Social Learning in non-stationary environments

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Abstract

Potential buyers of a product or service, before making their decisions, tend to read reviews written by previous consumers. We consider Bayesian consumers with heterogeneous preferences, who sequentially decide whether to buy an item of unknown quality, based on previous buyers' reviews. The quality is multi-dimensional and may occasionally vary over time; the reviews are also multi-dimensional. In the simple uni-dimensional and static setting, beliefs about the quality are known to converge to its true value. Our paper extends this result in several ways. First, a multi-dimensional quality is considered, second, rates of convergence are provided, third, a dynamical Markovian model with varying quality is studied. In this dynamical setting the cost of learning is shown to be small.

Keywords: Social Learning, Bayesian Estimation, Non-Stationary Environment, Change-Point Model

After buying and experiencing a product, people often leave reviews on sites such as Amazon, Tripadvisor, Yelp, etc. When consumers observe only the purchasing behavior of previous consumers, there is a risk of a cascade of bad decisions: if the first agents make the wrong decision, the subsequent agents may follow them thinking that what they did was optimal and herding happens. It seems reasonable to conjecture that, if consumers write reviews about the product that they bought, then social learning will be achieved. While classical models consider the former case (only observe previous consumers' decision), social learning with reviews recently gained interest with the emergence of online review platforms.

This work considers heterogeneous consumers arriving sequentially in a monopolistic market and—before deciding whether to buy a product of unknown quality—observe the reviews (e.g., like/dislike) provided by previous buyers. Consumers buy if their expected utility of buying is positive. Each buyer posts a sincere review that summarizes the experienced quality of the product. Ifrach et al. (2019) studied this model in the case where the intrinsic quality of the product is one-dimensional, fixed over time, and can assume just two values; they studied conditions for social learning to be achieved. We extend their results in two main directions. First, we allow the quality to be multidimensional, i.e., to have different features that consumers experience and evaluate. Second, we consider a model where the quality can occasionally change over time. The latter model justifies the behavior of consumers who only pay attention to recent reviews in practice (Murphy, 2019). In both static and dynamic cases, we show that the product quality is accurately learned under mild conditions.

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