

## Subcampaign j

Advertising

## Update the GP for the current day in the classical way

Retrieve from the real curve the number of click,given the budget above

 $N_j(y_{j,t})$ 

 $(n_i(.))$ 

Number of clicks of the current day  $N_j(y_{j,t)}$ 

## Pricing

Update the TS for the current context in the classical way, given the daily number of clicks above

Extract the daily reward  $(r_{j,t})$ 

Calculate the daily regret as:  $P_{j,t} = (N_j(Y_{j,t}) * R_{j,t}) - (N_j(y_{j,t}) * r_{j,t})$ 

Prepare the value of  $n_j(.)$  and  $v_j$  for the update of the budget allocator ( $v_j$  is derived from the cumulative reward of this subcampaign)

Legend:

t = current day

 $N_i(.)$  = Real distribution function for advertising

 $n_j(.)$  = Learned (from GP) distribution function for advertising

Y<sub>i,t</sub> = Real best budget allocation

 $y_{j,t}$  = Learned best budget allocation for the budget allocator

 $R_{j,t}$  = Best daily reward

 $r_{i,t}$  = Learned daily reward

v<sub>i</sub> = Value per click

Same for the other subcampaigns

New Knapsack problem to solve:

$$\max_{y_{j,t}} \sum_{j=1}^{N} v_j \ n_j(y_{j,t})$$
s.t. 
$$\sum_{j=1}^{N} y_{j,t} \le \overline{y}_t$$