the execution of the algorithm in comparison with a CPU-based version. The GPU-based algorithm was tested on a collection of data sets for shape clustering. Results are particularly enhanced for data sets having more than 1000 objects to be grouped.

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Application of active learning metamodels and clustering techniques to emergency medical service policy analysis

Antunes, F.
Ribeiro, B.
Pereira, F.

Due to the multiplicity of variables and relationships, as well as their stochastic nature, the majority of the real-world urban and transportation systems are not easily modeled by conventional analytic methods. Hence, simulation modeling is a recurrent approach which aims to mimic such environments in order to understand and thus predict their behavior. Nevertheless, in certain extreme scenarios where each simulation run proves to be computationally expensive, detailed exploration of the simulation input space can be compromised or even virtually impossible. Simulation metamodels along with active learning procedures have been employed to address such kind of shortcomings. In this paper, and within the context of active learning, we apply the Gaussian Process (GP) framework as a simulation metamodeling tool to the exploration process of a simulator's output behavior with respect to its inputs variables. The output values predicted by the GP are then clustered so that relevant simulation input regions can be easily identifiable. We illustrate our methodology using an Emergency Medical Service (EMS) simulator and ultimately analyze the performance of two associated emergency policies. Two output indicators are studied and compared, namely, the average survival rate and the response time. The presented results show that combined usage of active learning, simulation metamodeling and clustering techniques is able to identify important policy-sensitive regions within the input space of the simulator in study.

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Characterization of the Human Gait through a Pressure Platform

Bastos, M.
Coutinho, F.
Tonelo, C.

Human stride and gait analysis have increasingly become the focus of research studies, giving rise to the development of technological solutions that help measuring its parameters. The PhysioSensing system is one such solution, which is composed of a pressure platform and a computational application that provides visual biofeedback. The purpose of this work is to enhance this system by providing features for aiding the healthcare professional performing dynamic gait analysis. Four prototypes were implemented (in C# and WPF) supporting four dynamic gait analysis profiles: Diabetic Foot Analysis, Footfall Analysis, Asymmetries Analysis, and General Analysis. These prototypes create clinical reports at the end of each session, and were successfully validated in tests conducted in a Clinic of Physical Medicine and Rehabilitation.

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14:15-15:15

Automatic evaluation of ERD in e-learning environments

Lino, A.
Rocha, A.
Macedo, L.

Currently, computer-aided assessments are widely used for multiple-choice questions, but they do not have the ability to assess student knowledge more comprehensively, going beyond right or wrong, which is necessary in teaching about constructing entity relationship diagrams. This article presents a novel approach for automatic evaluation of relationship entity diagrams that returns in addition to a response on the correct result, a note that most closely approximates the optimal solution. The method, based on machine learning techniques, uses structured query language metrics extracted from entity and relationship diagram and expert grade to create the prediction model. The preliminary results present our approach as an alternative to automatically evaluate entity and relationship diagrams.

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Oliveira, N.
Prates, P.
Ribeiro, B.

Evaluation of ensemble methods for predicting defects in sheet metal forming

Predicting defects is a challenge in many processing steps during sheet metal forming because a great number of variables is involved in the process. In this paper, an empirical study is presented with the objective to choose the best configuration of an ensemble learning algorithm that will be able to predict sheet metal forming defects. For this purpose, three distinct datasets were generated from numerical simulation results of a sheet metal forming process. Three types of sheet materials where used, one for each dataset: Mild Steel, HSLA340 and DP600. In this work two types of defects, springback and maximum thinning, were considered. The experiments were performed with 30 runs of different ensemble learning models using two different methods: Stacking and Majority Voting. In this process several PCA values for the preprocessing stage and distinct base learners were setup. Results show that one ensemble method performs better than the other, one depending on the type of material.

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Deep Learning for Drug Target Interaction Prediction

Coelho, G.
Arrais, J.
Ribeiro, B.

The discovery of antibiotics was quickly followed by the emergence of bacterial antibiotic resistance. This resistance, makes the discovery of new drugs an urgent need. Identifying interaction between known drugs and targets is a major challenge on drug discovery. Traditionally, the performance of drug target interaction prediction models depends heavily on the descriptors used, and there is no widely agreement on which drug and target descriptors have the best predictive power. This makes the use of traditional machine learning algorithms a rudimentary approach. In this work, to accurately predict new drug target interactions, we developed a deep learning based architecture, capable of understanding, during training, the best descriptors for the classification. The proposed model reaches an accuracy of 0.90, outperforming current state-of-the- art methods based on shallow architectures. The results obtained suggest that the model could be further used to predict the interaction between drugs and target and the be used on the identification of new leads for drug repositioning.

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Evolutionary insights from the comparative analysis of hominid genomes

Teixeira, A.
Pratas, D.
Pinho, A.
Silva, R.

