[2022 IEEE International Conference on Evolving and Adaptive Intelligent Systems]

EAIS 2022

25-26 May, 2022
LARNACA, CYPRUS

CONTENTS

WELCOME NOTE

Over the past decade, the area of Evolving and Adaptive Intelligent Systems, has emerged to play an important role on a broad international level in today's real-world applications, especially those ones with high complexity and dynamics change. Its embedded modelling and learning methodologies are able to cope with real-time demands, changing operation conditions, varying environmental influences, human behaviors, knowledge expansion scenarios and drifts in online data streams.

The IEEE Conference on Evolving and Adaptive Intelligent Systems 2022 (IEEE EAIS 2022) serves as an international forum focusing on the discussion of recent advances, the exchange of recent innovations, and the outline of important future challenges in the above defined area. As such, IEEE EAIS addresses a variety of topics covering a wide research area that includes, among others, soft computing, fuzzy systems, evolutionary algorithms, pattern recognition, etc. The conference also welcomes practical papers that address the needs of contemporary application domains, such as cloud computing and big data. Finally, the conference supports the organization of Special Sessions that focus on specific aspects of the broad area of evolving and adaptive intelligent systems.

EAIS 2022 is the 14th edition of a long standing event that started back in 2006 and is held annually:

- EFS'06 (Lake District, UK), chair: Plamen Angelov
- GEFS'08 (Witten-Bomerholz, Germany), chair: Frank Hoffmann
- ESDIS'09 (Nashville, USA), chair: Plamen Angelov
- EIS'10 (Leicester, UK), chair: Plamen Angelov
- IEEE EAIS 2011 (Paris, France), as part of the IEEE SSCI 2011 conference,

Symposium chairs: Plamen Angelov, Dimitar Filev, Nik Kasabov

- IEEE EAIS 2012 (Madrid, Spain), chair: José Antonio Iglesias
- IEEE EAIS 2013 (Singapore), as part of the IEEE SSCI 2013 conference,

Symposium chairs: Plamen Angelov, Dimitar Filev, Nik Kasabov

- IEEE EAIS 2014 (Linz, Austria), chairs: Edwin Lughofer, Plamen Angelov
- IEEE EAIS 2015 (Douai, France), chairs: Plamen Angelov, Dimitar Filev, Nik Kasabov
- IEEE EAIS 2016 (Natal, Brazil), chairs: Bruno Costa, Luiz Affonso Guedes
- IEEE EAIS 2017 (Ljubljana, Slovenia), chairs: Igor Škrjanc, Sašo Blažič
- IEEE EAIS 2018 (Rhodes, Greece), chairs: Plamen Angelov, Yannis Manolopoulos
- IEEE EAIS 2020 (Bari, Italy), chairs: Giovanna Castellano, Corrado Mencar

In response to the call for papers and the subsequent review process that generated close to 100 reviews, we were able to accept 19 papers from 62 authors that satisfy the high standards and quality requirements of an established IEEE conference. The authors come from several different countries in the Americas, Europe, and Africa, demonstrating the international dimension of EAIS.

The papers are grouped into the following sessions:

- General Track I & II
- Adaptive Computational Intelligence, Machine Learning and Applications I & II
- Adaptive Learning Systems for Image Processing
- Recent Advances on Text and Document Streams Mining

Authors of selected papers will be invited to publish extended versions of their conference contributions in the journal Evolving Systems, published by Springer.

Finally, this year's conference features an invited talk by Igor Škrjanc on the ***evo***lution of Neuro Fuzzy systems in monitoring and control.

EAIS 2022 is organized by the Department of Computer Science (Software Engineering and Internet Technologies (SEIT) Lab), University of Cyprus, Cyprus, sponsored by the IEEE Systems, Man, & Cybernetics Society and its Technical Committee on Evolving and Intelligent Systems, and supported by the University of Cyprus.

We would like to thank the members of the International Program Committee, the reviewers of the contributed papers and the members of the Organizing Committee for their most valuable support and work during the preparation of this conference.

