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Using Machine Learning to Model and Predict the Effects of Atmospheric Turbulence on Lasers

Free-Space Optical (FSO) communication links have utilized Orbital Angular Momentum (OAM) modes as channels in Mode Division Multiplexing (MDM) systems. OAM modes suffer from turbulence-induced OAM crosstalk which degrades the performance of FSO communication links. OAM crosstalk flow with a certain extent of memory. Analytical models exist to predict OAM crosstalk are memoryless, probabilistic and do not describe OAM crosstalk evolution with time. This research proposes an alternate approach to model the OAM crosstalk using machine learning. Such a memory model can potentially be used in the future to optimize crosstalk mitigation techniques such as forward error techniques by introducing predictive capabilities on OAM modes. The temporal correlations in time series data were learned by the model. Lateral displacement, tilt angle and OAM crosstalk coefficients were generated and measured from a laboratory link. These measured variables were used to train and test the machine learning model. Finally, an analytical expression approximated the OAM crosstalk and was compared with the machine learning model OAM crosstalk prediction.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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