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Abstract Book

Global Webinar on Artificial Intelligence, Machine Learning and Data Science

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Daniela Cardone
D'Annunzio University of Chieti - Pescara, Italy

Thermal infrared imaging applications in human-machine interaction

Human-machine interaction (HMI) is a spreading research field, which studies the interactionbetween humans and machines. In HMI, it is of fundamental importance to establish thepsychophysiological state of the human to favor the interaction with the machine. Typically,psychophysiological states are assessed through the measurements of autonomic nervous systemrelated parameters.

Classical approaches developed to monitor these variables require the use of contact sensors,thus resulting invasive for the subject and biasing the estimation of the psychophysiologicalstate, since the complete participation of the individual is required.

To overcome the limitations of contact sensors, computational psychophysiology based onthermal infrared (IR) imaging has been used for the quantitative evaluation of several autonomicparameters.

The possibility to access the human factors through a non-contact technology makes thermal IRimaging perfectly suitable in the HMI field. It has been successfully used in the automotiveresearch area for driver drowsiness/fatigue monitoring and emotional state detection as well as inthe robotics research area, with a deep focus on social robots and rehabilitative robots. The mainaim is using thermal IR imaging to understand the human's need and his/her affective stateduring the interaction with the artificial agent and regulate consequentially the behavior of thesocial robot or to monitor the motivational state of the subjects as to enhance the rehabilitativeoutcomes in patients with motor impairment.

Future studies still need to be performed to strengthen and improve the interaction between thehuman and the artificial agent, but the perspective is strongly promising.

Biography:

Daniela Cardone obtained a Master's Degree in Biomedical Engineering at the La SapienzaUniversity of Rome in 2009. She obtained the title of Ph.D. in Neuroscience and Neuroimagingat the University of Chieti-Pescara.

Nowadays she has the role of Research Fellow, Senior Research at the Department ofEngineering and Geology of the University of Chieti-Pescara.

Her research work mainly concerns the development of processing methods and analysis ofimages and physiological signals, of various nature.More recently, her research has focused on affective computing and human-machine interaction,with particular reference to the automotive research field and assistive robotics.

David Perpetuini
University G. D'Annunzio of Chieti-Pescara, Chieti, Italy

Machine Learning Approaches in Neuroimaging for Early Alzheimer's Disease Detection

Alzheimer's disease (AD) is a form of dementia marked by progressive memory loss and a decline in visuospatial abilities. Typically, clinical tests are used to evaluate these symptoms in the early stages of a disease. Nevertheless, performance on a single test is not typically indicative of AD. In an ecological setting, functional neuroimaging may be utilized during these tests to aid in diagnosis. In clinical settings, ecological neuroimaging techniques, such as Electroencephalography (EEG) and functional Near-Infrared Spectroscopy (fNIRS), may be used to aid in the early AD diagnosis without compromising the doctor-patient interation. In addition, Alzheimer's disease is characterized by microcirculation changes associated with impaired endothelial microvascular responsiveness and altered flow motion patterns. Consequently, multimodal EEG-fNIRS could be used to measure neurovascular coupling (NC) and detect its alterations in AD. In addition, the endothelium influences the vascular tone as well as the peripheral small superficial blood vessels, which can be assessed by infrared thermography (IRT). Machine learning (ML) and artificial intelligence (AI) algorithms have been used to increase the capability of neuroimaging tools to detect physiological changes during rest. In fact, disruptions in microcirculation and alterations in NC may also affect brain activity during rest.

Focusing on EEG, fNIRS, and IRT, we will investigate the use of ML and AI algorithms applied to neuroimaging to detect AD in this presentation. Specifically, the use of such algorithms for the analysis of imaging data during both cognitive tasks and resting states is described, with an emphasis on their practicality and efficacy.

Biography:

David Perpetuinigraduated in Biomedical Engineering from the Marche Polytechnic University of Ancona in 2012. In 2018, he earned a Ph.D. in Neuroscience and Neuroimaging at the University "G. d'Annunzio" of Chieti-Pescara. Since 2018 he has been a post-doctoral researcher at the Department of Neuroscience and Imaging of the University "G. d'Annunzio " of Chieti-Pescara. His research focuses primarily on the study of brain activity through functional near-infrared spectroscopy and Elctroencephalography, particularly in Alzheimer's disease, employing machine learning and artificial intelligence techniques. Moreover, he develops algorithms for the detection of the autonomic nervous system activity through functional thermal imaging.