Neanderthal groups have been found in Eurasia while Denisovan groups were found only in Denisova Cave (Eurasia) until now. Around 40,000 years ago, these groups inhabited the same places with modern humans. There are many evidences that show genome admixture between these hominid populations. In this study, we use CHESTER to find exact genomic regions (i.e. substitutions are considered absent) present in modern human DNA and not present in ancient genomes. The identification of these regions is important to understand evolutionary traits. We found around 30 coding genes, 6 RNA genes and a few uncharacterized sequences that are present only in modern human DNA. Coding genes are involved in several processes, such as hematopoietic cell differentiation, metabolism and olfactory functions. In the future, the identification and comparison of these sequences is crucial to understand the role of these genes in cell biology, human health and evolutionary history.

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Identification of antifungal targets using alignment-free methods

Figueiredo, C.
Pratas, D.
Pinho, A.
Silva, R.

Invasive fungal infections are a growing concern worldwide, especially the emergence of opportunistic pathogen species in nosocomial environments. The increase in Candida infections is linked to the ability to colonize implanted medical devices (e.g., central venous catheters) and development of cross-resistance to antifungal compounds that arises mainly due to mutations in the target enzymes or drug efflux-pumps. Here, we have used alignment-free methods with the human genome as reference to screen several yeast genomes and have identified novel targets suitable for the development of antifungal drugs.

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Action Recognition for American Sign Language

Phong, N.
Ribeiro, B.

In this research, we present our findings to recognize American Sign Language from series of hand gestures. While most researches in literature focus only on static handshapes, our work target dynamic hand gestures. Since dynamic signs dataset are very few, we collect an initial dataset of 150 videos for 10 signs and an extension of 225 videos for 15 signs. We apply transfer learning models in combination with deep neural networks and background subtraction for videos in different temporal settings. Our primarily results show that we can get an accuracy of 0.86 and 0.71 using DenseNet201, LSTM with video sequence of 12 frames accordingly.

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SAR missions with commercial UAVs over Mixed-Reality interfaces

Rosero, R.
Marcillo, D.
Grilo, C.
Silva, C.

The use of unmanned aerial vehicles (UAV) has become an important tool in Search And Rescue (SAR) scenarios, because they are used to preserve human lives and quickly explore areas affected by natural disasters. Also, human body detection has been possible through algorithms which analyse optical and thermal images obtained from the installed cameras. On the other hand, Ground Stations (GS) with First Person Vision (FPV) interfaces have been implemented with Augmented Reality (AR). Nevertheless, satisfactory projects with commercial UAVs are not common, because these drones are difficult to control for non-expert pilots. These are the reasons why we propose the creation and implementation of an architecture with these requirements. Also, we aim at providing a more user immersive interaction through Mixed Reality (MR) interface over Head-Mounted Display (HMD) glasses.

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Traffic sign recognition using shallow learning techniques

Pessoa, D.
Lopes, F.
Valente, F.
Medeiros, J.
Teixeira, C.

Traffic Sign Recognition Systems are widely used in the new high tech-nology vehicles, providing an easier and safer driving experience. So,it is extremely necessary to develop pattern recognition systems that areable to identify correctly all the existent traffic signs in the fastest waypossible. In this work, we evaluate the use of shallow machine learningalgorithms such as Support Vector Machine (SVM), K-Nearest Neighbor(k-NN), Naive Bayes and Minimum Distance Classifier (MDC), for auto-matic classification of 43 different traffic signs. Results reveal that k-NNclassifier achieve the best accuracy of 95.9%, which approaches the per-formance obtained with deep convolutional neural networks (CNN), withthe advantage of a computationally lighter training.

Friday October 26th 2018
Poster Session 3 - Computer Vision, Forecast, Social and Music Applications
Papers: 1, 6, 7, 8, 9, 10, 12, 17, 19, 20, 25, 38, 41, 43, 44
Chair: Catarina Silva

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Surface Cameras from Shearing for Disparity Estimation on a Lightfield

Monteiro, N.
Barreto, J.
Gaspar, J.

Disparity estimation from lightfields is usually based on multi-view stereo geometry, epipolar plane image geometry, or on testing some disparity hypotheses using shearing. Recently, the concept of surface camera image has been used to improve disparity estimation. In this work, we introduce the idea of considering a surface camera image as a generalization of shearing and evaluate the capabilities of using surface camera images in disparity estimation.

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Use of Epipolar Images Towards Outliers Extraction in Depth Images

Celorico, D.
Cruz, L.
Dihl, L.
Gonçalves, N.

