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Convolutional neural networks for DESY photon science

Tuesday, 25 August 2020 12:00 (30 minutes)

We are exploiting possible applications of artificial intelligence at the German electron synchrotron (DESY) in Hamburg, in particular in the field of photon science. Our current focus is on the use of convolutional neural networks applied to 2D and 3D image analysis for life science.

We will present successful applied semantic segmentation of volumetric 3D synchrotron radiation microcomputed tomography (SRμCT) data with a U-Net. We have trained a convolutional neural network to segment biodegenerable bone implants (screws) and degeneration products from bone and background. The results obtained significantly outperform the previously used semi-automatic segmentation procedure in terms of accuracy and has successfully been applied to more than 100 rather heterogeneous datasets. Remarkably the performance of the U-Net segmentation is considerably better than the experts segmentation that has been used for training.

In addition to our ongoing work for instance segmentation (SRμCT) in the context of material science, object detection and classification for cryo electron tomography will be introduced. With a combination of a U-Net and a simple convolutional network for object classification, membrane protein complexes are identified in CryoEM tomograms, for subsequent subtomogram averaging. The machine learning efforts at DESY-IT also include the development of a classification/filter method for XFEL SFX diffraction data.

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