亮点报道：OptoGPT: 搭建多层薄膜结构的逆向设计基础模型

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光学多层薄膜结构是几种最重要的光子学结构之一，被广泛应用于许多领域，包括颜色滤光片、吸收器、光学腔或谐振器、光伏和辐射冷却、极紫外光刻和太空望远镜的特殊反射镜等等。

美国密西根大学安娜堡分校 L. Jay Guo 教授的研究团队引入了一种名为 OptoGPT 的新形逆向设计算法，该算法受到了自然语言处理中极为流行且强大的 GPT 模型的启发。在这些 GPT 模型中，给定一个输入提示，它们可以输出符合要求且有意义的语句作为答案。首先引入了结构标记化的概念，将每层的材料和厚度信息转换为单个标记。然后，他们使用结构序列化将多层薄膜结构转换为 GPT 模型的输入序列。通过这种方式，他们的 OptoGPT 模型可以有效地设计材料和厚度信息。另一方面，为了使他们的模型适应不同类型的光学响应，他们提出同时设计透射光谱和反射光谱，并使用多种技术扩展到多样化的响应。

团队最终构建了一个能够统一多层设计的模型，适用于不同材料和厚度，以及不同类型的光学响应，包括透射、反射、吸收、结构色、角度和偏振状态，这显著简化了逆向设计过程，更加易于研究人员和工程师使用。

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Highlights: OptoGPT: building foundation models for multilayer thin film design

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Optical multilayer thin film structure is one of the most important photonic structures widely used in many applications, including color filters, absorbers, optical cavities or resonators, photovoltaic and radiative cooling, special mirrors for extreme UV lithography and for space telescopes.

Prof. Guo's research Group introduced a new inverse design algorithm called OptoGPT, inspired from the popular and powerful GPT models in natural language processing, such as OpenAI's ChatGPT and Google's Bard. In these GPT models, given an input prompt such as questions or guidance, they can output desirable and meaningful sentences as answers. The proposed OptoGPT model works in a similar way. When given a specific type of optical responses that a user desires, the model can output a designed multilayer structure directly.

By using finetuning and "mixed sampling", their model can work for different incident angles and different polarizations, as well as simultaneous design that can satisfy multiple angles and polarization requirements. In this way, ultimately the team build a model that can unify the multilayer design for different materials and thickness, and for different types of optical responses, including transmission, reflection, absorber, structural color, angles, and polarization states, which significantly simplify the inverse design process, making them easily accessible to researchers and engineers.

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