

## Symposium

### Experts on biobanking, digital pathology and AI met at BBMRI.at partner Med Uni Graz

Under the title "AI & Machine Learning for Digital Pathology - From Biobanks to Knowledge Banks", international experts from Europe and the US met to discuss about the current state and the future of artificial intelligence (AI) and machine learning in biobanking and pathology.

The symposium was organized by BBMRI.at partner MUG to celebrate the efforts of Prof. Kurt Zatloukal in biobanking, digital pathology and artificial intelligence on the occasion of his 60th birthday.

Among the speakers and participants were representatives from Google, BBMRI.de and BBMRI.at.



Left: Speakers with Kurt Zatloukal (5th from the right)

Selected papers will appear in this volume of Springer Lecture Notes in Computer Science.

the call for papers is open until end of September 2019:

<https://human-centered.ai/springer-lncs-ai-machine-learning-for-digital-pathology/>

#### Abstracts of the program:

**Peter REGITNIG** (Medical University of Graz, Diagnostic and Research Institute of Pathology): Expectations and Challenges of AI in Pathology – What a Pathologist Expects

Although extremely important steps have been made within the last ten years to make artificial intelligence possible in the field of pathology, we are currently far away from using artificial intelligence software in our daily pathology practice. Going away from a holistic pathologists' replacement scenario, this talk will focus on low hanging fruits, which could be solved and which could be done better by artificial intelligence compared to a human. Examples are as follows: Finding small tumour deposits within lymph nodes, quantification of positive tumour cells in immunohistochemistry, pre-check of PAP stained gynaecological cytology in cervical cancer screening, text feature extraction, text interpretation and coding error prevention, machine learning in next generation virtual autopsy. In the view of the pathologist an intensified cooperation between computer-/artificial intelligence scientists and pathologists would bring enormous progress to the field.

**Karine SARGSYAN** (Biobank Graz): Biobanks as Basis Infrastructure for Artificial Intelligence in Medicine

Biobanks are fundamental for biomedical research. To drive innovation, we need to manage and share big data. Even though the existing high-tech resources have the capability to reach new levels of data integration in biobanks and in biobanking networks, the progressive prevailing data-management tools pose new challenges (policies, practices, infrastructural needs and ethics). Engaging in these issues requires a constructive and progressive framework for scientific progress. Digital pathology is transforming worldwide the biomedical research by supporting data sharing and integration in the context of tissue-based biomedical research through the whole diagnostic and/or drug development process. International preclinical research has been globalized and interdisciplinary influences have been exerted on solving medical research problems, but they have also created challenges. In this crossroad, Artificial Intelligence (AI) solutions for medical research, and in particular for digital pathology represent real opportunities, to support and foster medical innovation.

More info: <https://biobank.medunigraz.at/general-information/team/>

**Klaus-Robert MÜLLER** (TU Berlin, Max Planck Institute for Intelligent Systems Tübingen & Korea University, Seoul): Explainable AI meets Digital Pathology

Machine Learning has become ubiquitous in our daily lives and has recently begun to enable the scientific discovery process. As a necessary prerequisite for being accepted in the science and in particular in medicine, Learning models need to lose their black box characteristics and become transparent. Such explainable AI (XAI) techniques are thus becoming both crucial and highly popular. This talk will briefly introduce XAI methods for deep learning such as LRP and deep Taylor and also recent XAI developments such as spectral relevance analysis. Subsequently an explainable Deep Learning application to breast cancer analysis is given and insights extracted using XAI is discussed. This is joint work with a vast number of colleagues among them Wojciech Samek, Alex Binder, Gregoire Montavon and Frederick Klauschen.

More info: [https://www.ml.tu-berlin.de/menue/members/klaus-robot\\_mueller/](https://www.ml.tu-berlin.de/menue/members/klaus-robot_mueller/)

**Peter HUFNAGL** (Charité Berlin): EMPAIA -Ecosystem for Pathology Diagnostics with AI Assistance

EMPAIA (EcosysteM for Pathology diagnostics with AI Assistance) is a BMBF-funded project within the framework of the call "Artificial Intelligence as a Driver for economically relevant ecosystems". The aim of the project is to establish an ecosystem for AI-supported, image-based diagnostics using the example of pathology. By creating a standardised marketplace under clear legal conditions, physicians will be able to routinely use validated and approved AI solutions.

The consortium consists of the following partners: Charité – Universitätsmedizin Berlin, Fraunhofer Institut für Digitale Medizin MEVIS Bremen, MindPeak GmbH Hamburg, QuIP – Qualitätssicherungs-Initiative Pathologie QuIP GmbH, HPS Gesundheitscloud gGmbH Potsdam.

