**WS: Machine Learning based decision support system for early-stage prediction of complications and risk stratification of COVID 19 patients**

**Timeline (27 July 2021 CET time 5.00 – 6.15 pm)**

**5:00 - 5:05 pm: Welcome by the workshop organizers**

**5:05 - 5:15 pm: Professor Noam Shomron,** Predicting Covid19 and other infections, Prof. Noam Shomron, Functional Genomic Team at the Faculty of Medicine at Tel Aviv University

**5:15 – 5:25 pm: Professor Elena Giovanna Bignami,** Artificial Intelligence in Anesthesia and Perioperative Medicine

**5:25 – 5:35 pm: Professor Massih Reza Amini,** A Semi-Supervised Multi-Task Learning Approach for Predicting Short-Term Kidney Disease Evolution

**5:35 – 5:45 pm: Dr Patrick Thoral,** Artificial Intelligence on the Intensive Care unit

**5:45 – 5:55 pm: Prof. Khan Shehroz,** Anomaly Detection Approach to Identify Early Cases in a Pandemic using Chest X-rays

**5:55 – 6:10 pm: Q&A session**

**6:10 – 6:15 pm: Closing remarks**

**Keynote Talk**

**Professor Noam Shomron**

**Title** Predicting Covid19 and other infections, Prof. Noam Shomron, Functional Genomic Team at the Faculty of Medicine at Tel Aviv University,

**Abstract**

Effective screening of SARS-CoV-2 or other infections enables quick and efficient diagnosis and can mitigate the burden on healthcare systems. Prediction models that combine several features to estimate the risk of infection have been developed. These aim to assist medical staff worldwide in triaging patients, especially in the context of limited healthcare resources. We established a machine-learning approach that trained on multiple records, confirmed infections and controls. Our model predicted infections with high accuracy using only a handful of binary features. Our framework can be used, among other considerations, to prioritize testing for COVID-19 and other types of infections when testing resources are limited.

**Bio**

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Descrizione generata automaticamente**

Professor Noam Shomron is passionate about using basic science to advance better healthcare. Prof Shomron heads the Functional Genomic Team at the Faculty of Medicine at Tel Aviv University, after training at MIT. He leads a multidisciplinary team of scientists that develops computational methods for parsing big-data in the bio-medical field using Artificial Intelligence. Shomron’s aim is to deepen our understanding of diseases in order to translate information into clinical reality. Shomron is also the Director of Djerassi Institute of Oncology; Editor of ‘Deep Sequencing Data Analysis’ book (Springer, Edition I and II); Director of ‘Rare-Genomics’ Israel (NPO); Academic Director of ‘ScienceAbroad’ (NPO); and, Co-founder and Chief Scientific Officer (CSO) of Variantyx which provides clinical interpretation of whole genome sequences.

Website: <https://nshomron.github.io/>

TEDx talks:

