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What Is an AI-Generated Artwork?

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The Research Catalyst

ROBOAI- CON2023



RoboAICon 2023

Conference Proceedings
Abstract eBook

**23 & 24 March 2023 (INPERSON)
25 March 2023 (VIRTUAL)**

Hampton

By Hilton Rome North Fiano Romano, Rome, Italy

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RoboAI-Con2023, organized by The Research Catalyst with the support of the Organizing Committee, the administrative team, and the virtual meeting team at 10Times.

The committee and the secretariat would sincerely like to thank all the participants who have taken part in the conference and delivered informative talks about their research work. The time and effort put into making this conference a success by everyone is sincerely acknowledged.

We hope the participants and the rest of the research community benefit from this thought-provoking event. Hoping to meet all the participants in the next edition of the conference soon.

*-Sincerely,
The Research Catalyst Team*

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**EXPLORING IMPACT TECH STARTUPS: A ML
METHODOLOGY TO IDENTIFY A NEW
ORGANIZATIONAL CATEGORY**

DAY 1

PROF. BENJAMIN GIDRON

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The goal of this study is to introduce a new and unexplored organizational category: The Impact Tech Startups. In an age when humanity is struggling to find solutions to the looming combination of social and environmental challenges it faces, ITSs is an organizational category, which has in the center of its activities a commitment to deal with those, using technologically innovative tools. Startup entrepreneurs are looking for opportunities to produce a product or deliver a service that potentially has a large market, preferably international, and are looking to expand and scale it and achieve financial success. ITSs follow that pattern, but the product or service they are creating is solving a social or environmental problem or issue and therefore is contributing not only to its immediate stakeholders but to society and humanity at large. This new organizational form was never studied. The paper presents a ML-based methodology to identify ITSs from within large business databases and categorizes them into the 17 Sustainable Development Goals (SDGs) of the UN. It will also present initial empirical findings of a study on Impact Tech Startups in Israel.

MACHINE LEARNING APPROACHES FOR CLASSIFICATION AND CLINICAL DETECTION OF BEVACIZUMAB RESPONSIVE GLIOBLASTOMA SUBTYPES BASED ON MIRNA EXPRESSION

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For the precise treatment of patients with glioblastoma multiforme (GBM), we classified and detected bevacizumab (BVZ)-responsive subtypes of GBM and found their differential expression (DE) of miRNAs and mRNAs, clinical characteristics, and related functional pathways. Based on miR-21 and miR-10b expression z-scores, approximately 30% of GBM patients were classified as having the GBM BVZ-responsive subtype. For this subtype, GBM patients had a significantly shorter survival time than other GBM patients ($p = 0.014$), and vascular endothelial growth factor A (VEGF) methylation was significantly lower than that in other GBM patients ($p = 0.005$). It also revealed 14 DE miRNAs and 7 DE mRNAs and revealed functional characteristics between GBM BVZ subgroups. After comparing several machine learning algorithms, the construction and cross-validation of the SVM classifier were performed. For clinical use, miR-197 was optimized and added to the miRNA panel for better classification. Afterwards, we validated the classifier with several GBM datasets and discovered some key related issues. According to this study, GBM BVZ subtypes can be classified and detected by a combination of SVM classifiers and miRNA panels in existing tissue GBM datasets. With certain modifications, the classifier may be used for the classification and detection of GBM BVZ subtypes for future clinical use.