Dr. Loai Abdallah
Max Stern Yezreel Valley College, Israel

K-Means Clustering Algorithm for Mixed Data

Background and goals:

Clustering is an artificial intelligence technique that partitions objects into sub-groups. In clustering the goal is to group similar objects together and different objects into different groups.

K-means is one of the well-known clustering algorithms and most popular. It works by assigning each point (i.e. object) to the closest center and then update the centers based on those points. However, clustering data with mixed types (i.e. attributed with numerical and categorical types) is still a challenging open problem. In this study, we proposed a new k-means clustering algorithm for mixed datasets.

Research method:

Running K-means clustering algorithm requires a distance function in order to associate each point to the closest center, and mean formula in order to update the centers.

Let $\{att_1, att_2, \dots, att_N\}$ assign the attributes, and let $\mathbb{R}_{att} = \{att_1, \dots, att_l\}, and\ \mathbb{C}_{att} = \{att_{l+1}, \dots, att_N\}$ contains the numerical and categorical attributes, respectively. Then, the distance between two points $X = \{x_1, x_2, \dots, x_N\}, Y = \{y_1, y_2, \dots, y_N\}$ will be:

$$dist(X,Y) = \sum_{i=1}^{l} (x_i - y_i)^2 + \sum_{i=l+1}^{N} \neg(x_i = y_i)$$

Where,

$$\neg(x_i = y_i) = \begin{cases} 1, & if\ x_i \neq y_i \\ 0, & if\ x_i = y_i \end{cases}$$

Using this distance, we built a distance matrix that includes all the distances between the points. Then we use the multi-dimensional-scaling technique in order to represent the objects in a continues form.

As a result, the new space will include only continues attributes that reflects the actual similarity between the objects as in the original form. Then we run the original k-means clustering algorithm on the new space dataset.

Experiments:

In order to compare the suggested method with the existing method, we run it on 3 different datasets. To compute the performance of each method, we use the sum-square-error (SSE) and the Rand-Index metric.

Conclusions and Contributions:

Our method outperforms the state-of-the-art methods in 2 main metrics: sum-square-error and Rand Index. However, the main disadvantage of our method is its expensive time complexity on big data.

Biography:

Loai received his B.Sc. - Ph.D. in Mathematics in 2014 in Artificial Intelligence from the University of Haifa. Currently he is a member in the department of Information Systems at The Max Stern Yezreel Valley College. Loai is a researcher and algorithm developer in the fields of artificial and business intelligence, computer vision, and big data from 2005. He founded xBiDa, a company that deals with artificial intelligence for big data and computer vision in 2017.

Dr. Robert Plana
ASSYSTEM, France

Artificial Intelligence as Enabling Technology for Complex Projects Delivery

In the context of climate change, we see a significant move concerning the Energy that will have to be clean, sustainable and affordable. This turns out to a radical change in the infrastructures that will have be developed with better performances, lower costs and higher resilience. This will translate into projects featuring much larger complexity. This complexity is reflected through the numbers of stakeholders, the number of requirements, number of interfaces and the multidisciplinary character. This results to a large diversity of data, fully unstructured that will have to be kept actionable for very long cycle (around 100 years).

Complex Systems modeling techniques coupled to data science ones will be key to structure the data and to create digital twin at system level that will facilitate the delivery of the large Energy Infrastructure Projects. NLP/OCR techniques coupled with ML/DL algorithms will enable the acceleration of the engineering processes. Robotic Process Automation will replace a large number of manual tasks and finally Optimization under constraints techniques will propose innovative delivery path for the projects minimizing the overrun and over cost.

The paper will overview the different technologies existing and under development through the angle of the delivery of Nuclear Power Plant.

