# VARIATIONAL HILBERT PHASE IMAGING FOR PROSTATE CELL ANALYSIS

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Quantitative phase imaging [1] is a well-established representative of the marker-free full-field optical characterization techniques based on the principles of interferometry, holography, microscopy and numerical processing. The information about measured transparent bio-structure (sample-induced optical path delay) is encoded in the phase distribution of the recorded interference pattern called the hologram. Its underlying phase term calculation is therefore required, especially using single-frame analysis methods due to their excellent time resolution and high environmental robustness. Two numerical steps are to be highlighted here: hologram preprocessing and its phase demodulation. We are proposing a novel "black-box" algorithmic solution called Variational Hilbert Phase Imaging (VHPI), where variational image decomposition (VID) [2] is used as hologram preprocessing tool and Hilbert spiral transform [3] is employed for filtered hologram phase demodulation. Automation, simplification, acceleration and quality boost of the previously complicated and arduous VID-based pre-filtering is provided by adding up-to-date block-matching 3D denoising and proposing the tolerance parameter as universal determinant for the end of iterative functional minimization.

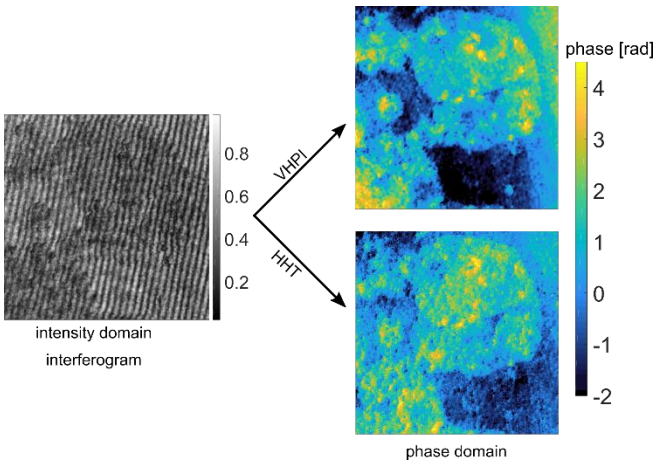


*Figure 1 Comparison of the phase demodulation result for Variational Hilbert Phase Imaging and Hilbert-Huang Transform*

In the studied case of prostate cell analysis the recorded hologram, Fig.1, is of low quality due to high noise and low fringe contrast. The result obtained by the VHPI compares favorably with the one provided by reference method based on the Hilbert-Huang Transform (HHT) [3] both in terms of lower noise and richer cell details.

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