PROF. HAO YU

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With the development of artificial intelligence, deep learning-based algorithms are more frequently used for applications in robotics than ever before, including simultaneous localization and mapping (VSLAM) on edge agents. Thus, the core technology of futural AI-based robotic systems focuses on how the design of high-speed, low-cost, and robust deep learning-based algorithms as well as the platforms. This talk will mainly introduce the robust Robotic VSLAM algorithms we have developed, including the deep learning-based Visual Odometry (VO) and Loop Closure Detection (LCD) with highly compressed neural networks, which are the essential components in VSLAM. In previous works, we proposed a tensor-compressed Vision Transformer-based model with tensor-train (TT) decomposition for LCD tasks named TT-LCD and achieved a 6.04× compression rate with even 2.13% present improvement of average accuracy on the NewCollege dataset. Besides, we have also proposed a new visual odometry framework, named ATFVO, which can be deployed on the edge device to resolve monocular visual odometry problems and achieved 141× compression rate in the LSTM part with 23× total speed-up compared with Flowdometry. Furthermore, high-performance, low-power, low-cost edge smart chips were developed for these algorithms. The development of the entire deep learning-based Robotic VSLAM algorithms and edge computing platform will help to reshape the robot design field from chip to application.

DR. ROSSELLA ARCUCCI

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This work fits into the context of digital twins, which are usually made of two components: a model and some data. When developing a digital twin, many fundamental questions exist, some connected with the data and its reliability and uncertainty, and some to do with dynamic model updating. To combine model and data, we use Data Assimilation (DA). DA is the approximation of the true state of some physical system by combining real-world observations with a dynamic model. DA models have increased in sophistication to better fit application requirements and circumvent implementation issues. Nevertheless, these approaches are incapable of fully overcoming their unrealistic assumptions. Machine Learning (ML) shows great capability in approximating nonlinear systems and extracting meaningful features from high-dimensional data. ML algorithms can assist or replace traditional forecasting methods. However, the data used during training in any ML algorithm include numerical, approximation and round off errors, which are trained into the forecasting model. Integration of ML with DA increases the reliability of prediction by including information in real time and with a physical meaning. This talk introduces Data Learning, a field that integrates Data Assimilation and Machine Learning to overcome limitations in applying these fields to real-world data. We present several Data Learning methods and results for some test cases, though the equations are general and can easily be applied elsewhere.

Keywords AI, Digital twins, Data Assimilation, Machine Learning, Data Learning

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PERSONAL AI: MAXIMIZING THE VALUE OF PERSONAL DATA WHILE DEFENDING HUMAN RIGHTS AND DEMOCRACY

DAY 2

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Value of personal data (PD) is maximized by decentralized management; i.e., aggregating PD to the data-subject individuals and letting them fully utilize their own PD. We have been developing PLR (personal life repository) as a software library to implement this decentralized management and applied it to various use cases including education, healthcare, and administrative services. Associated with your PLR, a personal AI (PAI) will be exclusively dedicated to you, managing your PD and fully utilizing it to optimize your life by intervening your actions more deeply and carefully than other technologies so far --- the best ever personal service potentially accounting for 25% of GDP. On the other hand, the central AI (CAI) based on centralized PD management threatens human rights and democracy. It is impossible for the humanity to jointly restrict CAI, because some companies and countries may eventually enjoy huge profit and power by CAI, unlike by a full-scale nuclear war. However, this risk could be overcome by letting service providers (both public and private) employ PAIs instead of CAIs in order to improve their profits.

**DR. IMMACULADA
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The development of artificial hands needs to be followed by a parallel development of objective methods to evaluate their performance. This need has been recognized by the robotics community in the last years as an important topic. Therefore, we have proposed the Anthropomorphic Hand Assessment Protocol (AHAP) by providing a measure for quantifying the grasping ability of anthropomorphic artificial hands and comparing hand designs for robotic and prosthetic applications. The AHAP is an experimental benchmark composed on 26 postures/tasks involving grasping with the eight most relevant human grasp types during activities of daily living (hook, spherical grip, tripod pinch, extension grip, cylindrical grip, diagonal volar grip, lateral pinch, and pulp pinch) and two non-grasping postures (index pointing/pressing and platform). The objects of the AHAP were selected from the Yale-CMU-Berkeley Object and Model Set due to their public availability. Three objects per grasp type and one for each non-grasping posture were used, being selected with different size, shape, weight, texture, and rigidity. The AHAP allows to quantify the anthropomorphism and functionality of artificial hands through a numerical Grasping Ability Score (GAS). To obtain the GAS, the AHAP considers both grasp correctness (human-like) and stability after rotating the artificial hand from supination to pronation. The AHAP enables replicability and it was tested with different hands (the first version of the hand of the humanoid robot ARMAR-6 with three different configurations resulting from attachment of pads to fingertips and palm as well as the two versions of the KIT Prosthetic Hand). The benchmark was used to demonstrate the improvements of these hands in aspects like the grasping surface, the grasp force and the finger kinematics. The reliability, consistency and responsiveness of the benchmark have been statistically analyzed, indicating that the AHAP is a powerful tool for evaluating and comparing different artificial hand designs.

