

In this paper, we present a distributed learning algorithm for the optimization of signal covariance matrices in Gaussian multiple-input and multiple-output (MIMO) multiple access channel with imperfect (and possibly delayed) feedback. The algorithm is based on the method of matrix exponential learning (MXL) and it has the same information and computation requirements as distributed water-filling. However, unlike water-filling, the proposed algorithm converges to the system's optimum signal covariance profile even under stochastic uncertainty and imperfect feedback. Moreover, the algorithm also retains its convergence properties in the presence of user update asynchronicities, random delays and/or ergodically changing channel conditions. Our theoretical analysis is complemented by extensive numerical simulations which illustrate the robustness and scalability of MXL in realistic network conditions. In particular, the algorithm retains its convergence speed even for large numbers of users and/or antennas per user.