Department of Computer Sciences
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AI2

Artificial Intelligence – Academy and Industry

Mon. 24.05.21
14:00-18:00 CET

International Online Conference
on Artificial Intelligence

מכון טכנולוגי חולון
Holon Institute of Technology

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PROGRAM

14:00-14:15 CET /
15:00-15:15 Israel Time

OPENING WORDS

Prof. Eduard Yakubov, President, HIT, Holon Institute of Technology

Prof. Ezra Zeheb, Dean of the faculty of sciences, HIT, Holon Institute of Technology

Dr. Ayelet Butman, Department chair of the computer sciences department, HIT, Holon Institute of Technology

14:15-15:30 CET /
15:15-16:30 Israel Time

SESSION I / AI IN EDUCATION

Keynote: Agent-Human Collaboration and Learning for Improving Human Satisfaction
Prof. Sarit Kraus, Bar Ilan University

A robot in a kindergarten – experiment review
Dr. Yaron Yavelberg, Do-Et institute

AI in Gaming and Edutainment in the MENA region
Dr. Liora Lukitz, Flying Camels

Time: 15:30-16:20 CET /
16:30-17:20 Israel Time

SESSION II / AI IN SOCIETY

Keynote: Social Physics and Automatic AI
Dr. Yaniv Altshuler, MIT, Massachusetts Institute of Technology

"Amalthea-M" – unified smartphone-based solution for industrial and enterprise biomonitoring
Dr. hickrin Dmitry Evgen'vich, Kazan Federal University, Russia

Improving Efficiency in Public Health Administration with Methods of Artificial Intelligence
Serge Dolgikh, Department of Information Technology, National Aviation University, Kyiv, Ukraine

Minimizing the number of vehicles to meet the fixed schedule: A journey from the ancient Dantzig-Fulkerson problem to fast AI algorithms for swarms of robots and UAVs
Prof. Eugene Levner, HIT, Holon Institute of Technology

16:20-17:10 CET time /
17:20-18:10 Israel Time

SESSION III / AI IN ENVIRONMENT

Keynote: Shape instead of being shaped!
Dalith Steiger, SwissCognitive

Using Artificial Intelligence to Irrigate Crops
Nir Averbuch, The Robert H. Smith Faculty of Agriculture

Early detection of plant disease using a phenotyping system and machine learning
Shani Friedman-Goldfarb and **Prof. Menachem Moshelion**, Hebrew University of Jerusalem

Flash floods prediction using precipitable water vapor derived from tropospheric path delays over the Eastern Mediterranean
Dr. Shlomi Ziskin Ziv, Eastern R&D center and Ariel University

17:10-18:00 CET time /
18:10-19:00 Israel Time

SESSION IV: AI IN INDUSTRY

Keynote: A Textless Approach for Generative Spoken Language Modeling
Dr. Yossi Adi, Facebook

Who would say no to get better, faster? (aka AI for Continuous Improvement)
Dror Jacoby, Shamaym Ltd.

Ethical issues in AI: sensitivity of neural networks to deliberate corruption of image classification
Dr. Amir Handelman, HIT, Holon Institute of Technology

Quality prediction for 3D printing through machine learning of triangular mesh data
Dr. Lynn Houthuys, Thomas More University

PANEL I AI IN EDUCATION

KEYNOTE: **AGENT-HUMAN COLLABORATION AND LEARNING FOR IMPROVING HUMAN SATISFACTION**

Prof. Sarit Kraus, Bar Ilan University

We consider environments where a set of human workers needs to handle a large set of tasks while interacting with human users. The arriving tasks vary: they may differ in their urgency, their difficulty and the required knowledge and time duration in which to perform them. Our goal is to decrease the number of workers, which we refer to as operators that are handling the tasks while increasing the users' satisfaction. We present automated intelligent agents that will work together with the human operators in order to improve the overall performance of such systems and increase both operators' and users' satisfaction. Examples include: home hospitalization environments where remote specialists will instruct and supervise treatments that are carried out at the patients' homes; operators that tele-operate autonomous vehicles when human intervention is needed and bankers that provide online service to customers. The automated agents could support the operators: the machine learning-based agent follows the operator's work and makes recommendations, helping him interact proficiently with the users. The agents can also learn from the operators and eventually replace the operators in many of their tasks.