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EXPECTATIONS AND BENCHMARKING OF PROSTHETIC HANDS
QUESTIONED

DAY 1

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TBA

**DESIGNING GAMIFICATION FOR LANGUAGE LEARNING:
A CRITICAL REVIEW OF ITS DESIGN, THEORETICAL
FOUNDATIONS, IMPACT AND CHALLENGES.**

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This article reviews recent (2018–2022) empirical studies that use gamification to foster language education. The studies were selected via a systematic search of databases. We focused on the status, trends, theoretical underpinnings, impact and challenges of gamification for language education. The design characteristics (e.g., gamification applications, gamified platform availability, game design elements and learning modes), contextual factors (e.g., educational level and language domains) and methodological factors (e.g., research design and measures) were considered to present a comprehensive picture of the state of the art in the field. The results showed that the full potential of gamification remains unexploited and that more research is needed in the aspects of utilising immersive-based game design elements (e.g., narrative and fantasy), incorporating team-based competitions, focusing on specific language skills, extending the research to K-12 settings and examining affective outcomes such as language learning anxiety, self-efficacy and confidence. Although the studies based on self-reported measures showed positive effects in favour of the gamification approach, the objective assessment-based studies showed a neutral impact. Finally, to maximise the effectiveness of gamification, we identify five challenges inhibiting its effective uptake and propose several promising yet under-researched directions for future investigations (e.g., using artificial intelligence to achieve adaptive gamification).

PROF. GILA KURTZ

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The use of instructional technologies to support learning and training has progressed from computer-aided presentations and online learning environments to one of the latest instructional technologies, humanoid robots (HR) such as NAO and Pepper. With AI capabilities, the evolving capability of human-like robots to interact with learners is being tested at almost all levels of education and across organizations. Studies have shown that learning-teaching with HR is engaging and promotes learners engrossed in the content mainly because of the human-robot interaction (HRI) novelty. However, the main challenges of HR are the need for initiated or spontaneous communication of HRI and human fear of the new technology. Overall, as an emerging field, HR opens new opportunities along with challenges for learning and teaching processes to be addressed by the research. In my talk, I will present results from our research over the past four years on using HR as an instructional tool. Also, I will offer recommendations for future research directions in favor of promoting HRI and AI integration for learning and training.

Keywords, humanoid robot, human-robot interaction learning, teaching

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An underlying theme in many modern scientific fields of inquiry is the deluge in the volume of data generated that require analysis and interpretation. Within the biomedical field, advances in high-throughput “omics” technologies in the past two decades have given rise to large-scale biological data that is measured on a variety of scales. These studies enable the simultaneous measurement of the expression profiles of tens of thousands of “omic” features, from an ever increasing number of individual patient samples that may represent phenotypes, experimental conditions or time points. Examples include genomic, proteomic, metabolomic, transcriptomic, radiomic and compound screening studies that are fundamental to molecular pattern discovery and drug development. Similarly, studies in neuroscience generate tens of thousands of signals from brain or muscle activity under a variety of experimental conditions across the time-frequency and spatial domains. For instance, identifying muscle synergies helps advance our understanding of motor control in healthy and pathological conditions. When information on patient outcome such as survival or disease recurrence is also available, one of the goals of an investigator is to understand how the expression levels of “omic”, clinical, laboratory and demographic features relate to an individual’s survival over the course of a disease. These massive data sets offer tremendous potential for growth in our understanding of the pathophysiology of many diseases and for designing personalized treatments; however, in order to extract actionable information from them that is useful for policy and decision making, several methodological and computational challenges have to be overcome. In this talk, I will address these problems and outline a variety of integrative, statistical machine learning approaches for large-scale biomedical data analytics encompassing applications in “omics” studies, electrophysiology and text mining.

