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A Near Optimum Receiver Scheme for Pulse Position Modulation by Local Measurements

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Quantum Discrimination Theory predicts great improvements in communication performance with respect to the current technology if the laws of quantum mechanics are exploited in the receiver design.
For Pulse Position Modulation (PPM), schemes that outperform classical photon counting receiver have so far been presented, such as the conditional nulling scheme by Dolinar ["A near-optimum receiver structure for the detection of M-ary optical PPM signals", The Telecommun. and Data Acquisition Rept., 1983] and two improved versions by Guha et al. ["Approaching Helstrom limits to optical pulse-position demodulation using single photon detection and optical feedback", J. Mod. Optic., 2011]. However, a significant gap is still observed between these solutions and the performance limits predicted by quantum mechanics.

We aim to reduce this gap by proposing a receiver scheme that employs repeated local measurements in distinct temporal slots within the symbol time interval. Each slot measurement is adaptively chosen on the basis of the outcomes in the previous slots. Then, by employing Dynamic Programming to optimize each measurement we approach the theoretical performance limits much closer than previous schemes.