Dynamic Pricing using Shape Constrained Nonparametric Bandits

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Abstract

We propose a novel theory-based approach to the multi-armed bandit problem of maximizing profits when faced with an unknown demand curve. We leverage the informational externalities inherent in price experimentation in two ways: demand is correlated at nearby prices and demand is monotonically decreasing. Following previous literature, the first information externality is captured using Gaussian process bandits. We expand on this by incorporating the second information externality (monotonicity), providing a monotonic version of both GP-UCB and GP-TS. Incorporating these informational externalities limits unnecessary exploration (and wrongful exploitation) of certain prices increasing profits and reducing needed experimentation. Across a wide spectrum of true demand distributions and price sets, our algorithm demonstrated a significant increase in rewards, most notably for underlying WTP distributions where the optimal is low among the set of prices considered.

Subject Areas: *New Product Development and Launch, Pricing*

Track: Methods, Modelling & Marketing Analytics