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OLD WINE IN NEW BOTTLE? - THE GEOGRAPHY OF SCALEUP CITIES IN ROBOTICS AND ARTIFICIAL INTELLIGENCE

DAY 2

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While Robotics and Artificial Intelligence are becoming increasingly important terrain for startups, less is known about the territorial pattern of these startups. To fill this gap, we retrieved from Dealroom.co data globally on 8,000 scaleups (startups raised more than 1 million euros in funding) in Artificial Intelligence and 2,000 scaleups in Robotics and matched them to EU-OECD functional urban areas classification. As alone these figures indicate, at present, Robotics lags far behind Artificial Intelligence in terms of many measures, such as the number of scaleups, their total funding and their scaling opportunities (measured as number of scaleups valued more than 200 M EUR). Similarly, strong territorial concentration is the main trend in both cases, as globally a handful of scaleup cities dominates the landscape, the scaleups in Artificial Intelligence are more widely distributed around the world than those involved in robotics. Hence, the paper looks at the factors influencing these different dynamics and territorial patterns, such as the specific feature of innovation economics, as well as the role of access to capital and talents in different scaleup cities.

DR. RUONAN LIU

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Fault diagnosis of complex industrial processes becomes a challenging task due to various fault patterns in sensor signals and complex interactions between different units. However, how to explore the interactions and integrate with sensor signals remains an open question. Considering that the sensor signals and their interactions in an industrial process with the form of nodes and edges can be represented as a graph, this article proposes a novel interaction-aware and data fusion method for fault diagnosis of complex industrial processes, named interaction-aware graph neural networks (IAGNNs). First, to describe the complex interactions in an industrial process, the sensor signals are transformed into a heterogeneous graph with multiple edge types, and the edge weights are learned by the attention mechanism, adaptively. Then, multiple independent graph neural network (GNN) blocks are employed to extract the fault feature for each subgraph with one edge type. Finally, each subgraph feature is concatenated or fused by a weighted summation function to generate the final graph embedding. Therefore, the proposed method can learn multiple interactions between sensor signals and extract the fault feature from each subgraph by message passing operation of GNNs. The final fault feature contains the information from raw data and implicit interactions between sensor signals. The experimental results on the three-phase flow facility and power system (PS) demonstrate the reliable and superior performance of the proposed method for fault diagnosis of complex industrial processes.

DR. SUSANNA SIU-SZE YEUNG

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Story retell is an effective pedagogical strategy in enhancing young children's language development. It also reflects how well a child has comprehended a specific story. It involves several steps, starting from telling the child that he or she needs to do retell, read the story with the teacher and finally inviting the child to tell the story as if he or she needs to tell someone who had never known the story. Teachers may also invite the child to elaborate on key ideas of the story. Such technique can be automated with the support of AI-technology. An application was developed by the research team to mimic this process. Apart from listening to a story told by the computer, a story co-telling function is developed, in which children can choose whether to tell the story together by reading some lines of a character in the story. The application is able to give immediate feedback on the reading performance (in terms of pronunciation accuracy) to children if they choose to do co-tell. After listening/co-tell the story, children are invited to retell the story.

The impacts of using the application on children's language development (vocabulary and comprehension) and learning engagement (motivation and interest) will be evaluated in second language learners of 6-8 years old. We will also compare the effects of the two functions of the applications.