A ROBOT IN A KINDERGARTEN – EXPERIMENT REVIEW

Yaron Yavelberg, Do-Et institute

The lecture will describe a unique experiment, made by a team of researchers from the field of robotics and technology, and social sciences. The experiment simulated several situations of an integration of a robot in a kindergarten, having different types of interactions with children, staff and parents. The situations were filmed and then shown to 3 focus groups – secular parents, religious parents and kindegarten teachers. The purpose of the experiment is to define and study the new field of interaction between robots (AI) and human beings. We believe this is a new type of "social" interaction that will be more common in the coming years, and needs new methods and concepts in order to be understood.

AI IN GAMING AND EDUTAINMENT IN THE MENA REGION

Liora Lukitz, Flying Camels

The Edtech virtual summit in Dubai, last February, provided an excellent overview of the UAE's strategies in education and its spilling over to other countries in the region. Technology in general and tools for education in particular, were the main focus with just a few mentions to contents.

Technology can enliven contents enhance their impact, and AI's use in research is, particularly, invaluable. The identification of the authors of the Dead Sea Scrolls, their location and time frame is a good example. Patterns in handwriting were analyzed and the throwing of light on a thousand years' mystery, opened new windows to the study of the region's ancient past. Other fascinating chapters in the history of the Middle East can also come to life with AI technology. Among them, the hidden narratives of ancient Assyrian reliefs, the logic behind the architectural constructions in Karnak and Luxor, the connections between Umm al-Nar and ancient Mesopotamia and, centuries later, Ibn Battuta's travels from Morocco to Arabia, Persia and the Far East.

AI-enhanced VR technologies added to TEL (technology-enhanced learning)can be extended to edutainment, engage young audiences and take the study of the region to new levels of creativity.

Also Robotics, already used to improve STEM education and competitions in real environments, can be used in gaming and engage young users in the creation of new contents. New apps, advanced HMI interface activities, and shared 3-D spaces that are extensions of virtual worlds, can be further explored. Already used by Unity, Ubisoft, Blizzard, Disney, Pixar – AI multiplies effects and characters performances.

In classics such as "How to Train your Dragon" AI can help decode the dragons' behavioral patterns so to engage young Viking friends. In the Middle East, AI empowered camels can take youngsters in the region and abroad to new and breathtaking adventures.

(AI technologies in Collaboration with Prof. Irad BenGal , head LAMBDA, TAU).

PANEL II

AI
IN SOCIETY

KEYNOTE: SOCIAL PHYSICS AND AUTOMATIC AI

Dr. Yaniv Altshuler, MIT, Massachusetts Institute of Technology

It is said that “Data is the new Oil”, and indeed in this Age of Data companies and government agencies alike gather data of all types and from numerous sources in an attempt to become data-driven organizations. A large portion of data however originates from a single underlying source: People. Tweets and blog posts are written by humans for humans; purchase transactions and phone call records convey human desires for things and other people; app logs report on how people interact with computers and mobile devices. Data derived from human behaviour is “messy”: it is dynamic, complex and extremely versatile. Humans’ behaviour, as recorded in such digital data channels, changes drastically over time, is influenced by underlying complex social networks, and is conveyed in highly multimodal data streams – posing a significant hurdle to any organization striving to truly base its decisions on operations on its data.

Developed at the MIT Human Dynamics Lab, Social Physics is a novel new scientific approach to data, which uses big data analysis and the mathematical laws of biology to understand the behaviour of human crowds, enabling the development of a fully-automatic platform that can absorb, analyze and merge dynamic data streams of various sources, forms and types. Social Physics is the technological framework behind the Endor analytics engine, serves global financial institutes and government agencies.

“AMALTHEA-M” – UNIFIED SMARTPHONE-BASED SOLUTION FOR INDUSTRIAL AND ENTERPRISE BIOMONITORING.

DR. Chickrin Dmitry Evgen'vich, Kazan Federal University, Russia

In the foundations of Amalthea-M lays KFU staff unique deep expertise and know-how in the fields of artificial intelligence, robotics, acoustic monitoring and vibroacoustic analysis, machine vision and others.

Our unique advantage - very large test sample size: we are performing all close beta testing at our own clinics client base (more than 20 000 students and employees of KFU).