Larnaca, Cyprus, May 2022

Plamen Angelov (University of Lancaster, UK),
George A. Papadopoulos (University of Cyprus, Cyprus),
Giovanna Castellano (University of Bari, Italy),
José A. Iglesias (Carlos III University of Madrid, Spain),
Gabriella Casalino (University of Bari, Italy),
Edwin Lughofer (Johannes Kepler University Linz, Austria),
Daniel Leite (Federal University of Lavras, Brazil)

COMMITTEES

- **General Chairs**

George A. Papadopoulos, Department of Computer Science, University of Cyprus, Cyprus
Plamen Angelov, Department of Computing and Communications, Lancaster University

- **Program Committee Chairs**

Giovanna Castellano, Department of Computer Science, University of Bari, Italy
José A. Iglesias, Computer Science Department, Carlos III University of Madrid, Spain

- **Special Sessions Chair**

Gabriella Casalino, Department of Computer Science, University of Bari, Italy

- **Financial Chair**

Constantinos Pattichis, Department of Computer Science, University of Cyprus, Cyprus

- **Publication Chair**

Edwin Lughofer, Institute of Mathematical Methods in Medicine and Databased Modelling, Johannes Kepler University Linz, Austria

- **Web & Publicity Chair**

Daniel Leite, Department of Engineering, Federal University of Lavras, Brazil

- **Local Conference Arrangements**

EasyConferences Ltd, Nicosia, Cyprus

KEYNOTE SPEAKERS

Igor Škrjanc *University of Ljubljana*

“EVOLVING NEURO-FUZZY SYSTEMS IN MONITORING AND CONTROL”

Abstract: Major assumptions in computational intelligence and machine learning consist of the availability of a historical dataset for model development, and that the resulting model will, to some extent, handle similar instances during its online operation. However, in many real- world applications, these assumptions may not hold as the amount of previously available data may be insufficient to represent the underlying system, and the environment and the system may change over time.

As the amount of data increases, it is no longer feasible to process data efficiently using iterative algorithms, which typically require multiple passes over the same portions of data. Evolving identification from data streams has emerged as a framework to address these issues properly by self-adaptation, single-pass learning steps and evolution as well as contraction of model components on demand and on the fly. This talk focuses on evolving fuzzy model identification on-line, in real-time environments where learning and model development should be performed incrementally, and the use of this kind of models in monitoring and control.

Bio: Igor Škrjanc received B.S., M.S. and Ph.D. degrees in electrical engineering, in 1988, 1991 and 1996, respectively, at the Faculty of Electrical and Computer Engineering, University of Ljubljana, Slovenia. He is currently a Full Professor with the same faculty and Head of Laboratory for Autonomous and Mobile Systems. He is lecturing the basic control theory at graduate and advanced intelligent control at postgraduate study. His main research areas are adaptive, predictive, neuro-fuzzy and fuzzy adaptive control systems. His current research interests include also the field of autonomous mobile systems in sense of localization, direct visual control and trajectory tracking control He is Humboldt research fellow, research fellow of JSPS and Chair of Excellence at University Carlos III of Madrid and the fellow of Slovenian Academy of Engineering.. He also serves as an Associated Editor for IEEE Transaction on Neural Networks and Learning System, IEEE Transaction on Fuzzy Systems, the Evolving Systems journal and International journal of artificial intelligence.

PROGRAMME

Wednesday • 25 MAY 2022

09:00-10:30 **Session 1**
Invited Talk
Chair: George A. Papadopoulos

10:30-11:00 **Coffee Break**

11:00-12:30 **Session 2**
General Track 1
Chair: Nedra Mellouli

EFNN-Gen - **a uni-nullneuron-based evolving fuzzy neural network with generalist rules**
Paulo Vitor de Campos Souza (*Johannes Kepler University Linz*) and Edwin Lughofer (*Johannes Kepler University Linz*).

Abstract: The evolving fuzzy neural networks have a high degree of interpretability and a high capacity for solving pattern classification problems. However, their accuracy could deteriorate when there are few samples for particular classes available, e.g., when new classes appear in the data stream. One way to improve these models' performance is to include a priori knowledge in their data-driven architectural structure. This article proposes the new concept of generalist rules based on assessing the specificity of Gaussian functions that make up the neurons of the first layer of the evolving fuzzy neural network (**EFNN-Gen**). These rules can be seen as general (expert) knowledge about the classification problem. Tests performed with real binary pattern classification bases proved that integrating generalist rules can increase the accuracy of an evolving system and that there is a specific limit on how many rules can be used for this improvement.

Evolving clustering algorithm based on average cluster distance - eCAD
Goran Andonovski (*University of Ljubljana*) and Igor Škrjanc (*University of Ljubljana*).

Abstract: This paper presents a preliminary study of an evolving clustering algorithm based on the average cluster distance - eCAD. This algorithm is mainly intended for online processing of data streams. It recursively computes the average distance between two consecutive data samples, which is included as the main measure in the evolving mechanisms. Accordingly, we have included a mechanism to automatically detect new clusters and a mechanism to merge existing clusters. This makes the algorithm autonomous and insensitive to the distribution of the data, which does not need to be prescaled or normalized. In addition, the number of clusters is not required as a predefined parameter. This algorithm could be classified as a density-based clustering algorithm and we therefore provide some comparison results with established clustering techniques.