<https://www.youtube.com/watch?v=NgVwPj54TEo>

<https://www.youtube.com/watch?v=wAoZym_anr0>

**Professor Elena Giovanna Bignami**

**Title** Artificial Intelligence in Anesthesia and Perioperative Medicine

**Abstract**

Risk stratification is a fundamental part of anesthetic evaluation. Through the identification of high-risk patients, it allows a specific risk / benefit analysis, a targeted perioperative optimization, a carefully planned anesthesiology management and an accurate and precise informed consent. Over time, numerous scores have been published, from the most generic, like the American Society of Anethesiologists’ Physical Status (ASA-PS), which describes the general clinical condition of the patient before the surgery, to the most specific, as the European system for cardiac operative risk evaluation (EuroSCORE) or the General Surgery Acute Kidney Injury Risk Index Classification System. Unfortunately, these scores have some limits, the first of which is the lack of individualized predictions; in fact, only risk classes can be provided. In the last decade, artificial intelligence (AI), including Machine Learning (ML), has begun to be applied in medicine. Thanks to the computerisation of health systems, large amounts of data have become available. However, characteristics such as data amount and diversity of sources have posed great difficulties to conventional analysis techniques. With the application of these new, more recent technologies, novel possibilities for the exploitation of these huge data collections has been created. Among them, ML aroused enthusiam in many branches of medicine, including the perioperative one. Considered an extension of traditional statistics, it differs from standard approaches because it is able to learn from examples and to improve continuously with the introduction of new data. In consideration of its specific characteristics, this analytical technique is well applicable for creation of predictive models; Authors even have described the “prediction” as their primary concern. However, many efforts are needed to create such models; furthermore, data extrapolation and analysis by such sophisticated techniques often require dedicated professional figures. We therefore decided to clarify the role of ML in the development of predictive post-surgical outcome models and to compare their effectiveness with traditional methods of analysis.

**Bio**



Elena Giovanna Bignami is Full Professor Anesthesiology, Critical Care and Pain Medicine Division, Department of Medicine and Surgery, University of Parma, Parma, Italy. Since 2000, She has regularly taken part in the conception, design and execution of mono-centric and multicentre randomized controlled trials (mRCT), under Good Clinical Practice (GCP) and She is Principal Investigator of many trials (see list: www.clinicaltrials.gov).

She has also been conducting meta-analysis studies in numerous topics related to Cardiovascular Anaesthesia and Intensive Care (especially about cardiac and renal protection in cardiac and non-cardiac surgery). At the moment, I am also collaborating in the creation of a network of 30 Italian cardio-surgical centres that participate to multicentre randomized controlled trials (mRCT).

Since 2000, She has attended and still do many courses in clinical research, in particular for “mRCT”; “Statistics in medicine”; “Study coordinator”; and “Organization of investigators meetings”. She has a considerable experience Artificial Intelligence in Perioperative Medicineand machine learning strategies. The clinical and research interest in Anaesthesia and Intensive Care has resulted in about 190 scientific publications and invitations in national and international congresses. Regularly involved in the conception, design and execution of mono-centric and multicentre randomized controlled trials as well as in conducting meta-analysis studies in numerous topics related to Anaesthesia and Intensive Care, also in AI setting.

**Professor Massih Reza Amini**

**Title** A Semi-Supervised Multi-Task Learning Approach for Predicting Short-Term Kidney Disease Evolution

**Abstract**

Kidney Disease (KD) may hide complex causes and is associated with a tremendous socio-economic impact. Timely identification and management from the first level of medical care represent the most effective strategy to address the growing global burden sustainably. Clinical practice guidelines suggest utilizing estimated Glomerular Filtration Rate (eGFR) for routine evaluation within a screening purpose. Accordingly, the analysis of Electronic Health Records (EHRs) using Machine Learning techniques offers great opportunities to monitor and predict the eGFR trend over time. This paper aims to propose a novel Semi-Supervised Multi-Task Learning (SS-MTL) approach for predicting short-term KD evolution on multiple General Practi- tioners’ EHR data. We demonstrated that the SS-MTL approach can (i) capture the eGFR temporal evolution by imposing a temporal relatedness between consecutive time windows and (ii) exploit useful information from unlabeled patients when labeled patients are less numerous with a gain of up to 4.1 % in terms of Recall. This situation reflects the real-case scenario, where available labeled samples are limited, but those unlabeled much more abundant. The SS-MTL approach, also given the high level of interpretability, might be the ideal candidate in general practice to get integrated within a decision support system for KD screening purposes.

**Bio**

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Massih Reza Amini is Professor of Computer Sci- ence at Université Grenoble Alpes. His research focuses on Machine Learning applied to large-scale applications in information access. He is particularly interested on the learnability of statistical models where only a small portion of data is labelled.