System reports creates with BI QlikView and Microsoft PowerBI platform - with full integrity of enterprise data banks and services. Main atomic functionality of Amalthea: Detection and analysis of cough attacks. Alcohol \ drug’s intoxication. Person’s posture, movement patterns and physical fatigue estimation. Emotion recognition and stress degree estimation. Andrenaline rush and neurological shock event’s recognition. Detection of falls; movements discoordination, neurological disorders. Heartrate and upper/lower blood pressure estimation. Voice keywords analysis.

IMPROVING EFFICIENCY IN PUBLIC HEALTH ADMINISTRATION WITH METHODS OF ARTIFICIAL INTELLIGENCE

Serge Dolgikh, Department of Information Technology, National Aviation University, Kyiv, Ukraine

The complexity and cost of public health administration including patient care is rapidly increasing in the developed world. Systems employing methods of Artificial Intelligence are proposed to improve efficiency in administration of diagnostics, screening and evaluation of preparedness for extraordinary events.

Improving accuracy of screening and diagnostic testing can provide noticeable improvements in the recovery and cost efficiency of the health care systems. A simple yet robust model of parallel decision making incorporating machine and human expert competences is proposed in which the strengths and advantages of Artificial Intelligence methods can be harnessed to improve the overall accuracy of essential testing, diagnostics, screening and other areas of patient care while ensuring safety and complete human control over the course of diagnostics and treatment.

Confidence of conventional statistical methods of factor influence analysis is often linked to the amount of analyzed data, with aggregation of significant volumes of data a prerequisite for the confidence of the conclusion. It is justified where a confident determination of safety of products that

can be used by millions of consumers is required, however it may present a challenge in novel and rapidly developing situations, such as new infectious epidemics, where the time factor can be essential or even critical to produce effective response. Application of methods of unsupervised machine learning such as deep neural network dimensionality reduction allowed to separate milder background cases from those with more rapid and aggressive onset of the epidemics. Methods and findings of unsupervised generative learning in data analysis can be used in evaluation of possible epidemiological scenarios and as an instrument in evaluation of the preparedness of public health units for extraordinary situations.

MINIMIZING THE NUMBER OF VEHICLES TO MEET THE FIXED SCHEDULE: A JOURNEY FROM THE ANCIENT DANTZIG-FULKERSON PROBLEM TO FAST AI ALGORITHMS FOR SWARMS OF ROBOTS AND UAVS

Prof. Eugene Levner, HIT, Holon Institute of Technology

Minimizing the number of vehicles for performing the fixed schedule of tasks is a fundamental real-life problem that can greatly benefit from the use of graph theory and AI.
The basic scheduling problem has been first efficiently solved by Dantzig and Fulkerson in Naval Research Logistics Quarterly, 1954. They considered the following simple version. Assume that there are n tasks Ti, to be started at time ai and finished at bi, and that the transfer time from Ti to Tj (made by vehicles) is known to be rij. How many vehicles is needed to perform all the tasks? From the Dilworth Theorem (Annals of Mathematics, 1950), it follows that the minimum number of needed vehicles equals to the maximum number of tasks, no two of which may be performed by the same vehicle. Dantzig and Fulkerson reduced this problem to a linear programming problem. Ford and Fulkerson (Flows in Networks,1962) found a combinatorial linear graph-based algorithm solving this problem.

PANEL III

AI
IN ENVIRONMENT

KEYNOTE: SHAPE INSTEAD OF BEING SHAPED!

Dalith Steiger, SwissCognitive

When we talk about AI, what are we actually referring to? How can we deal with the legitim fears of citizens?

AI is fundamental to our societal development. It is a powerful tool that can support the UN SDGs.

I will reflect on some real-world use cases and the opportunity to combine AI for good and AI for business for the benefit of people, and discuss why such an emerging technology as AI is so important for small countries like Israel and Switzerland.