Hybrid Classifier for Signal Aspect Detection in Railway Infrastructure

Dirk Friedenberger (*Hasso Plattner Institute*), Felix Grzelka (*Hasso Plattner Institute*) and Andreas Polze (*Hasso Plattner Institute*).

Abstract: In this paper, we present a hybrid classifier built by combining object detection (YOLOv5) and signal aspect detection through traditional image processing routines. The hybrid classifier is part of our test automation toolchain. It is intended to be used for monitoring railway signals in end-to-end integration test scenarios when bringing interlockings into service. In our field tests, we have successfully demonstrated recognition and classification of signal aspects for German KS signals and UK running signals. The aspect detection provides distance metrics for the position, radius, and color of the lights in the signal. We trained a logistic regression classifier with these metrics to classify detected signal light candidates. The set of detected lights is then matched against all predefined signal aspects to determine the signal aspect. We tested our algorithm in our lab and a test field. The F1 score of the presented algorithm is 0.74 for the KS signal and 1 for the UK running signal.

12:30-14:00 **Lunch Break**

14:00-15:30 **Session 3**

SS2 - Adaptive Computational Intelligence, Machine Learning and Applications - Part I

Chair: Marta Cimitile

Using Machine Learning for early prediction of Heart Disease

Martina Iammarino (*Università degli studi del sannio*), Lerina Aversano (*University of Sannio*), Mario Luca Bernardi (*University of Sannio*), Marta Cimitile (*Unitelma Sapienza University*), Debora Montano (*University of Sannio*) and Chiara Verdone (*University of Sannio*).

Abstract: Heart disease is today the leading cause of death in the world. The early diagnosis can significantly reduce the risk of death and can be useful to drive successful treatment. However, the early diagnosis requires continuous monitoring of a large set of clinical and lifestyle indicators. This is the reason why there is an increasing number of studies aimed to adopt machine learning to predict heart disease starting from the analysis of the vast range of clinical data that we can collect today thanks to the advent of digital folders. This work investigates the adoption of a large set of machine learning and deep learning classifiers to predict heart disease from the data gathered by a proposed feature model. The study also proposes hyperparameters optimizations aimed to improve the performance of the adopted classifiers. The evaluation is performed on a real dataset and the obtained results show good performance.

Kernel Evolving Participatory Fuzzy Modeling for Time Series Forecasting: New Perspectives Based on Similarity Measures

Eduardo Santos (*Federal University of Juiz de Fora*), Kaike Alves (*Federal University of Juiz de Fora*), Direnc Pekaslan (*University of Nottingham*) and Eduardo Aguiar (*Federal University of Juiz de Fora*).

Abstract: The evolving Fuzzy Systems (eFSs) has demonstrated a powerful class of model for time series forecasting, due to their autonomy to handle with the data, and with highly complex problems in real-world applications. Unfortunately, real-world data contains sources of perturbations and variations that can be correlated to external variables, known as randomness. An alternative cause of randomness is chaos, forming the chaotic time series. This paper suggests the ePL-KRLS-FSM, a new class of evolving fuzzy modeling approach that combines participatory learning (PL), a kernel recursive least squares method (KRLS), and data transformation into fuzzy sets (FSs). This transformation allows better handling of inaccuracies with the data, proposing a model that can predict chaotic data with more exactness. The model is evaluated using the Mackey-Glass time series benchmark with different levels of chaos. Furthermore, the performance of the ePL-KRLS-FSM is compared with some related state-of-the-art rule-based eFSs and traditional forecasting models. The computational results show that the proposed model is competitive and performs more consistently than the compared models.

Insect Collision Detection Using Machine Learning with Correlation to Climatic Conditions

Tudur David (*Bangor University*), Matt Jones (*Bangor University*), Paul Cross (*Bangor University*) and Cristiano Palego (*Bangor University*).

Abstract: Insects have experienced dramatic declines over the past 20 years. This has driven the need to monitor populations in relation to the impact of weather conditions and mitigations to conserve insect communities. A machine learning approach is introduced to analyse car number plates for insect collisions. This is subsequently correlated with various weather conditions and journey parameters to monitor changing insect populations. The present approach does not impose stringent requirements on the resolution/format of plate images, nor involves application of physical frames for image collection.

15:30-16:00 **Coffee Break**

16:00-17:30 **Session 4**
SS2 - Adaptive Computational Intelligence, Machine Learning and Applications - Part II
Chair: Mario Luca Bernardi

Piezometric level prediction model based on Transformers

Nedra Mellouli (*University Paris 8*), Mohamed Louay Rabah (*University of Manouba*) and Imed Riadh Farah (*University of Manouba*).

