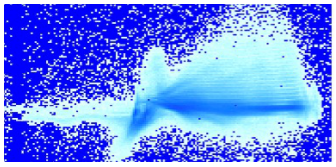

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# Algorithmic and computational advances in holotomography

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Holotomography is a coherent imaging technique that provides three-dimensional reconstruction of a sample's complex refractive index by integrating holography principles with tomographic methods. This approach is optimal for the micro- and nano-tomography instruments at the newest generation of synchrotron sources. With the aim of facilitating the use of the optimal phase retrieval approaches, we present a family of novel algorithms wrapped in an efficient software implementation of X-ray holotomography reconstruction [1]. This development incorporates advanced iterative schemes for simultaneous object phase and beam illumination retrieval, facilitating high-fidelity reconstructions with enhanced accuracy. Notably, these schemes minimize the number of measurements, such as holography planes (distances) and tomography angles, required for accurate object reconstruction, thereby optimizing data acquisition efficiency. Basic holography and tomography operators are implemented using CUDA C-language functions, leveraging the computational power of GPUs for rapid processing. Iterative reconstruction schemes are written in CuPy, ensuring seamless integration into existing workflows. For interactive data exploration and analysis, the package is accessible through Jupyter Notebooks, well-suited for fast prototyping to advance the field of 3D phase contrast imaging. The efficacy of the software is demonstrated with experimental data from the Projection X-ray Microscope Instrument at the ID16A beamline of ESRF.

[1] https://github.com/nikitinvv/holotomo

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