Machine Learning for Advertiser Engagement

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Eco-system in Online Advertising

- Users
- Ad Platform
- Publishers
- Advertisers
  - Customers of Ad Platform: Pay for the service, need customer support
## Pain Points: Don’t Know Why

<table>
<thead>
<tr>
<th>Keywords</th>
<th>Status</th>
<th>Match type</th>
<th>Current bid (max. CPC)</th>
<th>Clicks</th>
<th>Impressions</th>
<th>CTR (%)</th>
<th>Conversions</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLOAD</td>
<td>Active</td>
<td>Exact</td>
<td>0.05</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>MLOAD</td>
<td>Active</td>
<td>Content</td>
<td>0.05</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>MLOAD 2010</td>
<td>Active</td>
<td>Exact</td>
<td>0.15</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>MLOAD 2010</td>
<td>Active</td>
<td>Content</td>
<td>0.05</td>
<td>0</td>
<td>0</td>
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<tr>
<td>online advertising</td>
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</tbody>
</table>

- **No impression**: MLOAD and MLOAD 2010 have no impressions despite being active.
- **Low conversion rate**: All items have a CTR of 0.00.
- **Low CTR**: All items have a CTR of 0.00.
Pain Points: Don’t Know How
Advertiser Engagement (AE)

• Provide a set of tools or functions to help advertisers address their pain points
• If we can do it
  – Improve advertiser satisfaction and campaign performance
  – Attract more advertisers
  – Raise ad platform revenue
• Otherwise
  – Damage campaign performance
  – Cause advertiser defection
  – Hurt ad platform revenue
Machine Learning for AE

• Machine learning techniques can help
  – Ad platform is very complicated
  – We have a huge volume of data

  Diagnosis
  • Help advertisers know why

  Improvement
  • Help advertisers know how
HOW TO DIAGNOSE
Stagewise Diagnosis

Campaign performance

Ad quality issue?

Keyword-adcopy relevance issue?

LP quality issue?

Keyword-LP relevance issue?

Bid strategy issue? (keyword/price)
Diagnose Ad Quality Issues: Formulation (1)

• Multi-class classification
• Data: \{(X,Y)\}
  – X: features to represent a keyword-ad pair
  – Y: 1, adcopy quality issue;
    2, keyword-adcopy relevance issue;
    3, LP quality issue;
    4, keyword-LP relevance issue
Diagnose Ad Quality Issues: Formulation (2)

• Causality inference

• Basic idea
  – Build a causality graph to represent the dependence
  – Learn the parameters of the causality graph using training data
  – Inference the hidden sub quality issues for new ads
HOW TO IMPROVE

Improve ad quality
Improve bid strategy
Optimize Ads Quality

- Example: how to optimize ad copy
- Formulate as a machine learning problem

\[ x \Rightarrow x' \]

\[
\max_{x'} \left[ U(x') + S(x, x') + N(x') \right]
\]

- Similarity between original ad and new ad
- Quality of new ad
- Likelihood of new ad
Improve Bid Strategy

• Bid strategy
  – Determine the set of keywords to bid
  – Determine the bid prices for those keywords
• Find optimal bid strategies to fulfill a certain campaign goal
  – Given budget, maximize click number
  – Given expected click number, minimize cost
Improve Bid Strategy: Goal 1

Maximize click number

\[
\max_b \sum_j \nu_j \alpha_{1,j} c_{1,j} \\
\max_b \sum_j \nu_j \alpha_{n,j} c_{n,j}
\]

S.t. \[ \sum_j \nu_j \alpha_{i,j} c_{i,j} \beta_{i,j} \leq B_i, \forall i \]
\[(\alpha, \beta) = A(b)\]
Improve Bid Strategy: Goal 2

\[
\begin{align*}
\min_b & \sum_j v_j \alpha_{1,j} c_{1,j} \beta_{1,j} \\
& \quad \ldots \\
\min_b & \sum_j v_j \alpha_{n,j} c_{n,j} \beta_{n,j} \\
\text{S.t.} & \sum_j v_j \alpha_{i,j} c_{i,j} = C_i, \forall i \\
(\alpha, \beta) &= A(b)
\end{align*}
\]
Summary

- Advertiser engagement (AE) is very important for online advertising
- Many AE tasks can be solved by machine learning techniques
- Machine learning for AE: a very promising direction
  - Auction mechanism design for AE (David Parkes’ talk)
  - Optimizing landing page
  - Campaign/account level bid strategy optimization
  - ...
Acknowledgement

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  – Tie-Yan Liu
  – Bin Gao
  – Taifeng Wang
Thanks

We are hiring!

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