Plenoptic cameras, such as Lytro and Raytrix, has been for the last years widely used. Their main feature is the acquisition of the light intensity from several point of views. As of these view point images, we can reconstruct a 3D model of the captured scene, by calculating the depth of each pixel, by passive depth estimation, using only one captured image. In this context, the depth denote the distance between the respective point and the camera. Although this 3D model can be directly used for several purposes, for example like refocusing after capture or object segmentation, they are often very noisy, what is a disadvantage for some applications like 3D visualization or more complex mesh processing. In this work, we will present a method for filtering the depth model, reconstructed from light field cameras, based on the removal of low confidence reconstructed values and using an inpainting method to replace them. This approach has shown good results for outliers removal.

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Uniquemark: A computer vision system for hallmarks authentication

Barata, R.
Cruz, L.
Gonçalves, N.

We are presenting a vision system for authentication based on random marks, particularly hallmarks. Hallmarks are used worldwide to authenticate and attest the legal fineness of precious metal artifacts. Usually the artifacts are punctured using a special tool, which embeds on the surface of the metal an illustration (Fig. 1 b) and c). In addition to the illustration, we propose the deposition on the metal surface of randomly scattered micro-diamond ($\approx 50\mu m$), in order to create a unique random pattern. The patterns described by the diamond particles are randomly produced, and the probability of two equal patterns coexist is equal to zero. By identifying the patterns present on a precious metal piece we are able to authenticate the piece. Our authentication method is based on a multiclass classifier model that uses a descriptor of the marks composed by several geometric features of the particles. The proposed authentication system has obtained very good results in both real examples and simulations.

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Graphic Code: Creation, Detection and Recognition

Patrão, B.
Cruz, L.
Gonçalves, N.

Graphic Code is a new Machine Readable Coding (MRC) method. Itcreates coded images by organizing available graphic primitives arrangedaccording to some predefined patterns. Some of these patterns are pre-viously associated to symbols used to compose the messages, this asso-ciation defines a dictionary. Using the same coding principle presentedin this work, we can developed three kinds of graphic codes, each oneable to create a very different coding style (black and white pixel-basedcodes, colored pixel-based codes, and icon-based codes). It dramaticallyenhances the code aesthetic. Besides aesthetic, this coding method is ableto encode more information than classical approaches, which opens newpossibilities of applications. Furthermore, we will present the pipeline fordecoding a graphic code from a photo. It is performed by evaluating someimages until recover the coded message and can be supported by using ofdata redundancy, and check digits to validate the message.

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Improving Facial Depth Data by Exemplar-based Comparisons

Dihl, L.
Cruz, L.
Gonçalves, N.

3D face models are widely used for several purposes, such as biometric systems, face verification, facial expression recognition, 3D visualization, etc. They can be captured by using different types of devices, like plenoptic cameras, structured light cameras, time of flight, etc. Nevertheless, the model generated by all of these consumers devices are very noisy. In this work, we present a filtering method for meshes of faces preserving their intrinsic features. It is based in an exemplar-based neighborhood matching where all models are in a frontal position avoiding rotation and perspective drawbacks. Moreover, the model is invariant to depth translation and scale. The obtained results showed that this method is robust and promising.

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Sharma, R.
Ribeiro, B.
Pinto, A.
Cardoso, F.
Armando, N.
Raposo, D.
Silva, J.
Oliveira, H.
Macedo, L.
Boavida, F.
Fernandes, M.
Rodrigues, A.

Unveiling Markers of Stress Via Smartphone Usage

There are numerous Android apps that leverage from the information provided by embedded sensors of the smartphones. The prime objective of this work is to conduct a state-of-the-art survey of stress-related research and determine which inbuilt sensors and features of smartphone applications can help in determining stress among students. The research was focused on three factors, physical activities, sociability, and ambiance, and it shows how smartphones can take advantage of these aspects to determine stress.

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Silva, W.
Fernandes, K.
Cardoso, M.
Cardoso, J.

Understanding Deep Neural Networks decisions in Medical Imaging

Interpretability is a fundamental property for the acceptance of machine learning models in highly regulated areas. Recently, deep neural networks gained the attention of the scientific community due to their high accuracy in vast classification problems. However, they are still seen as black-box models where it is hard to understand the reasons for the labels that they generate. This paper proposes a deep model with monotonic constraints that generates complementary explanations for its decisions both in terms of style and depth. Furthermore, an objective framework for the evaluation of the explanations is presented. Our method is tested on a post-surgical aesthetic evaluation dataset and demonstrates an improvement in relation to traditional models regarding the quality of the explanations generated.

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Forecasting Household Energy Consumptions using Capsule Networks

Leitão, J.
Gil, P.
Ribeiro, B.
Cardoso, A.

In this work we apply the novel capsule networks to forecast energy consumptions in a domestic environment. We take consumption data from a real-world dataset to train and test our capsule model. Despite their improvements over other neural network architectures, namely convolutional networks, predictions computed with our model remain far from the expected values. These results call for further investigation on the design of the network and definition of its parameters, as well as in data pre-processing, in order to improve forecasting accuracy.

