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Deep learning for the generation of artificially stained 3D virtual histology of bone implants

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As part of our correlative characterisation studies of biodegradable metal bone implants we have performed both synchrotron-radiation microtomography (SR-µCT) and histology sequentially on the same samples and regions of interest. Histological staining is still the gold standard for tissue visualisation yet requires multiple time-consuming sample preparation steps (fixing, embedding, sectioning and staining) before imaging is performed on individual slices, in contrast to the non-invasive and 3D nature of x-ray tomography. In the process of correlating the corresponding data sets, we are able to combine advantages of both modalities by training machine learning networks for modality transfer on SR-µCT/histology pairs to generate artificially stained 3D virtual histology data from SR-µCT datasets, with promising preliminary results.

Primary author: IRVINE, Sally (Helmholtz-Zentrum Hereon)

Co-authors: MOOSMANN, Julian (Helmholtz-Zentrum Hereon); ZELLER-PLUMHOFF, Berit (Hereon (Helmholtz-Zentrum Hereon))

Presenter: IRVINE, Sally (Helmholtz-Zentrum Hereon)

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