USING ARTIFICIAL INTELLIGENCE TO IRRIGATE CROPS

Nir Averbuch, The Robert H. Smith Faculty of Agriculture

Well-irrigated plants produce the highest yields. However, optimal irrigation depends on many different atmospheric conditions (e.g., light, temperature, wind speed, relative humidity), plant requirements (e.g., species, age, size), and soil conditions (e.g., type, temperature), which often vary over time and space. The FAO-56 Penman-Monteith equation (FPME; based on the above parameters) is the most commonly used method for calculating plant water requirements in greenhouses and open fields. However, the FPME is usually used with environmental data from a single measuring station located 2 m above the canopy, ignoring the microclimatic changes within the canopy and the impact of plant interactions with the environment. Therefore, this method may imprecisely determine the exact

water demand of the plant, resulting in water waste and the pollution of groundwater by fertilizers.

We hypothesized that taking micro-meteorological factors into account would help us to more precisely forecast plant water demand, to optimize irrigation. To test this hypothesis, we set up 72 pots in a greenhouse (8 m × 1.4 m) that contained 12 meteorological stations. Inverse-distance weighting interpolation was used to evaluate atmospheric conditions and estimate water evaporation at each pot location. Those estimations were then compared with the actual water loss from the pots, as continuously recorded by load-cell weighing lysimeters. Data were sent to the database at 3-min intervals, for a total of 34,580 data points for the 72 pots per day and ~1,0485,576 data points for a period of 3.5 months. We compared the actual evaporation with the calculated FPME and created deep learning-based models to predict actual pot evaporation based on atmospheric conditions alone. A comparison of Scikit RF and ANN models revealed that an ANN sequential model with six input layers and four hidden layers that used the 'relu' activation and 'adam' optimizer provided the best results.

EARLY DETECTION OF PLANT DISEASE USING A PHENOTYPING SYSTEM AND MACHINE LEARNING

Shani Friedman-Goldfarb and **Prof. Menachem Moshelion**, Hebrew University of Jerusalem

Each year, plant diseases cost the global economy around $220 billion. Monitoring of plant health and early disease detection are essential for effective disease management.

Environmental conditions such as temperature and humidity influence plant growth and disease spread. A better understanding of how environmental factors influence plants' physiology (e.g., growth and water loss) can improve yields.

Machine-learning (ML) models are already successfully used to predict the effects of external factors on various indices (e.g., stock prices). When used with large datasets, ML models can provide high-resolution forecasting in many fields.

This study integrated a telemetric system (multiple sensors that monitor the physiology of different plants continuously and comparatively) with thermal imaging, to detect early-stage plant disease. Over the past 4 years, we have collected continuous environmental and plant-physiological data from more than 5,000 plants in our telemetric greenhouse. This large data set is unique and contains data from different crops and stress treatments such as drought and salinity. We are also running ongoing experiments with randomly infected plants to enlarge this data set. This data set will provide a basis for understanding and monitoring plant health. We are in the first stages of training ML models such as ARIMA XGBoost and NN to predict plant responses to environmental factors and to distinguish between healthy and diseased plants.

We believe this work will provide the basis for a better understanding of how environment and stress impact whole-plant traits. It will constitute a milestone in the use of artificial intelligence for the early detection of plant diseases. It will also deepen our understanding of plant "disease" environment relationships. Our next step will be to combine thermal images of the canopy (captured continuously) with telemetric information, with the goal of developing a system that can be applied in commercial fields.

FLASH FLOODS PREDICTION USING PRECIPITABLE WATER VAPOR DERIVED FROM TROPOSPHERIC PATH DELAYS OVER THE EASTERN MEDITERRANEAN

Dr. Shlomi Ziskin Ziv, Eastern R&D center and Ariel University

A flash flood is a rapid and intense response of a drainage area to heavy rainfall events. In the arid and semi arid parts of the Eastern Mediterranean (EM) region, the spatio-temporal distribution of rainfall is the most important factor for flash flood generation. A possible precursor of heavy rainfall events is the rise in tropospheric water vapor amount, which can be remote sensed using ground based Global Navigation Satellite Systems (GNSS). Here we use the Precipitable Water Vapor (PWV) derived from 9 GNSS ground based stations in the arid part of the EM region in order to predict flash floods. Our approach includes using three types of Machine Learning (ML) models in a binary classification task which predicts whether or not a flash flood will occur given 24 hours of PWV data. Our dataset includes 107 unique flash flood events which we vigorously test using a nested cross validation technique. Our results show a good agreement between all three types of models and across various score metrics. The models are further improved by adding more features (e.g., surface pressure measurements). Finally, we suggest augmenting the current flash flood warning systems with a near real-time GNSS ground based data driven approach as demonstrated in this work.

