

Title: Joint Inventory Allocation and Order Fulfillment in Online Retail

Abstract:

We consider inventory allocation and fulfillment decisions faced by an online retailer. We have a set of products with given numbers of units to be allocated at different fulfillment centers with capacity constraints. Once we make the allocation decisions, we face random demands over the selling horizon for the products from different demand regions. In response to each demand, we choose a fulfillment center to use to serve the demand. Our goal is to decide where to place the units to maximize the total expected profit from the sales over a finite selling horizon. We give a general approximation framework for this joint inventory allocation and fulfillment problem. Our framework is based on constructing a surrogate function that upper bounds the total expected profit obtained by the optimal policy, and lower bounds the total expected profit obtained by an approximate policy. We make the inventory allocation decisions by maximizing the surrogate subject to capacity constraints at the fulfillment centers, whereas we make the fulfillment decisions by following the approximate policy. We show that we can obtain a performance guarantee by using this general framework. We use synthetically generated datasets, as well as datasets based on an online retailer, to test the practical performance of our framework.