Some Operational Problems in Internet Advertising

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Abstract: This study provides an approach to manage an on-going Internet ad campaign that substantially improves the number of clicks and the revenue earned from clicks. The problem we study is faced by an Internet advertising firm (Chitika) that operates in the Boston area. Chitika contracts with publishers to place relevant advertisements (ads) over a specified period on publisher websites. Ad revenue accrues to the firm and the publisher only if a visitor clicks on an ad (i.e., we are considering the cost per click model in this study). This might imply that all visitors to the publisher’s website be shown ads. However, this is not the case if the publisher imposes a click-through-rate constraint on the advertising firm. This performance constraint captures the publisher’s desire to limit ad clutter on the website and hold the advertising firm responsible for the publisher’s opportunity cost of showing an ad that did not result in a click. We develop a predictive model of a visitor clicking on a given ad. Using this prediction of the probability of a click, we develop a decision model that uses a threshold to decide whether or not to show an ad to the visitor. The decision model’s objective is to maximize the advertising firm’s revenue subject to a click-through-rate constraint. A key contribution of this paper is to characterize the structure of the optimal solution. We study and contrast two competing solutions: (1) a static solution, and (2) a rolling-horizon solution that re-solves the problem at certain points in the planning horizon. The static solution is shown to be optimal when accurate information on the input parameters to the problem is known. However, when the parameters to the model can only be estimated with some error, the rolling-horizon solution can perform better than the static solution. When using the rolling-horizon solution, it becomes important to choose the appropriate re-solving frequency. The implemented models operate in real time in Chitika’s advertising network. Implementation challenges and the business impact of our solution are discussed.

Bio: Vijay S. Mookerjee holds a Ph.D. in Management, with a major in MIS, from Purdue University. His current research interests include social networks, optimal software development methodologies, storage and cache management, content delivery systems, and the economic design of expert systems and machine learning systems. He has published in and has articles forthcoming in several archival Information Systems, Computer Science, and Operations Research journals. He serves (or has served on) the editorial board of Management Science, Information Systems research, INFORMS Journal on Computing, Operations Research, Decision Support Systems, Information Technology and Management, and Journal of Database Management.