

CLAIMS

1. A computer-implemented method for grouping users, comprising:

dividing a plurality of users targeted by ~~the~~ an advertisement candidate into a plurality of user buckets, wherein each of the plurality of user buckets is associated with a first conversion score;

obtaining a trained prediction model corresponding to the advertisement, wherein the trained prediction model is able to predict a conversion score based at least on the first conversion score associated with a user bucket and a second conversion score associated with a group of user buckets comprising the user bucket;

constructing an optimization model using the trained prediction model, wherein an objective function of the optimization problem is to maximize a total conversion score with a grouping strategy represented by a plurality of decision variables;

solving the optimization problem to determine values of the plurality of decision variables; and

assigning the plurality of user buckets to one or more user groups for the advertisement candidate according to the grouping strategy.

wherein:

each of the plurality of users is associated with a third conversion score corresponding to the advertisement;

each of the plurality of user buckets comprises one or more of the plurality of users;
and

the first conversion score associated with the each of the plurality of user buckets comprises an average of one or more third conversion scores associated with the one or more of the plurality of users in the each of the plurality of user buckets.

2. The method of claim 1, further comprising:

identifying a plurality of the advertisement candidates targeting a user;

for each of the plurality of the advertisement candidates, determining a score for delivering the each advertisement candidate to the user, wherein the score is determined based at least on the grouping strategy;

identifying one or more of the plurality of advertisement candidates based at least on one or more corresponding scores; and

automatically delivering the one or more advertisement candidates to a computing device associated with the user to cause the one or more advertisement candidates to be displayed on the computing device.

3. The method of claim 2, wherein the determining a score for delivering the each advertisement candidate comprising:

determining the score based at least on the first conversion score associated with one of the plurality of user buckets comprising the user, and the second conversion score associated with one of the one or more user groups comprising the one user bucket.

4. The method of claim 2, wherein the identifying one or more of the plurality of advertisements comprises:

identifying the one or more advertisement candidates with the highest scores.

~~5. The method of claim 1, wherein:~~

~~each of the plurality of users is associated with a third conversion score corresponding to the advertisement;~~

~~each of the plurality of user buckets comprises one or more of the plurality of users;~~
~~and~~

~~the first conversion score associated with the each of the plurality of user buckets comprises an average of one or more third conversion scores associated with the one or more of the plurality of users in the each of the plurality of user buckets.~~

~~65.~~ The method of claim ~~51~~, wherein:

the third conversion score is a click through rate in response to the advertisement.

~~76.~~ The method of claim 1, wherein:

the second conversion score associated with a group of one or more of the plurality of user buckets is determined based at least on the first conversion scores associated with the one or more of the plurality of user buckets in the group and a number of users in each of the one or more of the plurality of user buckets.

~~87.~~ The method of claim 1, wherein:

the prediction model is a tensor flow model that fits historical data of exposure rate to estimate a plurality of parameters of a logistic function.

~~98~~. The method of claim 1, wherein:

the values of the plurality of decision variables are binary values; and
each of the plurality of decision variables represents whether one of the plurality of user buckets is assigned to one of the one or more user groups.

~~109~~. The method of claim 1, wherein:

a quantity of the one or more user groups is a configurable value associated with the advertisement.

~~110~~. The method of claim 1, wherein:

the optimization model comprises a constraint that one user bucket is assigned to one and only one user group.

~~1211~~. The method of claim 1, wherein:

the objective function of the optimization problem is $\max \sum_{j=1}^J \sum_{i=1}^I f(s_i, t_j) * n_i * x_{ij}$;

where J is the quantity of the one or more user groups;

where j corresponds to j_{th} user group;

where I is a number of the plurality of user buckets;

where i corresponds to i_{th} user bucket;

where $f(s_i, t_j)$ corresponds to the trained prediction model;

where s_i corresponds to the first conversion score of the i_{th} user bucket;

where t_j corresponds to the second conversion score of the j_{th} user group;

where n_i corresponds to a number of users in the i_{th} user bucket; and

where x_{ij} corresponds to a decision variable indicating whether the i_{th} user bucket is assigned to the j_{th} user group.

~~1312~~. A system for grouping users, comprising one or more processors and one or more non-transitory computer-readable memories coupled to the one or more processors and configured with instructions executable by the one or more processors to cause the system to perform the method of any claims 1-~~1211~~.

~~44~~13. A non-transitory computer-readable storage medium configured with instructions executable by one or more processors to cause the one or more processors to perform the method of any claims 1-~~42~~11.

~~45~~14. An apparatus for grouping users comprising a plurality of modules for performing the method of any claims 1-~~42~~11.