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**ROBUST AUTONOMOUS DRIVING SYSTEMS
THROUGH ADVERSARIAL TEST SET GENERATION**

DAY 2

DR. DEVRIM UNAL

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Correct environmental perception of objects on the road is vital for the safety of autonomous driving. Making appropriate decisions by the autonomous driving algorithm could be hindered by data perturbations and more recently, by adversarial attacks. We propose an adversarial test input generation approach based on uncertainty to make the machine learning (ML) model more robust against data perturbations and adversarial attacks. Adversarial attacks and uncertain inputs can affect the ML model's performance, which can have severe consequences such as the misclassification of objects on the road by autonomous vehicles, leading to incorrect decision-making. We show that we can obtain more robust ML models for autonomous driving by making a dataset that includes highly uncertain adversarial test inputs during the re-training phase. We demonstrate an improvement in the accuracy of the robust model by more than 12%, with a notable drop in the uncertainty of the decisions returned by the model. We believe our approach will assist in further developing risk-aware autonomous systems.

PROF. DR. RALF MULLER

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Fast and resource-efficient inference in artificial neural networks (ANNs) is of utmost importance and drives many new developments in the area of new hardware architectures. In this work, we present a novel method for lowering the computation effort for ANN inference utilizing ideas from information theory. Weight matrices are sliced into submatrices of logarithmic aspect ratios. These slices are then factorized. This reduces the number of required computations without compromising on fully parallel processing. We also provide a tool to map these sliced and factorized matrices efficiently to reconfigurable hardware. By comparing to the state of the art FPGA implementations, we lower hardware resources measured in look-up-tables (LUTs) by a factor of four to six. Our method does not rely on any particular property of the weight matrices of the ANN. It works for the general task of multiplying an input vector with a constant matrix and is also suitable for convolutional neural networks as well as digital signal processing beyond ANNs.

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CHILD SEX DOLLS/ROBOTS AND THE CRIMINAL
LAW FRAMEWORK IN THE UK

DAY 1

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The agriculture industry faces tremendous pressure to increase crop production and yields to meet future consumer demand for food. This problem is compounded by the population growth of the planet, severely limited natural resources (arable land and water), unpredictable weather patterns, the requirement of sustainability, and climate change, among other variables. In an effort to intensify production, growers are increasingly turning to environmental measurement and data analysis. Computing systems can automate this process to facilitate faster problem diagnosis, more accurate outcome prediction, and proactive decision making.

Toward this end, we present SmartFarm -- a new, unifying, and open approach to agriculture analytics and precision farming that leverages and integrates IoT, ML/AI, and cloud technologies to provide farmers with new sensing, decision support, and data-driven actuation and control technologies. SmartFarm is an integrated, distributed (cloud/edge/sensor) system that facilitates investigation, validation, and demonstration of new approaches for sensing, data analytics and machine intelligence, and actuation of farm operations, while ensuring that farm data and analyses remain under the control of growers.

DR. XIAOLING HU

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Stroke is a leading cause of long-term disability in adults. However, regular and intensive physical training is hard to be accessed by discharged patients because of limited outpatient resources and interruptions by pandemics, e.g., COVID-19. Effective and self-help telerehabilitation with remote professional supervision is needed for long-term post-stroke rehabilitation.

A hybrid robotic arm was invented for post-stroke upper limb rehabilitation at different joints, i.e., the elbow, wrist and fingers. It integrated the advantages of neuromuscular electrical stimulation, soft artificial muscle and exoskeleton in one system (exoneuromusculoskeleton), with the purposes to improve the robot-assisted rehabilitative effectiveness after stroke and to provide a novel rehabilitation service, i.e., self-help and mobile telerehabilitation for outpatients. The invention received a series of international awards and has been recognized as one of the five key developments which will impact the rehabilitation robotic global market in the near future. The technology and the service model are undergoing the process of commercialization, in collaboration with local companies and hospitals mainly located in the Greater Bay Area of China.