Biography:

Robert Plana has been Professor at Paul Sabatier University in Toulouse and at the Institute Universitaire de France in the field of Internet of Things Technologies. He has occupied numerous top management positions at CNRS, National Research Agency and Ministry of higher education and research. In the private sector, he has been working with a startup (SiGe Microsystems) as Senior Technology Leader, with Alstom as Open Innovation Director and with GE as the CTO and Ecosystem Director of the GE Digital Services for Europe. He is now the Chief Technology Officer of ASSYSTEM Group in charge of the Innovation strategy and leading the program “Engineering Powered by digital services”. He is pioneering the convergence between Big Data, Artificial Intelligence and Advanced System engineering for mission critical Infrastructures.

Dr. Stefan Stanciu
University Politehnica of Bucharest, Romania

Automated Corneal Edema Detection with Second Harmonic Generation Microscopy and Deep Learning

When the cornea becomes hydrated above its physiologic level it begins to significantly scatter light, loosing transparency and thus impairing eyesight. This condition, known as corneal edema, can be associated with different causes, such as corneal scarring, corneal infection, corneal inflammation, corneal dystrophies, and others, making it difficult to diagnose and quantify. Previous works have shown that Second Harmonic Generation Microscopy (SHG) represents a valuable non-linear optical imaging tool to non-invasively identify and monitor changes in the collagen architecture of the cornea, potentially playing a pivotal role in future in-vivo cornea diagnostic methods. In this work we explore the use of three Deep Learning models, the highly popular InceptionV3 and ResNet50, alongside FLIMBA, a custom developed architecture, requiring no pre-training, to automatically detect corneal edema in SHG images of porcine cornea. We discuss and evaluate data augmentation strategies tuned to the specifics of the herein addressed application and observe that Deep Learning models building on different architectures provide complementary results for the classification of cornea SHG images. Importantly, we observe that the combined use of such complementary models boosts the overall classification performance in the case of differentiating edematous and healthy corneal tissues, up to an AU-ROC=0.98. These results have potential to be extrapolated to other diagnostics scenarios, such as automated extraction of hydration level of cornea, or automated identification of corneal edema causes, and thus pave the way for novel methods for cornea diagnostics with Deep-Learning assisted non-linear optical imaging.

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Biography:

Stefan G. Stanciu received the Ph.D. degree in electronics and telecommunications from University Politehnica of Bucharest (UPB), Bucharest, Romania, in 2011. He was a Postdoctoral Researcher with UPB and ETH Zurich, Zürich, Switzerland. He is currently a Principal Investigator with Center for Microscopy-Microanalysis and Information Processing, UPB, and is habilitated in Physics. He has co-authored >70 Web of Science journal articles, with >30% as main author, and several book chapters. His research focuses on high- and super-resolution imaging by scanning laser and scanning probe microscopies. Stefan currently coordinates various research projects that focus on super-resolved imaging of cells, tissues, and advanced materials, and on the development of related image analysis and processing methods, with focus also on artificial intelligence.

Dr. Yaroslav D. Sergeyev
University of Calabria, Italy

Numerical infinities and infinitesimals in optimization and not only

In this talk, a recent computational methodology is described. It has been introduced with the intention to allow one to work with infinities and infinitesimals numerically in a unique computational framework. It is based on the principle 'The part is less than the whole' applied to all quantities (finite, infinite, and infinitesimal) and to all sets and processes (finite and infinite). The methodology uses as a computational device the Infinity Computer (a new kind of supercomputer patented in USA and EU) working numerically with infinite and infinitesimal numbers that can be written in a positional system with an infinite radix. On a number of examples (numerical differentiation, divergent series, ordinary differential equations, fractals, set theory, etc.) it is shown that the new approach can be useful from both theoretical and computational points of view. The main attention is dedicated to applications in optimization (local, global, and multi-objective) - the field thast is actively used in machine learning. The accuracy of the obtained results is continuously compared with results obtained by traditional tools used to work with mathematical objects involving infinity. The Infinity Calculator working with infinities and infinitesimals numerically is shown during the lecture. For more information see the dedicated web page https://www.theinfinitycomputer.com and this survey: Sergeyev Ya.D. Numerical infinities and infinitesimals: Methodology, applications, and repercussions on two Hilbert problems, EMS Surveys in Mathematical Sciences, 2017, 4(2), 219–320.