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Sheet Music Player based in Image Processing

Caridade, C.
Rosendo, S.

The aim of this paper is to present an automatic application developed to detect musical symbols in digital sheet images and their reproduction. The application was developed in Matlab using digital image processing techniques. For this purpose, the application used converts the image to gray and then to binary image where the stave and lines are located. Stave are separate and lines are deleted. Then all the notes of each stave are recognized by their signature and beat. Finally the sound was reproduced.

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Locally Affine Light Fields as Direct Measurements of Depth

Marto, S.
Monteiro, N.
Gaspar, J.

Light field imaging allows discriminating object radiance according to multiple viewing directions. We introduce the minimal light field representation from which depth can be extracted, the affine light field, which is a first order approximation. One setup to acquire one globally affine light field is proposed. Consequently, we show how Dansereau Bruton's gradient based reconstruction method [1] can be derived from the locally affine light field assumption.

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Application of Lifelong Learning with CNNs to Visual Robotic Classification Tasks

Zacarias, A.
Alexandre, L.

The field of robotics is becoming continuously more important, due to the impact it can bring to our everyday life. A long standing problem with neural network learning is the catastrophic forgetting when one tries to use the same network to learn more than one task. In this paper we present results of the application of a method to avoid catastrophic forgetting while using Convolutional Neural Networks (CNNs) to some visual recognition tasks relevant to the field of robotics. The results show that with this method a robot can learn new tasks without forgetting the previous learned tasks. Results also showed that if we applied this method, the performance on isolated tasks increases and it is better to use it than train a CNN in an isolated way (single task). We use for our experiments two well known data sets, namely, Olivetti Faces and Fashion-MNIST.

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Comparing Learning Approaches for Twitter Sentiment Analysis

Guevara, J.
Morales, M.
Costa, J.
Silva, C.

Nowadays, sentiment analysis is a popular technique for the analysis of social networks. One of the most popular social networks and microblogs is Twitter, which allows a user to express his/her opinions using short texts. That is why it is important to analyze and know what people think about a topic and finally provide help to make decisions in the face of some problem. In this work we compare different machine learning approaches for sentiment analysis in Twitter social network.

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Granularity and time window on forecasting regression problems

Silva, C.
Grilo, C.
Silva, C.

Load forecasting has different approaches and applications, with the general goal of predicting future load for a period of time ahead on a given system. In this paper we analyse the effect of granularity and time window on two different forecasting regressions problems: web server load prediction and energy load prediction. Tests are conducted with three different learning methods, and results on two datasets show the prominent performance on the resulting models.

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Twitter message: is bigger the better for classification purposes?

Costa, J.
Silva, C.
Ribeiro, B.

Last year Twitter doubled the size of the tweet. Character count initially set to 140 character was then expanded to 280 characters and, according to the Twitter official blog, the idea was reducing the effort of fitting the message into the tweet, and thus minimizing the problem of abandoning tweets before sending, due to the time spent in editing. However, and considering the relevance of information extraction from such media, it is important to understand the impact of such change in Twitter message classification. In this work, we present the effect of doubling the size of a tweet in the scope of a Twitter classification problem. Results on a real dataset suggest that the bigger tweets are, the harder they are to classify, making the scenario more challenging.

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Automatic music transcription using a one-classifier-per-note approach

Gil, A.
Reis, G.
Domingues, P.
Grilo, C.

This paper describes a new approach to the automatic music transcription problem. The architecture of this approach consists on an artificial neural network per each possible note, plus an additional one (per note) for post-processing. We refer to the main artificial neural networks as classifiers and the additional ones, used for post-processing, as post-processing units. From our knowledge, it is the first time that a comparison of several classifiers with the traditional one-single classifier approach is done. In addition, to the best of our knowledge, it is the first time that an artificial neural network is applied as a post-processing method, in the problem of automatic music transcription.

Program Overview

Friday October 26th 2018		
Registration	Salas dos Escritores	09:00-10:00
FRI1 - Opening Session	Sala da Lareira	10:00-10:15
FRI2 - Plenary Session	Sala da Lareira	10:15-11:15
Coffee Break	Salas dos Escritores	11:15-11:45
FRI3 - Poster Session	Galeria	11:45-12:45
Lunch Break	Sala da Lareira	12:45-14:15
FRI4 - Poster Session	Galeria	14:15-15:15
Coffee Break	Salas dos Escritores	15:15-15:45
FRI5 - Poster Session	Galeria	15:45-16:45
FRI6 - Closing Session	Sala da Lareira	16:45-17:00
FRI7 - Visit	Science Museum	17:00-18:00

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