Abstract: Over the recent years, Neural Networks have been used as an alternative for classical numerical approaches in order to facilitate tasks like classification or prediction. The purpose of our study is to predict the groundwater levels for 18 stations scattered in France and explore the applicability of different approaches for prediction. The provided meteorological and hydrological data and the sensors measurements were used as our principal data source. A correlation between piezometric data, maxima-minima differences, precipitation, evaporation and stream flow are used as input to train the compared models which are characterized by employing sequential data. The models have shown promising results as we mention the application of both GRU and Transformer architecture which is newly GW forecasting. The findings of this study can be used to give direction for future use of GW. Furthermore, this work can be a useful reference for other time series problems in geotechnical fields.

Dilated Long Short-Term Attention For Chaotic Time Series Applications

Fatimah Al-Yousif (*King Faisal University*) and Nora Alkhaldi (*King Faisal University*).

Abstract: Improving state-of-the-art models has always attracted the attention of researchers and scientists for the sake of analysing Chaotic Time Series datasets. Starting from the proposal of traditional Neural Networks, the emergence of different Neural Network models has gotten faster. Among these models, Recurrent Neural Network, particularly, Long Short-Term Memory. Long Short-Term Memory has been widely used to forecast via regular Time Series data. When it is used to forecast through Chaotic Time Series, it suffers a lot due to the complexity and nonlinearity of this type of dataset, as well as missing data that results from the long time series. In this project, Dilated Long Short-Term Attention was implemented; an attention mechanism was integrated inside the cell by staking multiple layers with different sizes of dilation. The proposed model was evaluated on data generated by Mackey Glass equation as well as real- world datasets. The experimental results show that the Dilated Long Short-Term Attention model has better improvement in the Mean Absolute Error, Root Mean Percentage Error and R Squared of the predicted values than the common Recurrent Neural Network and Long Short-Term Memory. The experimental results show that the proposed model model has the advantages of high prediction accuracy and small error, which is helpful for the application of deep learning algorithms in Chaotic Time Series datasets.

A Machine Learning approach for Early Detection of Parkinson's Disease Using acoustic traces

Lerina Aversano (*University of Sannio*), Mario Luca Bernardi (*University of Sannio*), Marta Cimitile (*Unitelma Sapienza University*), Martina Iammarino (*University of Sannio*), Debora Montano (*University of Sannio*) and Chiara Verdone (*University of Sannio*).

Abstract: Parkinson's disease is one of the most common diseases of the nervous system, which although typically develops after age 50, in some cases it also affects younger individuals. Its diagnosis is mainly based on the analysis of symptoms, it affects movement, coordination, and muscle control. Doctors generally analyze tremors, stiffness, slow movement, and difficulty walking as symptoms of the disease. Furthermore, changes in the voice are very common in patients with Parkinson's disease, although such changes are not easily noticeable at an early stage. The disease can change your breathing, tone of voice, or lower the volume by up to 10 decibels. Therefore, speech recognition can introduce a new methodology of investigation in the diagnosis and monitoring of Parkinson's disease. This study aims at the development of a model based on the use of Neural Networks for the diagnosis of the disease on voice recordings of different nature, made by both healthy and sick patients. In particular, three types of networks were used: Long Short Term Memory (LSTM) and Convolutional Neural Network (CNN) with one and two dimensions. The results are very satisfactory, highlighting the excellent performance of the LSTM with an F-Score of 97%. These results are very encouraging, suggesting that the use of the proposed approach can improve the Parkinson diagnostic, making it a less costly in terms of time and effort.

Thursday • 26 MAY 2022

09:00-10:30

Session 5

SS6 - Adaptive Learning Systems for Image Processing

Chair: Manuel Jesús Cobo Martín

An Explainable and Evolving Car Driver Identification System based on Decision Trees

Lerina Aversano (*University of Sannio*), Mario Luca Bernardi (*University of Sannio*), Marta Cimitile (*Unitelma Sapienza University*), Pietro Ducange (*University of Pisa*), Michela Fazzolari (*National Council for Research*) and Riccardo Pecori (*University of Sannio*).

Abstract: Shared mobility represents a more and more widespread model ensuring several advantages for citizens and reducing gas emissions. The birth of car-sharing models drives the necessity to use car monitoring systems able to reduce the possibility that unauthorized people drive a certain car. In this paper, we discuss the architecture of car driver identification systems based on incremental fuzzy decision trees. The main features of the proposed system are i) the explainability, namely the possibility of giving explanations regarding its decisions, provided in terms of linguistic rules, and ii) the possibility of continuously updating the classification model. We show the preliminary results of an experimental campaign in which we compare both fuzzy and non-fuzzy incremental decision trees, both in terms of classification performance and model complexity/explainability.

