Data Intelligence Applications

Matching and Advertising Project

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Outline

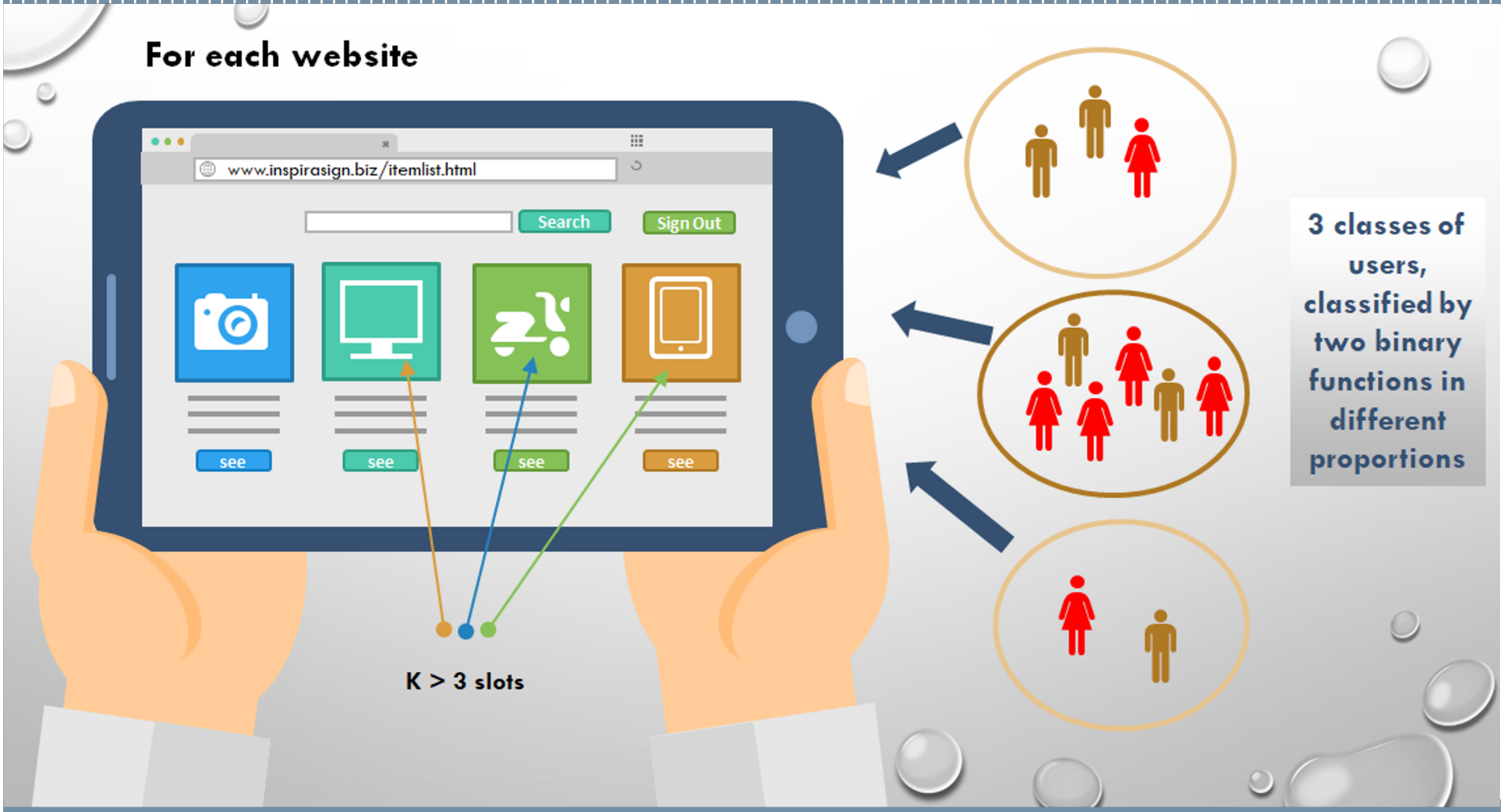
1. Environment: advertisers, publishers, users
2. Advertisers and slots: a Bipartite Matching Problem
3. Learning click probabilities: a Combinatorial Bandit Algorithm
4. Price discrimination with a user's class: Context Generation
5. Advertisers and slots with a limited budget: VCG auction
6. Campaign optimisation

