



Second-Order Non-Stationary Online Learning for Regression

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The goal of a learner, in standard online learning, is to have the cumulative loss not much larger compared with the best-performing function from some fixed class. Numerous algorithms were shown to have this gap arbitrarily close to zero, compared with the best function that is chosen off-line. Nevertheless, many real-world applications, such as adaptive filtering, are non-stationary in nature, and the best prediction function may drift over time. We introduce two novel algorithms for online regression, designed to work well in non-stationary environment. Our first algorithm performs adaptive resets to forget the history, while the second is last-step min-max optimal in context of a drift. We analyze both algorithms in the worst-case regret framework and show that they maintain an average loss close to that of the best slowly changing sequence of linear functions, as long as the cumulative drift is sublinear. In addition, in the stationary case, when no drift occurs, our algorithms suffer logarithmic regret, as for previous algorithms. Our bounds improve over the existing ones, and simulations demonstrate the usefulness of these algorithms compared with other state-of-the-art approaches.

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