

## SMART OPTICS: THE EMERGING ROLE OF ARTIFICIAL INTELLIGENCE IN LIGHT-BASED TECHNOLOGIES

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*Optics has been greatly improved by the application of various forms of Artificial Intelligence (AI). AI enhances the design, evaluation, and subsequently the performance of optical systems such as lens optimisation, meta-surface design, optical imaging enhancement and network optimisation, primarily through the use of data driven modelling and solutions, as opposed to solely utilising traditional modelling techniques). The trend for modern optical systems is towards increasing complexity, resulting in the need for faster computation, along with adaptive control techniques. Machine learning algorithms also improve pattern recognition, predictive modelling, and ultimately automation within optical sensing and imaging. AI is also enabling greater reliability of fibre optic communication systems through improvements in photo-integrated circuit and overall communication network performance. This paper examines the breadth of AI-based applications within optics, provides a discussion of the benefits of AI to optical technologies, and outlines challenges and future developments. Ultimately, through AI and its application to optical systems, increased efficiency, decreased design cycle time, and improved performance are expected in medical imaging, telecommunication, optical sensor systems, and advanced photonic research.*

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