Biography:

Yaroslav D. Sergeyev is Distinguished Professor at the University of Calabria, Italy (professorship awarded by the Italian Government) and Head of Numerical Calculus Laboratory at the same university. He is also Member of the University International Council and Professor (part-time contract) at Lobachevsky Nizhniy Novgorod State University, Russia, Affiliated Researcher at the Institute of High Performance Computing and Networking of the Italian National Research Council, and Affiliated Faculty at the Center for Applied Optimization, University of Florida, Gainesville, USA. He was awarded his Ph.D. (1990) from Lobachevski Gorky State University and his D.Sc. degree (1996) from Lomonosov State University, Moscow (this degree is Habilitation for the Full Professorship in Russian universities). In 2013, he was awarded Degree of Honorary Doctor from Glushkov Institute of Cybernetics of The National Academy of Sciences of Ukraine, Kiev. His research interests include numerical analysis, global optimization (he was President of the International Society of Global Optimization, 2017-2021), infinity computing and calculus (the field that he has founded), philosophy of computations, set theory, number theory, fractals, parallel computing, and interval analysis. Prof. Sergeyev is included in the lists "Top Italian Mathematicians" and "Top Italian Computer Scientists". He was awarded several research prizes (Khwarizmi International Award, 2017; Pythagoras International Prize in Mathematics, 2010; EUROPT Fellow, 2016; Outstanding Achievement Award from the 2015 World Congress in Computer Science, Computer Engineering, and Applied Computing, USA; Honorary Fellowship, the highest distinction of the European Society of Computational Methods in Sciences, Engineering and Technology, 2015; The 2014 Journal of Global Optimization (Springer) Best Paper Award; Lagrange Lecture, Turin University, Italy, 2010; MAIK Prize for the best scientific monograph published in Russian, Moscow, 2008, etc.). In 2020, he was elected corresponding member of Accademia Peloritana dei Pericolanti in Messina, Italy. In 2020 and 2021, he was included in the rating "Highly cited authors in Scopus". His list of publications contains more than 250 items (among them 6 books). He is a member of editorial boards of 12 international and 3 national journals and co-editor of 11 special issues. He delivered more than 70 plenary and keynote lectures at prestigious international congresses. He was (Co) Chairman of 11 international conferences and a member of Scientific Committees of more than 60 international congresses. He is Coordinator of numerous national and international research and educational projects. Software developed under his supervision is used in more than 40 countries of the world. Numerous magazines, newspapers, TV and radio channels have dedicated a lot of space to his research.

Prof. AgnisStibe
EM Normandie Business School, France

Hyper-Performance with Human Artificial Intelligence

While artificial intelligence can make fundamental transformations, people are still at the core of achieving profound organizational hyper-performance. Why? Because, human factors, such as decision-making and behavioral choices, continuously influence and determine the level of success and results for most organizations. Therefore, artificial intelligence should be well prepared to manage the peculiarities of human psychology and neurology. Artificial intelligence is already helping organizations to manage increasing loads of exponentially growing data volumes, thus enabling rapid behavioral pattern recognition. That helps to narrow down and locate groups of people with distinct behavioral deviations, which highlights the possibility of having a common attitudinal barrier behind their underperformance. This keynote is an engaging deep dive into the science and practice of designing transformative solutions that efficiently blend technological advancements with human nature. It provides many insightful videos that uncover who we really are and convincingly portrays a prosperous future with united human artificial intelligence.

Biography:

Prof. AgnisStibe is a 4x TEDx speaker, MIT alum, and YouTube creator. Globally recognized corporate consultant and scientific advisor at AgnisStibe.com.Offers an authentic science-driven STIBE method and practical tools for hyper-performance.Artificial Intelligence Program Director and Professor of Transformation at EM Normandie Business School.Adjunct Professor of Human-City Interaction at the University of Oulu. Paris Lead of Silicon Valley founded the Transformative Technology community. At the renowned Massachusetts Institute of Technology (MIT), he established research on Persuasive Cities for sustainable wellbeing. Currently working with the MIT Media Lab on the SoCity project.