**Dr Patrick Thoral**

**Title** Artificial Intelligence on the Intensive Care unit

**Abstract**

The Intensive Care unit (ICU) is a high-resource environment where treatment takes place that cannot be achieved elsewhere in the hospital. Due to the data driven nature of the ICU where patients are closely monitored and supported by medical devices, the high impact of medical decisions on the ICU lend themselves for support using advanced algorithms based on big data. In this session, we will discuss real-world examples of decision support on the ICU and possible future directions.

**Bio**

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Descrizione generata automaticamente**

Patrick is a Consultant Intensivist at Amsterdam UMC where he is responsible for the implementation of EHRs in the ICU. He has worked in close collaboration with the Hospital Pharmacy of Amsterdam UMC, the department of Computational Intelligence of Vrije Universiteit of Amsterdam and private data science companies to develop and implement multiple models including optimal dosing of antibiotics and anti-coagulants and prediction of core ICU outcome measures including ICU readmission, mortality, reintubation rates and kidney injury. His recent project with the start-up Pacmed “machine learning to prevent ICU readmission” was awarded the Dutch Digital Impact Award 2018. In addition, he had a major role in releasing AmsterdamUMCdb, the first freely accessible European ICU database.

**Prof. Khan Shehroz**

**Title** Anomaly Detection Approach to Identify Early Cases in a Pandemic using Chest X-rays

**Abstract**

The current COVID-19 pandemic is now getting contained, albeit at the cost of more than 2.3million human lives. A critical phase in any pandemic is the early detection of cases to develop preventive treatments and strategies. In the case of COVID-19,several studies have indicated that chest radiography images of the infected patients show characteristic abnormalities. However, at the onset of a given pandemic, such asCOVID-19, there may not be sufficient data for the affected cases to train models for their robust detection. Hence, supervised classification is ill-posed for this problem because the time spent in collecting large amounts of data from infected persons could lead to the loss of human lives and delays in preventive interventions. Therefore, we formulate the problem of identifying early cases in a pandemic as an anomaly detection problem, in which the data for healthy patients is abundantly available, whereas no training data is present for the class of interest (COVID-19 in our case). To solve this problem, we present several unsupervised deep learning approaches, including convolutional and adversarially trained autoencoder. We tested two settings on a publicly available dataset (COVIDx) by training the model on chest X-rays from (i) only healthy adults, and (ii) healthy and other non-COVID-19 pneumonia, and detected COVID-19 as an anomaly. Afterperforming3-fold cross validation, we obtain a ROC-AUC of 0.765. These results are very encouraging and pave the way towards research for ensuring emergency preparedness in future pandemics, especially the ones that could be detected from chest X-rays

**Bio**

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Dr, Shehroz Khan is a Scientist in the Artificial Intelligence and Robotics in Rehab Lab at the KITE, Toronto Rehabilitation Institute, University Health Network, Canada. He is also cross appointed as an Assistant Professor at the Institute of Biomedical Engineering, University of Toronto, Canada. He holds a PhD Degree from the University of Waterloo, Canada in Computer Science with specialization in Machine Learning. Dr. Khan’s main research focus is the development of zero-effort machine learning and deep learning algorithms within the realms of Aging, Rehabilitation and Intelligent Assisted Living (ARIAL). As a Principal Investigator (PI) and Co-PI, his research program has been funded through NSERC, CIHR, SSHRC, AGEWELL NCE, AMS Healthcare, CABHI, UAE University and Shastri Indo-Canadian Institute. He successfully led a study in a specialized dementia unit on the use of multimodal wearable sensors and cameras to detect agitation in people living with dementia. Currently, he is developing a novel cloud-based multimodal sensor platform to assess various health indicators among the people living in the community. He has also started a research program to facilitate telerehabilitation using advanced computer vision techniques to determine patient engagement, exercise compliance and their dropout rates. He has published 46 research papers in top international journals and conference that have garnered around 2380 citation on Google scholar. He is the founder and organizer of the peer-reviewed International Workshop on Artificial Intelligence for ARIAL that is held in conjunction with top conferences in the field (2017-2021).