ANOUSHKA VYAS - 20171057

ADAPTIVE SIGNAL PROCESSING PROJECT

OBJECTIVE

The goal of this project is to propose novel strategies for adaptive learning of signals defined over graphs, which are observed over a (randomly time-varying) subset of vertices. Primarily, I am going to use the least mean squares (LMS) adaptive estimation strategy and if time permits I can use the recursive mean squares (RLS) adaptive estimation strategy.

DESCRIPTION AND EXPECTATIONS

The LMS algorithm is used to incorporate a probabilistic sampling mechanism, where each node of the graph, at every time instant, is sampled with a given probability. Then, we derive a mean-square analysis that illustrates the role played by the sampling probabilities on the reconstruction capabilities and performance of the LMS algorithm. On the basis of the developed analysis, we design probabilistic sampling strategies aimed at minimizing the graph sampling rate (or maximizing the mean-square performance) while imposing accuracy (and/or sampling) constraints.The RLS reconstruction strategy that collects data over the graph by the same probabilistic sampling method. Then, after giving necessary and sufficient conditions for adaptive graph signal reconstruction, we formulate an optimization problem to design the sampling probability at each node in the graph, reducing the sampling rate from one side, while also guaranteeing signal reconstruction and a prescribed steady-state performance.

The proposed methods exploit the graph structure that describes the observed signal and, under a bandlimited assumption, enable adaptive reconstruction and tracking from a limited number of observations taken over a (possibly time-varying) subset of vertices. An interesting feature of our strategies is that this subset is allowed to vary over time, provided that the average sampling set satisfies specific conditions enabling graph signal recovery.

https://arxiv.org/pdf/1709.03726.pdf