MIMTT 2022

MIMTT2022: The 3rd Europe - China Health IT Summit
on AI in Medical Informatics, Medical Imaging, Medical Innovation and Medical Technology Transfer

Prague, The Czech Republic
23-27 August 2022

AI in MI3 as a driver for Innovation: healthcare before Healthcare

Masterclass Medical Imaging and AI

August 23, 2022, 14:00-15:30 (EU CET) /20:00-21:30 (CN)

Join Zoom Meeting
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Summary

Medical imaging, providing anatomical, pathological and functional information of target organs, has revolutionized modern medicine, and the AI-assisted diagnosis and therapy has potential for another reformation to healthcare. This masterclass will focus on the whole chain from data to algorithm to application in AI-assisted medical imaging and the problems and challenges associated with it. Topics include: 1) Artificial Intelligence for Medical Imaging: from weak supervision, unsupervised learning to combined computing of multimodality images; 2) Towards trustworthy AI for medical imaging and analysis.

Co-Chairs

- **Shuangyi WANG**, Professor Institute of Automation, Chinese Academy of Sciences, China,
- **Thomas DESERNO**, Professor President Elect, EFMI

Speakers

- **Xiahai Zhuang**, School of Data Science, Fudan University, "*Artificial Intelligence for Medical Imaging: from weak supervision, unsupervised learning to combined computing of multimodality images* "
- **Hao Chen**, Department of Computer Science and Engineering. The Hong Kong University of Science and Technology, "*Towards Trustworthy AI for Medical Imaging and Analysis*"
- **Li Xiao**, Institute of Computing Technology, Chinese Academy of Sciences, "*Micro-scale Biomedical Computing System*"

Lectures

Artificial Intelligence for Medical Imaging: from weak supervision, unsupervised learning to combined computing of multimodality images, *Xiahai Zhuang, School of Data Science, Fudan University.*

Abstract: Before the pandemic of COVID-19 which now appeared in all topics of academia, deep learning-based artificial intelligence (AI) has be prevailing almost every field including medicine and clinics. Medical imaging, providing anatomical, pathological and functional information of target organs, has revolutionized modern medicine, and the AI-assisted diagnosis and therapy has potential for another reformation to healthcare. To successfully translate these AI technologies into practice, having big training data is the key but in many scenarios becomes the insurmountable problem, as medical images with ground truth are expensive to obtain, and sometimes even unavailable. In

addition, medical imaging has the nature of being multi-modality, from which the complementary information should be combined to generate the full picture for clinical applications. This talk covers the introduction of the challenges and preliminary results from our group with exemplar applications. Our code, data and project information can be found from https://zmiclab.github.io/projects.html.

Xiahai Zhuang is Professor of artificial intelligence for medical imaging, and assistant dean of School of Data Science, Fudan University. He obtained PhD from University College London in 2010. He has been primary investigator (PI) or co-PI in over 10 grants and published over 100 articles. He is currently associate editor for a number of top journals, including Medical Image Analysis, IEEE Transactions on Medical Imaging and Neurocomputing. Some of his works were finalist for MICCAI young scientist award and most cited Medical Image Analysis articles. He is elected Board Member of Directors, the Medical Image Computing and Computer-Assisted Intervention (MICCAI) society.

Towards Trustworthy AI for Medical Imaging and Analysis, by Hao Chen, *The Hong Hong University of Science and Technology.*

Abstract: Artificial intelligence (AI), especially deep learning with large-scale annotated datasets, has dramatically advanced the recognition performance in many domains including speech recognition, visual recognition and natural language processing. Despite its breakthroughs in above domains, its application to medical imaging and analysis remains yet to be further explored, where large-scale fully and high-quality annotated datasets are not easily accessible. In this talk, I will share our recent progress on developing trustworthy AI for medical imaging and analysis, including medical imaging super-resolution, label-efficient deep learning methods by leveraging an abundance of weakly-labelled and/or unlabelled datasets, domain generalization, uncertainty quantification, with versatile applications to image enhancement, disease diagnosis, lesion segmentation, hybrid human-machine collaboration, etc. Challenges and future directions such as privacy-preserving and explainable AI (XAI) will also be discussed.

