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Applying Deep Learning Approaches to Estimate the Number of Layers in Nanomaterials from Optical Images

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Atomic-level engineering enables the creation of hybrid structures that enhance light-matter interactions and advance next-generation optical devices. Two-dimensional (2D) materials are important in nanophotonics due to their unique properties.

In this study, the authors introduce a hybrid vision transformer model, termed 2D-HVT, specifically designed for identifying and analyzing 2D materials. This model incorporates the FastViT encoder alongside a composite decoder that merges LRASPP and Knet, optimizing inference speed without compromising accuracy in assessing the thickness of molybdenum disulfide (MoS_2) layers, which may range from monolayer to multilayer configurations.

To facilitate practical application, we developed a graphical user interface (GUI) that enables real-time data acquisition from a microscopic camera. This interface effectively applies the trained model to produce predictive outputs based on the acquired images. The process begins with the microscope scanning a substrate chip coated with a MoS_2 film synthesized through CVD (Chemical Vapor Deposition), followed by image capture and processing. The resulting optical images serve as input for our model, which generates predictive outcomes that are further analyzed using histogram techniques to establish a layer distribution profile.

This innovative approach aims to propel materials science research forward and enhance the exploration of the unique properties of 2D materials, thus opening new avenues for their application in various technological domains.

Type of presence

Presence online

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