DR. ARINDAM PAL

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Phishing is the fraudulent attempt to obtain sensitive information or data, such as usernames, passwords, credit card numbers, or other sensitive details, by impersonating as a trustworthy entity. Phishing has grown significantly in the past few years, and is predicted to further increase in the future. Phishing is lucrative because it is a low-cost job for the attackers, it is difficult to find and prosecute them, and numerous phishing toolkits to design phishing websites are freely available online. In this talk, we will analyse several methods for detecting phishing websites.

In the first part, we will discuss PhishZip, which is a novel phishing detection approach using a compression algorithm to perform website classification. We will illustrate how to construct word dictionaries, by analysing the likelihood of word occurrences to build compression models optimised for both phishing and legitimate websites. We introduce compression ratio as a novel machine learning feature, which significantly improves the performance of machine learning algorithms for phishing detection systems. Compression ratio measures the distance or cross-entropy between the predicted website and phishing/non-phishing website content distribution. PhishZip outperforms the best-performing HTML-based features proposed in past studies by a large margin, and works very fast in practice for large websites. In the second part, we will describe another tool called PhishSim, which is a feature-free system of detecting phishing websites, using the Normalised Compression Distance (NCD) to measure the similarity of websites. PhishSim examines the HTML source code of web pages and attempts to measure their similarity with a known phishing website. We propose the clustering of websites, together with the Furthest Point First (FPF) algorithm to extract phishing prototypes. These prototypes are used to select representative phishing web pages. We introduce an incremental learning algorithm as a framework for continuous and adaptive detection. We develop a general architecture for a phishing detection system, that can be deployed on an organisation's email and web servers, and on a cloud service (such as Amazon Web Services and Microsoft Azure). Using this continuous learning framework, the system can detect phishing sites with high accuracy.

ROBOAI-CON2023

**COGNITIVE ROBOTICS: RESEARCH CHALLENGES,
RECENT ADVANCES AND FUTURISTIC TREND**

DAY 3

DR. MENG JOO ER

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The quest for building human-like intelligence has gained enormous momentum in recent decades. Since the seminal works on Artificial Intelligence (AI), the desire of realizing the quest has become stronger. With the rapid developments in Science, Engineering, Technology and Mathematics, machines that mimic human intelligence have become a reality and sometimes indispensable parts in our daily life, such as Apple Siri and Google Voice. Cognition is a group of mental processes that include attention, memory, producing and understanding language, solving problems and making decisions and making decisions. Cognitive robotics is concerned with endowing robots with intelligent behavior by providing a processing architecture that will allow it to learn and reason about how to behave in response to complex goals in a complex world. In this talk, recent developments of cognitive robotics with applications in the healthcare industry, domestic services, unmanned systems will be reviewed. Research challenges and futuristic trends will also be discussed.

PROF. WEI ZUO

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Taking the Chang'e-4 and Chang'e-5 landing areas as the study areas, we extract the geological unit information from the regional USGS geological map, as well as the feature information such as topography and geomorphology, material composition and mineral abundance from Chang'e-2 DOM and DEM, wide angle camera (WAC) and Kaguya multi-band imager data. By applying methods including the statistical-based estimation of mutual information of data and the integrated-algorithmic-model-based evaluation of feature importance to this extracted information, we screen the significant features and construct a high-precision classification model by combining machine learning algorithm with important features of sample data. The practical application of the multi-classification prediction on the complex geological units in the two study areas achieves 97.9% and 95.1% accuracy. The method provides a new idea for the predicted mapping of geological units of lunar global digital mapping. At the same time, the significant characteristics of the study area are mined, and the rules and knowledge associated with the geological evolution of the study area are obtained.