Dr. Hao Chen is an Assistant Professor at the Department of Computer Science and Engineering, The Hong Kong University of Science and Technology. He leads the Smart Lab focusing on developing trustworthy AI for healthcare. He received the Ph.D. degree from The Chinese University of Hong Kong (CUHK) in 2017. He was a postdoctoral research fellow in CUHK and a visiting scholar in Utrecht University Medical Center previously. He has 100+ publications (Google Scholar Citations 15000+, h-index 55) in MICCAI, IEEE-TMI, MIA, CVPR, AAAI, Radiology, Lancet Digital Health, Nature Machine Intelligence, JAMA, etc. He also has rich industrial research experience (e.g., Siemens and startup), and holds a dozen of patents in AI and medical image analysis. He received several premium awards such as MICCAI Young Scientist Impact Award in 2019, Forbes China 30 under 30 and three best paper awards. He serves as the Associate Editor of journals including IEEE Transactions on Neural Networks and Learning Systems, Frontiers in Artificial Intelligence, Medical Physics, etc. He serves as the program committee of multiple international conferences including Area Chair of MICCAI 2021-2022, ISBI 2022, MIDL 2022 and SPC of AAAI 2022, etc. He also led the team winning 15+ medical grand challenges.

Micro-scale Biomedical Computing System by Li Xiao, Institute of Computing Technology, Chinese Academy of Sciences

Abstract: Artificial intelligence (AI), especially deep learning with large-scale annotated datasets, has dramatically advanced the recognition performance in many domains including speech recognition, visual recognition and natural language processing. Despite its breakthroughs in above domains, its application to medical imaging and analysis remains yet to be further explored, where large-scale fully and high-quality annotated datasets are not easily accessible. In this talk, I will share our recent progress on developing trustworthy AI for medical imaging and analysis, including medical imaging super-resolution, label-efficient deep learning methods by leveraging an abundance of weakly-labelled and/or unlabelled datasets, domain generalization, uncertainty quantification, with versatile applications to image enhancement, disease diagnosis, lesion segmentation, hybrid human-machine

collaboration, etc. Challenges and future directions such as privacy-preserving and explainable AI (XAI) will also be discussed.

Xiao Li, Associate Professor, Institute of Computing Technology, Chinese Academy of Sciences, has a strong experience in the field of modeling and computation of medical big data. Aiming for two essential challenges in biomolecular simulation: (1) simplification of massive high-dimensional continuous states computation and (2) Disentanglement of complex multiple physical effects, he innovatively proposes a multi-scale modeling paradigm based on the implicit solvent model and develops a three-dimensional fluid dynamical simulation system, achieves the dynamical coupling of implicit solvent and all-atom force field, and demonstrate the consistency between implicit and explicit solvent simulation for the first time. This achievement has won the Justine Lambert prize at the University of California, Irvine, awarded for the best paper in fundamental science, with only 1-2 winners every other year. Focusing on the medical big data modeling and analysis including medical images, electronic medical records, and multi-modal and multi-omics data, Dr. Li invents a series of new deep learning methods: the medical image report generation system based on knowledge graphs; a new equipment of augmented reality microscope for bone marrow cell analysis; a multi-modal diagnosis algorithm based on multi-layer GCN combining medical image and non-imaging phenotype data; a top likelihood algorithm to reduce false positives in detecting breast cancer and colonoscopy polyps; Unsupervised /semi-supervised segmentation algorithms for Covid-19 lesions in CT. He has collaborated with 20+ well-known hospitals (including Peking University Third Hospital, West China Hospital, Peking Union Medical College Hospital, etc.), and published 40+ papers in high-impact journals/conferences such as MEDIA, TMI, IJCAI, MICCAI, including 11 JCR Q1 journal papers with major contributions. He has been supported by the Hundred Talents Program of the Chinese Academy of Sciences (with preferential support), the CCF-Tencent rhinoceros bird Fund (30 / 211) (win Excellence Award 6/30), etc. His results have been applied on several leading research platforms.

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