数据驱动下的偏振成像技术研究进展

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偏振是光波的基础属性之一，体现了光波的矢量横波特性。深度学习作为一种基于神经网络的高级机器学习范式，借助于卷积核模块的非线性数据表征，实现学习和提取抽象的高维特征，从而在计算机视觉等领域实现卓越性能。

西安电子科技大学邵晓鹏、刘飞教授研究团队针对深度学习与偏振成像领域各自的问题，阐述神经网络对融合不同表征方式的偏振乃至多维光场特征、嵌入现有物理模型成果、延伸现有成像边界过程中的优化和补充作用，丰富现有偏振成像的应用领域。随着数据驱动的偏振成像研究领域的不断探索，对偏振信息的利用已逐渐从直接获取的偏振信息趋向于预处理后的偏振特征。现有数据驱动的偏振成像技术已应用于偏振信息的重建与增强、目标检测、生物医学成像与病理性诊断、语义分割、透散射介质、三维重建、反射移除等领域。

数据驱动的偏振成像作为新型的交叉研究领域，可有效增强现有的信息解译和成像效果，拓展未知的应用领域。在未来的研究中，可以考虑与更多现有的物理模型进行更深入的结合，从而优化网络的训练结果，提升神经网络的可解译性，同时为更全面的合成数据集的生成提供研究基础。

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Data-driven polarimetric imaging

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Polarization is one of the fundamental properties of light waves, manifesting the vector transverse wave nature of light. Deep learning, as an advanced machine learning paradigm based on neural networks, achieves exceptional performance in fields such as computer vision by leveraging the non-linear data representation capabilities of convolutional kernel modules for learning and extracting abstract high-dimensional features. Existing data-driven polarization imaging technologies have gradually found applications in polarization information reconstruction and enhancement, target detection, biomedical imaging, pathological diagnosis, semantic segmentation, diffusive scattering media, 3D reconstruction, reflection removal, and other fields.

The research group of Prof. Xiaopeng Shao from Xidian University review "data-driven polarimetric imaging: a review". This review addresses issues in existing polarization imaging applications and provides an overview of the research progress in data-driven polarization imaging, focusing on trends, applications, information utilization, and discussions on future development directions.

In the realm of data-driven polarization imaging, as a novel interdisciplinary research area, the complementary strengths of data-driven approaches and physical models effectively enhance existing information interpretation and imaging outcomes, thereby expanding into unknown application domains. In future research, deeper integration with existing physical models can be considered to optimize network training results, improve the interpretability of neural networks, and provide a research foundation for generating more comprehensive synthetic datasets.

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