Dynamic Hybrid Learning for Improving Facial Expression Classifier Reliability

Jordan Vice (*Curtin University of Technology*), Masood Khan (*Curtin University of Technology*), Tele Tan (*Curtin University of Technology*) and Svetlana Yanushkevich (*University of Calgary*).

Abstract: Independent, discrete models like Paul Ekman's six basic emotions model are widely used in affective state assessment (ASA) and facial expression classification. However, the continuous and dynamic nature of human expressions often needs to be considered for accurately assessing facial expressions of affective states. This paper investigates how mutual information-carrying continuous models can be extracted and used in continuous and dynamic facial expression classification systems for improving the efficacy and reliability of ASA systems. A novel, hybrid learning model that projects continuous data onto a multidimensional hyperplane is proposed. Through cosine similarity-based clustering (unsupervised) and classification (supervised) processes, our hybrid approach allows us to transform seven, discrete facial expression models into twenty-one facial expression models that include micro-expressions. The proposed continuous, dynamic classifier was able to achieve greater than 73% accuracy when experimented with Random Forest, Support Vector Machine (SVM) and Neural Network classification architectures. The presented system was validated using the Ryerson Audio-Visual Database of Emotional Speech and Song (RAVDESS) and the extended Cohn-Kanade (CK+) dataset.

Adaptive Classification of Occluded Facial Expressions of Affective States

Jordan Vice (*Curtin University of Technology*), Masood Khan (*Curtin University of Technology*), Iain Murray (*Curtin University of Technology*) and Svetlana Yanushkevich (*University of Calgary*).

Abstract: Internationally, the recent pandemic caused severe social changes forcing people to adopt new practices in their daily lives. One of these changes requires people to wear masks in public spaces to mitigate the spread of viral diseases. Affective state assessment (ASA) systems that rely on facial expression analysis become impaired and less effective due to the presence of visual occlusions caused by wearing masks. Therefore, ASA systems need to be futureproofed and equipped with adaptive technologies to be able to analyze and assess occluded facial expressions, particularly in the presence of masks. This paper presents an adaptive approach for classifying occluded facial expressions when human faces are partially covered with masks. We deployed an unsupervised, cosine similarity-based clustering approach exploiting the continuous nature of the extended Cohn-Kanade (CK+) dataset. The cosine similaritybased clustering resulted in twenty-one micro-expression clusters that describe minor variations of human facial expressions. Linear discriminant analysis was used to project all clusters onto lower-dimensional discriminant feature spaces, allowing for binary occlusion classification and dynamic assessment of affective states. During the validation stage, we observed 100% accuracy when classifying faces with features extracted from the lower part of the occluded faces (occlusion detection). We observed 76.11% facial expression classification accuracy when features were gathered from the uncovered full-faces and 73.63% classification accuracy when classifying upper-facial expressions, applied when the lower part of the face is occluded. The presented system promises an improvement to visual inspection systems through an adaptive occlusion detection and facial expression classification framework.

10:30-11:00 **Coffee Break**

11:00-12:30 **Session 6**

SS7 - Recent Advances on Text and Document Streams Mining

Chair: Pietro Ducange

Uncovering the conceptual structure of sentiment analysis re search field during the period 2017–2021

Manuel Jesus Cobo Martin (*University of Granada, Granada*), Ignacio J. Perez (*Uni versity of Granada, Granada*), Antonio Velez-Estevez (*University of Cadiz*) and F.J. Cabrerizo (*University of Granada, Granada*).

Abstract: Sentiment analysis has gained much attention from both academics and industry in the last years. The increasing availability of data on the opinion of users in social platforms such as Twitter, Facebook and others have enabled the development of artificial intelligence to uncover hidden knowledge in social media and perform strategical business decisions. In this way, due to the impact on business strategic decisions, the research advancements in the field of sentiment analysis has quickly grown, and consequently 5293 documents have been published in the last five years, making an impossible task to stay up to date on these advancements. Therefore, given the implications of the new techniques and approaches in the field, in this contribution, we performed a science mapping analysis to uncover the conceptual structure of the area, showing the noteworthy techniques and detecting the possible applications of them. Results show how the sentiment analysis research field paid great attention to topics related to the pandemic (COVID-19, vaccinations) and mental health. Also, advanced artificial techniques such as deep-learning and transfer learning have been widely used in the last years.

Multi-labeled Dataset of Arabic COVID-19 Tweets for Topic-Based Sentiment Classifications

Fatima Alderazi (*King Faisal University*), Abdulelah Algosaibi (*King Faisal University*) and Mohammed Alabdullatif (*King Faisal university*).