Dr. Dileep Kumar Yadav
Galgotias University, India

Moving Human Detection and Tracking in Thermal Video through Intelligent Surveillance System for Smart Applications

Now a days, the huge demand of everyone in the society for video based surveillance systems that monitors regular activities continuously for safety and security of everything (human, things, activity, etc.). As per development and innovations of technology, the society is also focusing for advanced surveillance system that focuses on suspicious activities, unauthorized incidents, trespassing, robbery, accidents, theft, etc. Practically, numerous tasks are very hard to handle such as camouflage, foreground aperture, bootstrapping, refection, dynamic background, variation of illumination, dust, mist, fog, snow etc. So, the surveillance system requires a solution that could deliver an effective solution to deal these problematic issues. This work focuses on moving human detection in thermal environment; the proposed work is able to handle critical tasks, extracts the exigent information and removes redundant information. This work extract the moving object (human, vehicle, animal, etc.) in the dark or unseen environment because thermal camera captures the heat generated from the manmade objects or humans and penetrates problems generated by cluttered nature, dim light, illumination variation, haze, mist, dust etc. available in the scene. The state-of-the-art methods has experimented and provided solutions for various issues occurred due to cluttered these challenges. This work developed an adaptive method for the maintenance of the background model and also updated the threshold adaptively. To compute the effectiveness of the proposed work, the performance is evaluated and analyzed by numerous parameters.. The experimental results as well as analysis (qualitative and quantitative) also demonstrate better performance against considered peer methods.

Biography:

Dr. Dileep Kumar Yadav received B. TECH. from UPTU, India in 2006. He earned M.TECH. and PhD from Jawaharlal Nehru University, New Delhi, India in 2011 & 2016, respectively. He is author of 65 research publications (Patent, Journals, and National/International conferences). His primary research interests are in AI, ML, and computer vision. Dr. Yadav is also associated with many international journals as Associate Editor, Member, Int. Editorial Board member etc. Dr. Yadav is recipient of various awards from various organizations in research and delivered consultancy work. Currently, Dr. Yadav is working as a Professor in Galgotias University, Greater Noida, and India.

Dr. VidyaSagar
University of Texas at Austin, USA

Artificial Intelligence in Healthcare and Medical Devices – The Regulations Matter

Artificial Intelligence (AI) has taken over the healthcare and medical device sector quite sustainably but effectively. AI and Machine Learning (ML) has been used in different health care applications and also in SAMED (Software as Medical Device). Entry of AI and ML in Health care sphere has opened up numerous opportunities that can help and sever the end user / patient in better. Similarly, in the field of the Medical Device, the AI linked SAMED have provided better diagnosis and treatment to the patients. However, the regulatory frame work for AI / ML in this field is nascent and more work has to done by the notified and regulatory bodies of all the countries. The USFDA and the EU have come out with few proposals on regulations linked to Risk management, Good Machine Learning Practices, Algorithm Protocol Control and SaMD Pre-Specifications, Locking Algorithms. However, much need to be done proper standards on Validation, verification protocols, Change controls etc for better patient safety and efficacy.

The FDA discusses how to deal with continuously learning systems. However, it has still not answered the question of what the best practices are for evaluating and approving a "frozen" algorithm based on AI processes. Guidelines, "Good Machine Learning Practices" as the FDA calls them, are still lacking. The FDA's idea of not requiring a new submission based on pre-approved procedures for algorithm modifications has its charms. I would like to see such specificity from the European legislators and authorities and much more for USFDA.

Biography:

Dr.VidyaSagar completed his PhD, PDF in Pharmacology and PG in AI / ML and MBA (AI) form University of Texas at Austin and NIBM Global respectively. He is a Subject Matter Expert on Medical Devices and Clinical Data Management. He worked as Technical – Head, Head- QA /RA, Chief Scientist, Lead Auditor, Data Scientist, Regulatory consultant of reputed Medical Device companies and Clinical Services. He has 17 years of extensive experience in Product Development, Regulatory, Clinical submissions, Outsourcing, Digitalization, Compliance, Quality Control, and Assurance; He guided 15 PhD projects, 5 Patents and has 60 international publications to his credit.

Next Event:

2nd Global Webinar on
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June 26-27, 2024

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