CC PUB #293
October 1999

Universal Prediction of Individual Binary Sequences in the Presence of Noise

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Abstract

The problem of predicting the next outcome of an individual binary sequence, based on noisy observations of the past, is considered. The goal of the predictor is to perform, for each individual sequence, "almost" as well as the best in a set of experts, where performance is evaluated using a general loss function. This setting is a generalization of the original problem of universal prediction of individual sequences relative to a set of experts. The data-corrupting noise processes considered in this work are of two types: binary-valued noise (where the observed bit is the bitwise XOR of the clean bit and the noise bit) and real-valued additive noise. it is shown that even in this more challenging situation, where the information available to the predictor regarding the past sequence is incomplete, a predictor can be guaranteed to successfully compete with a whole set of experts in considerably strong senses.