

Memory Efficient Volumetric Deep Neural Network for Digital Volume Correlation

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The optical flow method is one of the emerging approaches for Digital Volume Correlation (DVC) to analyze the volumetric deformation during in situ experiments of material science research. However, deep optical flow neural networks for DVC are limited by memory requirement, especially for high volumetric resolution data from Synchrotron Radiation Computed Tomography (SRCT) in the scale of micro-meter or nano-meter. In this work, we extend our study on optical flow networks VolRAFT, by focusing on memory efficiency during the supervised training of volumetric neural networks using high-resolution micro-CT and nano-CT data. We present approaches to reduce maximum memory requirement based on network architectural and non-architectural changes, utilizing cutting-edge Graphics Processing Units (GPUs). We develop an “on-the-fly” synthetic dataset generator to reduce the storage space needed during training. We compare these approaches by the memory requirement and the accuracy of deformation fields under various volumetric resolutions, based on experimental data of bone-implant materials, lignocellulosic tissues and shape memory alloy wires.

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yes

Author: WONG, Tak Ming (Helmholtz-Zentrum Hereon)

Presenter: WONG, Tak Ming (Helmholtz-Zentrum Hereon)

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