Abstract: Natural Language Processing (NLP) can be utilized for analyzing and classifying the growing number of expressed openions and feelings of online texts, and getting the required feedback in a quick and timely manner. The technique of automatically labeling a textual document with the most appropriate collection of labels is known as text classification, whearas supervised text classifiers require extensive human expertise and labeling efforts. This paper seeks to build a multi-labeled Arabic dataset by labeling an Arabic Covid-19 Tweet to two groups based on it's lexical features: related topic and associated sentiment. A big dataset was created from Twitter posts to achieve this purpose. There are over 32k multi-labeled tweets in the dataset. The datasets will be made freely available to the Arabic computational linguistics research community. We used both regular machine learning approachs and a deep-learning approach to investigate the performance this dataset. In this paper we have demonstrated that traditional ML approaches provides higher accuracy with almost stable performance when experienced on Twitter dataset for both sentiment analysis and topic classification.

Online Monitoring of Stance from Tweets: The case of Green Pass in Italy

Alessandro Bondielli (*Università di Pisa*), Giuseppe Cancello Tortora (University of Pisa), Pietro Ducange (University of Pisa), Armando Macrì (Universitty of Pisa), Francesco Marcelloni (University of Pisa) and Alessandro Renda (Università degli Studi di Firenze).

Abstract: Stance detection on social media has attracted a lot of attention in the last few years, as opinionated posts are an invaluable source of information which can possibly be exploited in dedicated systems. This is especially true in the case of particularly polarizing topics for which there is no clear consensus among population. In this paper, we focus on one of these topics, namely the EU digital COVID certificate (also known as Green Pass), with the objective of uncovering the stance towards it in a specific time period for the Italian Twitter community. To this aim, we first tested some classifiers for determining the most suitable one in terms of performance and complexity for the stance detection problem under consideration. Then, we compared several approaches aimed at counteracting the occurrence of concept drift, i.e., that phenomenon for which the characteristics of the dataset vary over time, possibly resulting in a degradation of classification accuracy. Our experimental analysis suggests that updating the classifier during the stance monitoring campaign is crucial for maintaining a satisfactory level of performance. Finally, we deployed our system to monitor the stance on the topic of Green Pass expressed in tweets published from July to December 2021 and to obtain insights about its evolution.

12:30-14:00 **Lunch Break**

14:00-16:00 **Session-7**
General Track - II
Chair: Jordan Vice

Spatio-Temporal Data Clustering using Deep Learning: A Review

Aparna R (*Cochin University of Science and Technology*) and Dr. Sumam Mary Idicula (*Muthoot Institute of Technology and Science*)

Abstract: Spatial and temporal information are recorded with each measurement in so-called spatiotemporal (ST) data. When the information of when and where they were collected is added to each measurement, the data attains enough complexity to dissent with classical statistical data mining methods. The challenging process of modeling the process that evolves in time, and space is becoming central to many disciplines. Spatiotemporal clustering groups data points that are similar in both space and time. While classical clustering algorithms solve the problem by considering time as an additional dimension, deep learning models with powerful data learning capability open up new possibilities. This paper examines recent significant works on clustering spatiotemporal data using deep learning in the context of advancements in deep clustering.

An active learning approach for classifying explosion quake

Antonino D'Alessandro (*Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Nazionale Terremoti*), Andrea Di Benedetto (*Universita' degli studi di Palerm*), Giosue Lo Bosco (*Universita' degli studi di Palermo*) and Anna Figlioli (*Universita' degli studi di Palermo*).

Abstract: In this work, an Active Learning approach for improving the prediction of specific seismo-volcanic events is proposed. Here we study the specific case of Explosion Quakes from Stromboli Volcano versus other seismo-volcanic events, recorded as seismograms, and the use of Random Forest as a Classification method. In conformity with the active learning paradigm, the approach recalls the human intervention for the annotation of uncertain data. The uncertainty is established by the event probabilities, predicted by a trained random forest classifier. The human intervention consists of editing and relabelling the data into these main three classes: Explosion Quakes, Non-Explosion Quakes or Non-Classifiable. The edited events are added as new training examples with the purpose of improving future predictions. The results demonstrate that the proposed active learning approach improves the probability distribution of the data after the human intervention, in particular, after a cut-out phase of the signals with low probabilities.

Collision-Free Navigation using Evolutionary Symmetrical Neur Networks

Hesham M. Eraqi (*The American University in Cairo*), Mena Nagiub (*Valeo Schalter und Sensoren GmbH*) and Peter Sidra (*The American University in Cairo*).