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DEEP CF-AMVRGO: DEEP COLLABORATIVE FILTERING USING ADAPTIVE MOMENT VARIANCE REDUCED GRADIENT OPTIMIZER

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Recommendation systems have become popular in the academic and commercial sectors in recent decades. They are being applied in various applications like social connections, movies, books, music, agriculture, online courses, and venues. Collaborative filtering is the most familiar approach to generate recommendations based on past preferences and similar users. Collaborative filtering algorithms confront severe issues such as sparsity, cold-start, and scalability, which significantly reduce the accuracy and performance of recommendation systems. The sparsity issue is swamped with Matrix Factorization, a traditional model-based collaborative filtering algorithm that predicts users' unknown ratings for a movie in movie recommendation systems. Matrix factorization does not capture the user-item interactions entirely as it uses a simple dot product while predicting the rating. A deep learning-based matrix factorization methodology is adopted to exploit the hidden, non-linear and non-trivial relationship between the user and movie, and a novel optimizer called Adaptive Moment Variance Reduced Gradient Optimizer (AMVRGO) is developed to enhance movie recommendation performance. In the proposed method, the rating matrix is fed to a deep learning-based Collaborative Filtering Algorithm, and then AMVRGO is used to minimize the error in the predicted ratings. This paper evaluates the proposed algorithm performance on three benchmark datasets; Movielens 100K, 1M, and 10M datasets. The simulation results showed that the proposed algorithm outperforms other state-of-the-art approaches in deep learning based collaborative filtering.

Keywords: Adaptive Moment Variance Reduced Gradient Optimizer; Matrix Factorization; Movie Recommendation; Neural Collaborative Filtering; Recommendation System.

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Radiomics is a quantitative approach to analyzing medical multi-layered images for diagnostic, prediction and prognosis of clinical task. With recent developments in medical imaging facilities, extensive medical imaging data are produced every day, especially in the field of oncology, providing an opportunity for researchers to develop AI methods for radiomics tasks. However, limited amount of data available remain a critical issue and sharing different dataset is in most of cases an unviable solution. In this context, Federated Learning came into play. FL is a new emerging learning paradigm involving different institutions/nodes which can exchange only information related to the models (such as the various parameters) they have learned locally, based on their own data. Accordingly, the approach does not expose any sensitive data, and can allow smooth collaboration while preserving privacy and while mitigating many security concerns that typically arise in distributed scenarios. FL in Radiomics has been identified as a promising field of research and in this talk a comprehensive look into its concepts will be give, as well as research trends and challenges emerged in radiomic applications.

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The author of this proposal presents the solution that efficiently, with the lowest latency and smallest idle makes an event-based communication between GNU/Linux C/C++ based Computer Vision engine and C#/.NET Core API that exposes it to an external site. The external site handles tasks and allows us to process them. Today many CNN (Convolutional Neural Networks) and DNN (Deep Neural Networks) engines have been discovered. The author of this paper uses his implementation of ported from CUDA to OpenCL famous Darknet engine accelerated on modern GPUs (Graphical Processor Units) and wants to make an easy-to-use demo of as an example YOLOv4 model with one-click upload image to test result. The end-users can use only that, and all technologies behind the scenes have been kept secret. The purpose of this publication is to share the backed solution.

ROBOAI-CON2023

**FROM RESPONSIBLE AI TO RESPONSIBILITY IN AI:
FAIRNESS AND TRANSPARENCY IN INFORMATION
ACCESS**

DAY 3

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Bias in data as well as lack of transparency and fairness in algorithms are not new problems, but with the increasing scale, complexity, and adoption, most AI systems are suffering from these issues at a level unprecedented. Information access systems are not spared since these days, almost all large-scale systems of information access are mediated by algorithms. These algorithms are optimized not only for relevance, which is subjective to begin with, but also for measures of engagement and impressions. They are picking up signals of what may be 'good' from individuals and perpetuating that through learning methods that are opaque and hard to debug. Considering 'fairness' and introducing more transparency can help, but it can also backfire or create other issues. We also need to understand how and why users of these systems engage with content. In this talk, I will share some of our attempts for bringing fairness in ranking systems and then talk about how the solutions are not that simple. To really address the problems of misinformation and misrepresentation in information access, we need to look for human-AI synergy where the responsibility of fairness and transparency lies not only on systems, but also on developers, regulators, and end-users.