PANEL IV

AI
IN SOCIETY

KEYNOTE: **A TEXTLESS APPROACH FOR GENERATIVE SPOKEN LANGUAGE MODELING**

Dr. Yossi Adi, Facebook

An open question for AI research is creating systems that learn from natural interactions as infants learn their first language(s): spontaneously and without access to text or expert labels. Current NLP systems require large amounts of text, which excludes plenty of the world's languages that have little textual resources or no widely used written form. In addition, text does not encode many expressive aspects of language (intonation, emphasis, emotion, etc.) which are important in the oral form.

In this talk, I'll present our recent studies in developing and evaluating a Textless Generative Spoken Language Modeling system. The proposed framework is comprised of a pseudo-text Encoder, Sequential modeling, and Speech generation components (all of which were trained in an unsupervised fashion). Lastly, I'll present various possible applications and future research directions in this field.

WHO WOULD SAY NO TO GET BETTER, FASTER? (AKA AI FOR CONTINUES IMPROVEMENT)

Dror Jacoby, Shamaym Ltd.

Shamaym transforms the way teams improve and help them get better, faster – in an ever-changing rapid world (https://www.shamaym.com).

The solution is a collaborative real-time learning platform that helps teams turn day-to-day work activities into actionable lessons learned, based on unique debriefing methodology.

The platform's is powered with few unique AI capabilities. Among those you can find algorithms that help users to qualify their lessons, to classify the lesson and to support a retrieval of a relevant lesson, just in time.

In this session, we will cover few of the AI capabilities and their business applications in the platform, while we will share some of the challenges and solutions we faced during the AI development lifecycle and how to best optimize it. Some, and not limited, of the key challenges are around classifiers for multi language support, which requires different approach, around training algorithms to match a methodology, based on highly unstructured input.

ETHICAL ISSUES IN AI: SENSITIVITY OF NEURAL NETWORKS TO DELIBERATE CORRUPTION OF IMAGE CLASSIFICATION

DR. Amir Handelman, HIT, Holon Institute of Technology

Artificial intelligence (AI) systems are extensively used today in many fields. In the field of medicine, AI-systems are especially used for the segmentation and classification of medical images. As reliance on such AI-systems increases, it is important to verify that these systems are dependable and not sensitive to bias or other types of errors that may severely

affect users and patients. In this lecture, I will discuss our latest published work that investigates the sensitivity of the performance of AI-systems to labeling errors. Such

investigation is performed by simulating intentional mislabeling of training images according to different values of a new parameter called "mislabeling balance" and a "corruption" parameter, and then measuring the accuracy of the AI-systems for every value of these parameters. The issues investigated in our work include the amount (percentage) of errors from which a substantial adverse effect on the performance of the AI-systems can be observed, and how unreliable labeling can be done in the training stage. The goals of this lecture are to raise ethical concerns regarding the various types of errors that can possibly find their way into AI-systems, to demonstrate the effect of training errors, and to encourage development of techniques that can cope with the problem of errors, especially for AI-systems that perform sensitive medical-related tasks.

QUALITY PREDICTION FOR 3D PRINTING THROUGH MACHINE LEARNING OF TRIANGULAR MESH DATA

Dr. Lynn Houthuys, Thomas More University

Over the past several decades, there have been many great advances in the field of 3D printing. New materials and processes are entering the market at a rapidly increasing pace, allowing for a growing number of exciting applications in fields such as manufacturing and medicine.

A common practise to present a shape in 3D printing, is to use a series of triangles. The most common file format

for triangular mesh representations, the .stl format, stores the vertices for each triangle, as well as each triangle's corresponding normal vector. Because the triangles are flat, they cannot perfectly describe curved surfaces, but instead must approximate them using a large number of small triangles. For curved surfaces, a higher density of triangles is needed to reproduce a shape with fidelity, while for flat surfaces, a far lower density is necessary.

Despite these advances, many challenges remain, including the presence of substantial geometric differences between a 3D printed part, and the shape that was intended. In other words, to predict the quality of a print job. These manufacturing defects can make it impossible to meet certain tolerances, and often lead to waste of both time and material.