Abstract: Collision avoidance systems play a vital role in reducing the number of vehicle accidents and saving human lives. In this paper, we extend the previous work done using evolutionary neural networks for reactive collision avoidance. We are proposing a new method we have called symmetric neural networks. The method improves the performance of the model by enforcing constraints between the network weights which reduces the model optimization search space, and hence, learns more accurate control of the vehicle steering for improved maneuvering. The training and validation processes are carried out using a simulation environment (code base is publicly available). Extensive experiments are conducted to analyze the proposed method and evaluate its performance. The method is tested in several simulated driving scenarios. In addition, the effect of the rangefinder sensor resolution and noise on the overall goal of reactive collision avoidance has been analyzed. Finally, we test the generalization of the proposed method. The results are encouraging; the proposed method improved both of the model's learning curve for training scenarios and generalization to the new test scenarios. Using constrained weights has shown significant improvement in the number of generations required for the Genetic Algorithm optimization.

Tiny-MLOps: a framework for orchestrating ML applications at the far edge of IoT systems

Mattia Antonini (*OpenIoT Research Unit, DICenter, Fondazione Bruno Kessler*), Miguel Pincheira (*OpenIoT Research Unit, DICenter, Fondazione Bruno Kessler*), Massimo Vecchio (*OpenIoT Research Unit, DICenter, Fondazione Bruno Kessler*) and Fabio Antonelli (*OpenIoT Research Unit, DICenter, Fondazione Bruno Kessler*).

Abstract: Empowering the Internet of Things devices with Artificial Intelligence capabilities can transform all vertical applications domains within the next few years. Current approaches favor hosting Machine Learning (ML) models on Linux-based single-board computers. Nevertheless, these devices' cost and energy requirements limit the possible application scenarios. Conversely, today's available 32-bit microcontrollers have much lower costs and only need a few milliwatts to operate, making them an energy-efficient and cost-effective alternative. However, the latter devices, usually referred to as far edge devices, have stringent resource constraints and host non-Linux-based embedded real-time operating systems. Therefore, orchestrating such devices executing portions of ML applications represents a major challenge with current tools and frameworks. This paper formally introduces the Tiny-MLOps framework as the specialization of standard ML orchestration practices, including far edge devices in the loop. To this aim, we will tailor each phase of the classical ML orchestration loop to the reduced resources available onboard typical IoT devices. We will rely on the proposed framework to deliver adaptation and evolving capabilities to resource-constrained IoT sensors mounted on an industrial rotary machine to detect anomalies. As a feasibility study, We will show how to programmatically re-deploy ML-based anomaly detection models to far edge devices. Our preliminary experiments measuring the system performance in terms of deployment, loading, and inference latency of the ML models will corroborate the usefulness of our proposal.

SOCIAL EVENTS

Welcome Cocktail

Date: **24 MAY, 2022**
Time: **19:00 – 20:30**
Where: **Venue**

Welcome Cocktail is the first social gathering between all conference delegates and it will take place at the Venue Hotel. It will be a relaxing evening during which delegates will have the opportunity to talk to colleagues and peers, while enjoying local drinks and ample canapés.

The Welcome Cocktail is included in all Registration Types.

Ticket per accompanying person: **€35.00**

Tour & Conference Dinner

Date: **25 MAY 2022**
Time: **17:45- 22:30**
Departure Time: **17:00**
Departure From: **Venue**

We will get together at the lobby of the Venue Hotel, from where we will promptly depart in air-conditioned coaches for a city tour. A professional guide will tell us about the history of Cyprus and Larnaca Town in particular. Dinner will take place at a traditional tavern serving excellent dishes of Cypriot cuisine complimented with local drinks and desserts.

The Conference Dinner is included in all Registration Types.

Ticket per accompanying person or Reduced Fees participant: **€60.00**

ABOUT LARNACA

Kamares Aqueduct

Larnaca is an area of outstanding natural beauty, endowed with numerous attractions, waterfronts and scenic vistas, complemented by some of the island's most outstanding beaches.

The city of Larnaca is located on the southern coast of Cyprus, with a population of approximately 85,000 and is the third largest city, after the capital Nicosia and Limassol. It is home to the island's largest airport, Larnaca International Airport, which is located on the outskirts of the city to the south with excellent road links to the whole of the island. Larnaca also has the island's second largest commercial port and a marina, which are two of the four official entry points by sea into Cyprus.

The old town

Larnaca Salt Lake is a distinctive and picturesque landmark, consisting of a network of four salt lakes of different sizes, with an overall surface area of 2.2km, located just off the road leading to the airport. It is considered one of the most important wetlands of Cyprus and has been declared a special protected area and is a prominent domain for wild birds.
The lake is home to 85 species of water birds and is a primary migratory passage through Cyprus. It is visited by flocks of pink flamingos that reside there from November until the end of March, a breath-taking sight to see.

