Automated Optimization of Online Advertising Campaigns

Problem proposed by HighMedia

Context of the problem

HighMedia, a company located in Montreal, manages a portfolio of web sites that include ads (purchased by the company's clients). On each web site, various ad zones are designated in advance and the advertisers (i.e., the clients) compete against one another in order to gain exposure by placing their ads on these zones. Each advertiser posts a "bid" he is willing to pay in order to place his ad in a given zone. A bid is expressed as a "cost per thousand" (CPM, in French) and represents the price paid by the client to purchase a block of one thousand impressions. An impression is defined as the display of the client's ad on the browser of a person accessing a HighMedia site. Observe that each advertising zone has its own characteristics (e.g., impression volume, web user categories, list of bids posted by diverse clients).

Each advertiser has a maximum amount to spend, which implies that HighMedia may not allocate to him more that a certain number of impressions (equal to the maximum amount divided by the advertiser's bid). Given that the total number of impressions is limited, HighMedia cannot satisfy the maximum demand of each and every advertiser. The company uses an ad selection algorithm that yields a good revenue without discouraging the advertisers whose bids are relatively low. Note that if the company only wished to maximize its current profit, it would sell the largest possible number of impressions to the client with the highest bid. This policy has a drawback, however, because some advertisers will stop making bids after failing to purchase any impression. Consider an example in which the bid of advertiser A is 0.10 dollar and that of advertiser B is 0.20 dollar, and the budget of B allows him to purchase all the available impressions. The company's algorithm may allocate 90% of impressions to B and 10% to A, which will encourage A to remain a client of HighMedia.

When a client posts a bid (and thus proposes to purchase impressions), his goal is to incite internet users to click on the ad purchased by the client. A click leads the internet user to the site of the advertiser (i.e., the client), where he may engage in activities such as subscription to a newsletter, purchase of a product or service, or document browsing. These activities are called "conversions". The advertiser wishes to increase the overall number of these conversions. To do so he must first evaluate the number of conversions following the impression of his ads. For each ad geared towards a specific conversion type, some advertisers are willing to increase their initial bid (up to a maximum) in order to increase the number of conversions. Note that a HighMedia client may post a new bid several times during a single hour. Hence he must expend a lot of effort collecting information on conversions and using this information to choose a bid. Some clients are trying to design "robots" that will choose bids for them automatically.

Problem statement

HighMedia would like to offer its clients au automated procedure for "optimizing" their advertising campaigns. The goal of this procedure would be to increase the volume of impressions for ads that produce the largest number of conversions, given the initial bid of each client, its maximal bid, the revenue generated by a conversion for each client, the click rate per ad, and the conversion rate per ad. The procedure could lead to an increase in the number of conversions for a given client, by controlling the parameters of an advertising campaign. The team will analyse the impact of the procedure on the revenues of HighMedia; in particular the team could propose a procedure that favours the advertisers

whose initial bids are relatively high.