

Selected research topics in Biomedical Engineering: Developments in Dental Research

Location: Kleiner Hörsaal, Universitäres Zentrum für Zahnmedizin Basel (UZB)

Date and time: Thursday, March 21, 2019, 12:00-13:30

Artificial intelligence/machine learning-based X-ray imaging of hard tissues at high resolution

G. Wang

*Clark & Crossan Chair, Director of Biomedical Imaging Center, Rensselaer
Polytechnic Institute, Troy, NY, USA*

Abstract. Currently, deep learning is the mainstream of machine learning and a most active area of artificial intelligence. Computer vision and image analysis are great application examples of deep learning. While computer vision and image analysis deal with existing images and produce related features, tomographic reconstruction produces images of internal structures from externally measured features (line integrals, k-space samples, etc.) of underlying images. Recently, deep learning techniques are being actively developed worldwide for tomographic image reconstruction. We believe that *image reconstruction is a new frontier of machine learning* (IEEE Transactions on Medical Imaging 37 (2018) 1289), and promises major impacts on the development of solutions to many inverse problems. Along this direction, over the past years we have been working on data-driven X-ray computed tomographic algorithms based on analytic and iterative algorithms for superior imaging performance in biomedical applications. In this presentation, we report our deep learning algorithms for super-resolution CT in multiple image contrasts (attenuation, energy-discriminative, phase-contrast, and small-angle scattering) and methodological innovations. We welcome exciting opportunities for collaboration on data-driven smart imaging of hard tissues such as dental and temporal bone structures.

Curriculum. Ge Wang authored the pioneering paper on the first spiral/helical cone-beam/multi-slice CT algorithm in 1991. Currently, there are over 100 million medical CT scans yearly with a majority in this mode. He also pioneered the area of bioluminescence tomography. His group published the first papers on interior tomography and omni-tomography (“all-in-one”) to acquire diverse datasets simultaneously (“all-at-once”) with CT-MRI as an example. His results were featured in Nature, Science, and PNAS, and recognized with academic awards. His interest includes hard X-ray CT, optical molecular tomography, multimodality fusion, and machine learning for biomedical imaging. He is the Lead Guest Editor of the five IEEE Transactions on Medical Imaging Special Issues, the founding Editor-in-Chief of the International Journal of Biomedical Imaging, and an Associate Editor of the IEEE Transactions on Medical Imaging, Medical Physics, and further journals. He is Fellow of the IEEE, SPIE, OSA, AIMBE, AAPM, and AAAS. His IOP Publishing ebook entitled “Machine Learning for Tomographic Imaging” will be published within this year.