1. Environment: advertisers, publishers, users

One product to advertise over a time horizon T, on four different websites

Over a time horizon T

1. Environment: advertisers, publishers, users



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1. Environment: advertisers, publishers, users

Our advertiser will learn:

- whether to disaggregate or not demand curves with respect to user's class
- the optimal bid with respect to his ad quality
- the optimal bid in competition with other stochastic advertisers (auctions for ads to be displayed in the limited number of slots)

2. Advertisers and slots: a Bipartite Matching Problem

Assumptions

- $q_{i,j}$ known by the other stochastic advertisers

  = ***P****[ad i is clicked once displayed in slot j]*

- the budgets are unlimited at first: auctions payments are neglected

⇒ match ad i to slot j (i=1,...,N; j=1,...,k; N>k)

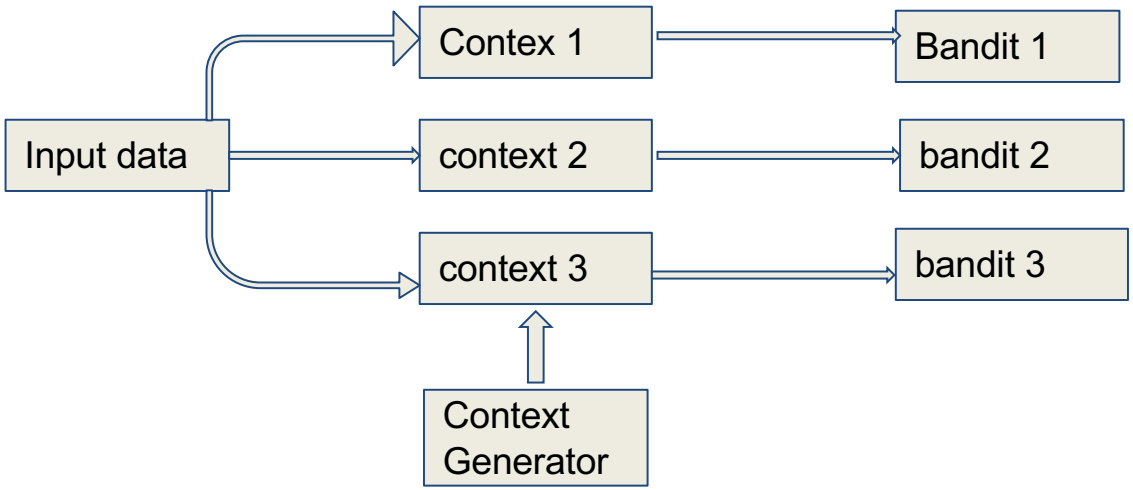
where the value of each edge is $q_{i,j}$ x b_i

3. Learning click probabilities: a Combinatorial Bandit Algorithm

Plot of the cumulative regret of our advertiser, learning $q_{i,j}$

4. Price discrimination with a user's class: Context Generation

- Context generation is used to design different bandits for different class of users



- We use Hoeffding bound: $\hat{x} - \sqrt{-\frac{log(\delta)}{2|Z|}}$

5. Advertisers and slots with a limited budget: VCG auction

Now our advertiser's budget is limited and we should consider the expected payments of the auctions, here in the case of a VCG auction - the bid is the value of the ad.

6. Campaign optimisation

Each subproblem (subcampaign) has been optimized

→ let's optimize the whole campaign!

The possible actions are the choices of bid and budget, that is initially equally distributed between the four websites.

6. Campaign optimisation

Plot of the cumulative regret of our advertiser

with respect to the clairvoyant algorithm