More

[cm.charite.de/metast/person/person/address\\_detail/hufnagl/](https://pathologie-cm.charite.de/metast/person/person/address_detail/hufnagl/)

info: [https://pathologie-](https://pathologie-cm.charite.de/metast/person/person/address_detail/hufnagl/)

**George DAGHER** (INSERM, Paris): Science and Society: The Future of European RI  
Research and innovation lie at the heart of Europe's economic strategy and make a critical contribution to the development of its society and cultures. They are a key source of new jobs, growth and competitiveness and underpin a wide range of policy priorities including digital Europe, energy efficiency and sustainability. Following its ambition of creating a European Research Era, the EU commission has developed a number of Research Infrastructures, as part of a bigger vision of EU harmonization. These are expected to be financially sustainable, to measure their performance and socio-economic impact. Sustainable development of Research Infrastructures (RI) is a concept gaining increasing interest among experts in different domains. It is thought to be an essential condition to ensure the excellency of research, facilitate access to services and advanced technologies, foster innovation to meet the needs of scientific communities and beyond that of the society. Sustainability of RI is a multi-dimensional question and includes scientific, social, financial and economic aspects. All these aspects need to be assessed in setting up a plan to develop and maintain the RIs.  
More info: <https://www.inserm.fr/>

**Craig MERMEL** (Google AI, Mountain View): Supervised and unsupervised Machine Learning in Pathology  
Deep learning-based methods have recently shown great promise in achieving expert-level accuracy across a number of medical imaging domains, including dermatology, ophthalmology, radiology, and histopathology. This talk will discuss recent progress in applying both supervised and unsupervised machine learning methods to help augment the pathologist's workflow across a number of tasks, including lymph node metastasis detection, Gleason grading of prostate cancer, and content-based retrieval of similar images in digitized whole slide image archives.  
More info: <https://ai.google/research/people/CraigMermel>

**Richard RÖTTGER** (South Denmark University, Odense): Privacy Preserving Federated Machine Learning  
Digital health, personalized medicine, digital pathology and many other modern concepts of the computer-aided medicine are highly data driven fields. That in turn means we are reliant on sufficient data of high quality; those data is normally spread across the globe in different hospitals and data centers. From a data scientist perspective, the ideal approach would be the consolidation of all available data into one cloud; but medical centers are rightfully reluctant to release patient data to the outside, even in anonymized form. The FeatureCloud project EU RIA 826078 aims to provide hospitals with the possibility to conduct clinical studies without releasing their data and thus endangering the privacy of their patients. In our federated machine learning approach, the data remains in the safe harbor of storage, the machine learning models are built locally and only the model features are combined in the cloud to a full model. This ensures full control and ownership over the data for the entire machine learning process and further allows GDPR compliant implementations. Here, we present the fundamental concept of privacy-aware, federated machine learning and discuss the potential, challenges, and solutions.  
More info: [https://imada.sdu.dk/~roettger/main\\_page/index.php](https://imada.sdu.dk/~roettger/main_page/index.php)

**Andre SANDER** (ID Berlin): Terminology meets Artificial Intelligence – How machine learning and terminologies can benefit from each other  
In the field of semantic structuring of unstructured information ("free text") a clear progress can currently be observed, as has been the case for some years in the field of image analysis using machine learning. The traceability of statistical and machine learning methods is still one of the central problems for the routine use of such systems. First approaches show that the indexing of training data could be a possible way to solve this problem. The lecture shows the delimitation of the approaches to each other and illuminates how the approaches can profit from each other. A future approach is in the combination of logic-based and neural network approaches, particularly in building  $n$ -layer And-Or-Graphs linked up with existing medical knowledge graphs.  
More info: <https://www.id-berlin.de/en/site/3-company/3-company-profile/>

**Michael HUMMEL** (Charite, Berlin): High-quality Biobanks are Enablers for Meaningful AI-based results  
Artificial intelligence will undoubtedly shape technological developments in the next years in medicine – affecting biobanks as well. First concepts already exist for the possible application of AI in biobank processes. Data quality, which depends on sample quality, plays the decisive role here. For this reason, high and also overarching quality standards are important to prepare biobanks for these technological innovations. In addition, the requirements for sample and data quality will be significantly affected by the EU regulation for in vitro diagnostics as its transition period ends in 2022. The demand for human biospecimens will consequently rise. In order to meet such requirements, the German Biobank Node (GBN) and the German Biobank Alliance (GBA) have established a quality management programme for German biobanks which includes e.g. an extensive quality manual and so-called friendly (cross-biobank) audits. The following article describes these developments with regard to their relevance for future biobank workflows using AI methods.  
More info: [https://pathologie-ccm.charite.de/metasperson/person/address\\_detail/hummel-3/](https://pathologie-ccm.charite.de/metasperson/person/address_detail/hummel-3/)

**Markus PASTERK** (ADSI, Innsbruck): Management Training for Leaders of Biobanks  
Despite the fact biobanking exists since decades only few formal training programmes exist around the world. Whereas almost all existing guidelines and best practices foster (in-house) training of biobanking personnel, little is known about the educational needs of leaders of biobanks. Based on the experience of the development of a competency framework for leaders of Research Infrastructures within the EU-funded H2020 Ritrain project we are discussing in this talk principles for the training of the Managers and leaders of Biobanks.  
More info: <http://www.adsi.ac.at/?lang=en>

**Petr HOLUB** (BBMRI-ERIC): Building and using large-scale data resources for AI as a part of a European medical RI  
This talk will focus on challenges and opportunities of building Europe-wide data cohorts, based on experiences with building BBMRI-ERIC CRC-Cohort, a colorectal cancer cohort with more than 10,000 contributed cases. The talk will focus on the process of getting good quality data as a permanent resource for Artificial Intelligence/machine learning-based research purposes and on challenges of using it as a part of international competitions. This is a contribution to celebration of prof. Zatloukal's anniversary, as he was the leader behind BBMRI-ERIC formation and a key initiator of the CRC-Cohort.  
More info: <http://www.bbMRI-eric.eu/bbMRI-eric/staff/>