Light Science & Applications

Learning to decompose highly multimode fiber system over 1000 modes using physics-informed mode decomposition neural network

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Multidimensional structured light fields offer promising, exciting applications due to their numerous degrees of freedom. In recent years, multimode fibers supporting multiple transverse modes have attracted a lot of research interest in different applications, for example, telecommunications, fiber laser, and sensing. Here, We propose a novel approach for the referenceless mode decomposition of highly multimode fibers. A deep neural network with the interaction of a physical model achieves the decomposition of over 1000 modes without pre-training. Based on the mode weights decomposed from a pure intensity image, the reconstructed light field has reached a high correlation coefficient of over 98% on synthetic data. The proposed efficient and economic method will facilitate research using multimode fibers in areas like optical fiber laser, spatial devision multiplexing.

Short Bio:

Qian Zhang is a Ph.D. student at the Laboratory for Measurement and Sensor System Technique. He received his Diploma degree in Electrical Engineering from the TU Dresden in 2020. He won the Faculty Award of the Gisela and Erwin Sick Foundation for his thesis. His research focuses on the application of artificial intelligence in optical measurement systems. With his deep learning-based approaches, he aims to contribute to more cost-effective and efficient measurement systems by replacing the use of conventional components in modern measurement systems with intelligent algorithms. Qian's research interests include deep learning, secure communication in optical waveguides, and quantum communication through few-mode fiber.