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Deep learning has attracted much attention from the ecological community for its capability of extracting and generalizing patterns from datasets with highly complicated structures, such as images, audio, and motion signals. However, despite the promising cases, deep learning may have shortcomings when applied to real-world ecological datasets.

In this presentation, I will summarize four characteristics of realistic datasets: 1) long-tailed; 2) open-ended; 3) multi-domain; and 4) imbalance between labeled v.s. unlabeled data. Then, I will focus on one of our most recent papers: Iterative human and automated identification of wildlife images, making AI recognition systems deployable with efficient humans in the loop and imperfect models.

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TBA

DAY 3

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SMILE (Smartphone Intuitive Likeness and Engagement) application, a portable Android application that allows a human to control a robot using speech input. SMILE is a novel open source and platform independent tool that will contribute to the robot soccer research by allowing robot handlers to verbally command robots. The application resides on a smartphone embedded in the face of a humanoid robot, using a speech recognition engine to analyze user speech input while using facial expressions and speech generation to express comprehension feedback to the user. With the introduction of intuitive human robot interaction into the arena of robot soccer, we discuss a couple specific scenarios in which SMILE could improve both the pace of the game and autonomous appearance of the robots. The ability of humans to communicate verbally is essential for any cooperative task, especially fast-paced sports. In the game of soccer, players must speak with coaches, referees, and other players on either team. Therefore, if humanoids are expected to compete on the same playing field as elite soccer players in the near future, then we must expect them to be treated like humans, which include the ability to listen and converse. SMILE (Smartphone Intuitive Likeness and Engagement) is the first platform independent smartphone based tool to equip robots with these capabilities. Currently, humanoid soccer research is heavily focused on walking dynamics, computer vision, and intelligent systems; however human-robot interaction (HRI) is overlooked. We delved into this area of robot soccer by implementing SMILE, an Android application that sends data packets to the robot's onboard computer upon verbal interaction with a user.

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Large Language Models are a hot topic in AI, and useful in mental healthcare. But what human dilemmas accompany these tools as they become nearly mimetic, meaning they do not imitate a general doctor, but the patient's specific doctor? And, if that happens, is the AI sentient? Does the AI deserve care just like the patient?

ROBOAI-CON2023

CODABENCH: FLEXIBLE, EASY-TO-USE, AND REPRODUCIBLE META-BENCHMARK PLATFORM

DAY 3

DR. ZHEN XU

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In almost all communities working on data science, researchers face increasingly severe issues of reproducibility and fair comparison. Researchers work on their own version of hardware/software environment, code, and data, and consequently, the published results are hardly comparable. We introduce Codabench, a meta-benchmark platform, that is capable of flexible and easy benchmarking and supports reproducibility. Codabench is an important step toward benchmarking and reproducible research. It has been used in various communities including graph machine learning, cancer heterogeneity, clinical diagnosis, and reinforcement learning. Codabench is ready to help trendy research, e.g., artificial intelligence (AI) for science and data-centric AI.

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In recent years, research on creativity has been strongly entangled with the breakthrough of artificial intelligence (AI) in art. In particular, three main areas study the relation between AI and art: cognitive science, computer science, and art theory. However, knowledge transfer between areas is challenging, as each speciality has its own definitions for the same concepts. In order to standardise terminology, I propose that an AI-generated artwork involves the conjunction of three elements: (1) an autonomous AI-production of a new and surprising idea or artefact, (2) which passes an internal evaluation mechanism embedded in the very same AI, and (3) is considered a candidate of appreciation by a human audience. This definition has been created to unite the abovementioned fields of study in this regard. As will be shown, it takes into consideration their similarities and particularities. Therefore, it is intended to be a transdisciplinary concept across art theory and AI research. Keywords: AI-generated artwork; AI; art; creativity; definition



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