The city also has a number of other landmarks, which include the Church of Saint Lazarus; the Catacomb of Phaneromeni Church; Hala Sultan Tekke; Kamares Aqueduct and the Fort of Larnaca. Additionally, Larnaca has a Municipal Theatre and an Art Gallery.

The beautiful seafront promenade, the "Phinikoudes", is not only lined with palm trees, but also an array of popular seafood restaurants, bars and cafés predominantly visited by tourists.

Church of Saint Lazarus

THE GOLDEN BAY BEACH HOTEL

Congress venue and facilities

The Golden Bay Beach Hotel is an exclusive 5-star luxury hotel, set in mature landscaped gardens on the beautiful island of Cyprus. Perfectly situated at the edge of Larnaca tourist area, the Hotel is just 10 km from the city center and 15 km from Larnaca International Airport. Instilled with a blend of Mediterranean color and culture, the Golden Bay Beach 5 star Hotel in Larnaka is renowned for its excellent facilities, luxurious surroundings, impeccable hospitality and haute cuisine.

Dining & Bars

Dining at the **Golden Bay** has always been a delightful indulgence of rich flavors and aromas, promisingly satisfying every palate. Whether you are craving quality cuisine, a breezy lunch or a light snack, Golden Bay delights in creating the ultimate gourmet experience for you to savour. Catering for all tastes and occasions, the Golden Bay promises to meet your expectations by offering a wide range of local and international dishes, all set in beautiful surroundings. Offering 4 establishments for dining and complemented by live music and entertainment, the Food & Beverage team has acquired the perfect recipe to delight for joy.

Thalassa Restaurant

Lunch at “Thalassa” (the sea) with a fabulous buffet of salads, meats, fish, and pasta dishes, or choose from our à la carte menu, which also includes an extensive vegetarian menu. Tastefully designed with outdoor and indoor seating, “Thalassa” offers a relaxing atmosphere, accompanied by beautiful panoramic views of the pool, beach, and sea.

The rooms

Featuring modern decor and comfortable furnishings, our spacious and bright guest rooms are the ideal choice for holidaymakers and business travelers alike. Offering Standard side sea view and inland view rooms, Pool and Front sea view rooms, Mini Suites, Grand Suites and a Presidential Suite, the Golden Bay can accommodate up to six – member families.

Les Etoiles Conference

The Golden Bay offers excellent conference facilities for up to 450 delegates, within an area of more than 300m^2 specially designed for conferences. With our touch, the versatile function halls are transformed into fully functional conference facilities or elegant romantic wedding venues.
These individual facilities can be separated into smaller sections to suit your needs. We understand the practical requirements of conference organizers as well as the incentive planners’ quest for original and theme-oriented entertainment programs.

A hallway of adjoining meeting rooms can be used separately or in combination, to accommodate up to 300 delegates. The adjacent Business Centre provides a quiet, private and fully equipped office environment. Incentive planners will value our staff’s creative organizational skills.

easy CONFERENCES

we take care of every detail

for your conference needs

FLEXIBLE SOLUTIONS TO SUIT YOUR SPECIFIC NEEDS

Easy Conferences Ltd has been in business since 1992 and has been specializing in the complete coordination and organization of conferences and all related activities. Through the development of its own online registration software, the company has expanded its operations outside Cyprus. We have extensive experience in organizing events ranging from 20 to 2000 participants for physical, hybrid or online participation. We consult, manage and assist in every step of the process of any event and we deliver top professional services throughout.

Our services extend from digital support, media promotion, conference website development and management, to the management of all conference related activities, complete interaction with suppliers and participants, online/onsite registration with secretariat, technical equipment and 24/7 phone help line. We are adaptable and extremely flexible as we are aware of the unique requirements and budget restrictions of each conference. Our services may be provided on an all-inclusive or on an a-la-carte basis.

Easy Conferences can provide organizers with a complete paper submission evaluation system at www.easyacademia.org. We also have our own, custom-made one-stop-shop Conference Management System, www.easyconferences.org, which offers participants the ability to sign up and within minutes register for the conference and its extra activities. Book participants accommodation, airport transfers, social activities for themselves and their accompanied persons and serves their pay instantly online.

Our extensive experience and personal attention to every participant's needs, backed by our team members' unrivaled expertise in their field, as well as the selection of the right partners, has resulted in our impeccable track record that is our guarantee for perfectly organizing any conference or event.

Please visit our website, www.easyconferences.eu for more information on our services, a list of upcoming and past events, as well as referrals from our customers.

P.O.Box 24420, 1704, Nicosia, Cyprus
+357 22 591900
+357 22 591700
info@easyconferences.eu

www.easyconferences.eu
www.easyconferences.org