To address these challenges we want to apply Machine Learning to predict the quality of a print job, based on the triangular mesh data describing the desired shape. Karzanov and Livshits (Automation and Remote Control, 1978) studied the following periodic version of the above problem. There are n tasks Ti, each to be performed during known time ti; the transfer time from Ti to Ti+1 (made by automatic operators) is known to be pi, and transfer time from Ti to Tj is rij; the movemen t of operators is to be periodic. The authors reduced the problem to a special (non-periodical) nxn assignment problem and solved it exactly in O(n3) time.

Kats and Levner (Annals of OR, 1997) considered the bi-criteria version of the above problem, one criterion being the minimal number of robots to be used, the other the period of a periodic schedule. These authors found the minimal number of needed robots , for all possible cycle lengths, the complexity of the suggested algorithm being O(n5), independently of the range within which the cycle length value may vary.

Orlin (Operations Research, 1982) and Kats and Levner (Euro. J. of Oper. Research, 1998) considered the problem of minimizing the number of planes needed to meet a fixed periodically repeating set of tasks where set-up times between the tasks either satisfy or do not satisfy the triangle inequality. This problem is reduced to finding the minimal length cycle-cover in a graph. In a special case, where the set-up times satisfy the triangle inequality, the problem is reduced to the assignment problem.

In Vishnevsky et al. (23rd DCCN, 2020), the theoretical foundation of the navigation system for airborne mobile communication system is proposed. This system is served for detection of a positioning location, a space shift, speed of an air mobile station based on a set of UAVs (drones). The analytical method of defining parameters for airborne mobile communication system is developed.

The main attention of the present talk will be devoted to the general problem of minimizing the number of unmanned aerial vehicles (drones) needed to serve the airborne mobile communication system. A new model of the airborne mobile communication system structure and the corresponding AI-based algorithm, developed by Kats, Levner and Vishnevsky, for minimizing the system size will be presented and closely explained.

KEYNOTES

DR. SARIT KRAUS is a Professor of Computer Science at Bar-Ilan University. Her research is focused on intelligent agents and multi-agent systems (including people and robots). Her application domains have included physical security, intelligent cars, human training, recommendation systems, automated negotiations and mediation, virtual humans, and rehabilitation. Kraus was awarded the IJCAI Computers and Thought Award, ACM SIGART Agents Research award, the EMET prize, and was twice the winner of the IFAAMAS influential paper award. She is a AAAI, ECCAI and ACM fellow and was awarded the 2020-2021 ACM Athena Lecturer award.

DR. YANIV ALTSHULER is the founder and CEO of Endor, an industry-leading start-up in the field of AI and advanced data analytics. His company develops product solutions for government agencies and Fortune-500 partners around the world. Yaniv is a passionate advocate of inter-disciplinary research in the fields of AI, Social Physics and Cybersecurity and alongside his commercial activities he is the author of over 80 scientific papers and 15 patents. He is also the author of several scientific research books such as "Security and Privacy in Social Networks", "Swarm Intelligence", and "Applied Swarm Intelligence".

DALITH STEIGER studied mathematics at the University of Zurich, co-founded the award-winning AI start-up SwissCognitive, and the CognitiveValley Foundation, together with Andy Fitze. Dalith was born in Israel and grew up in Switzerland. She is a global AI advisor and speaker, sharing her extensive knowledge and experience in the field of AI around the world. She is also CEO of the Swiss IT Leadership Forum, and Member of the Advisory Council of digital-liberal.ch. Dalith sits in the jury of the Digital Economy Award as well as the START Hack, she is an advisor at Kickstart Innovation, a mentor at the Founder Institute, and teaches AI & Machine Learning in a CAS module at the Applied University of Luzern.

YOSSI ADI is a Research Scientist at Facebook AI Research. Before joining Facebook, he completed his Ph.D. in Computer Science at Bar-Ilan University under the supervision of Prof. Joseph Keshet. Yossi's research interests are in both speech and language processing using machine learning and deep learning techniques together with trustworthy learning algorithms. Yossi's research spans core machine learning and deep learning algorithms, their applications in speech and audio processing, the impact of the technology it produces on social systems, and raises critical concerns about model evaluation.

CONFERENCE ORGANIZATION COMMITTEE:

Dr. Ayelet Butman
Dr. Jonathan Schler
Dr. Michal Gordon