Advanced Fringe Patterns Denoising and Processing via Ensemble Deep Learning Model

Metrology & Hallmark

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Abstract

The strength of deep learning methods has shown substantial achievements in optical metrology, especially in fringe denoising, fringe analysis, and phase unwrapping. Despite extensive research efforts for decades, the challenge of accurately extracting desired phase distribution information from recorded fringes remains one of the most challenging open problems. This study introduces an ensemble methodology that leverages two deep neural models, such as Single Shot Detector (SSD), and You Only Look Once (YOLO), for automated fringe pattern analysis in decision-making support for the determination of parameters from the calculated phase distribution. The assessment of the proposed methodology, as detailed in this study, was conducted using heterogeneous datasets encompassing data recorded in Kösters interferometer placed in the laboratory of the Polish Central Office of Measures and computer-generated fringe sample images. We benchmark our methodology for the fringe analysis task and find generalization behavior and robustness to noisy recorded data.

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