Avazu Click-Through Rate Prediction

Late submission solution by Pavel Troshenkov

Moscow, Russia, 2018

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Task

In this competition we are asked for CTR problem. We need to predict the probability of user's click on advertisement

Metrics

- Logloss

Dataset

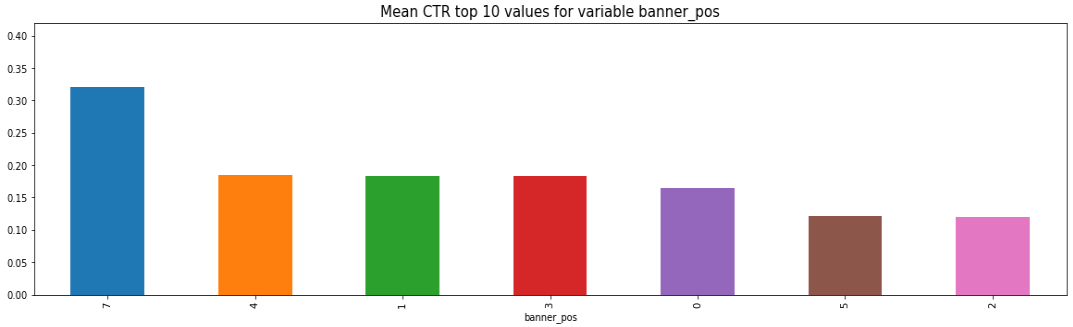
- 40 kk samples for train and 4 kk for test
- 22 categorical features

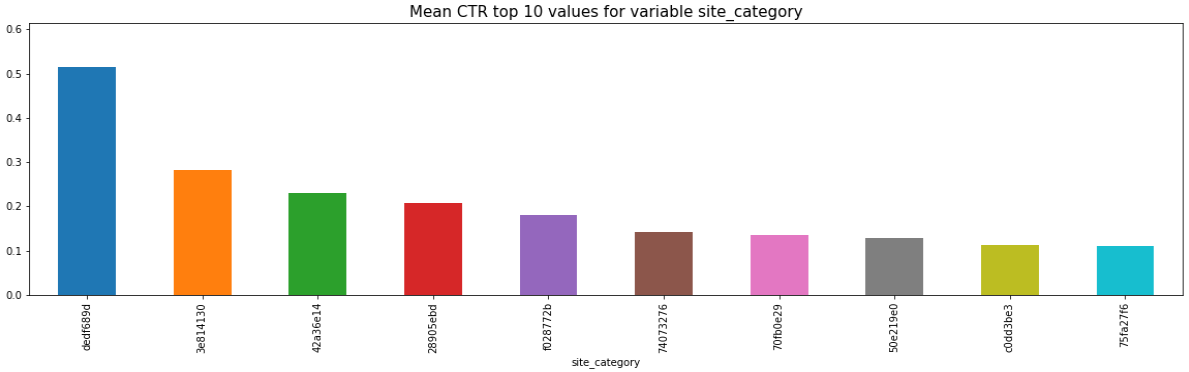
Feature space

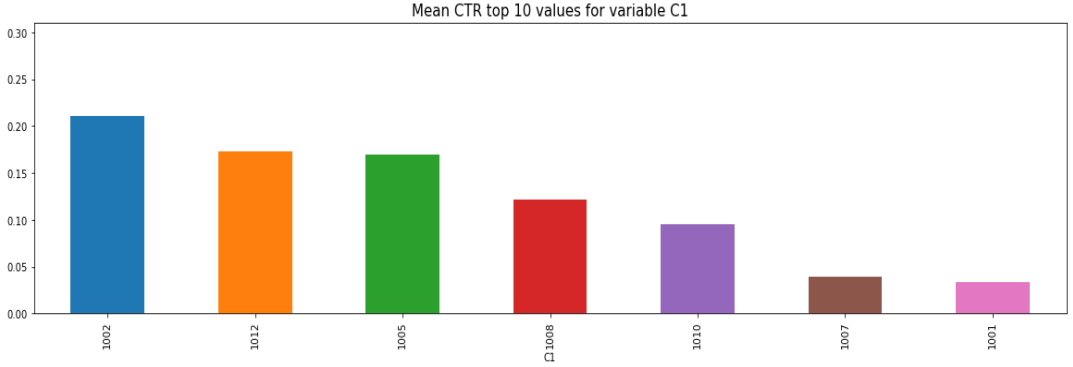
- We are given with only categorical features with thousands of unique values

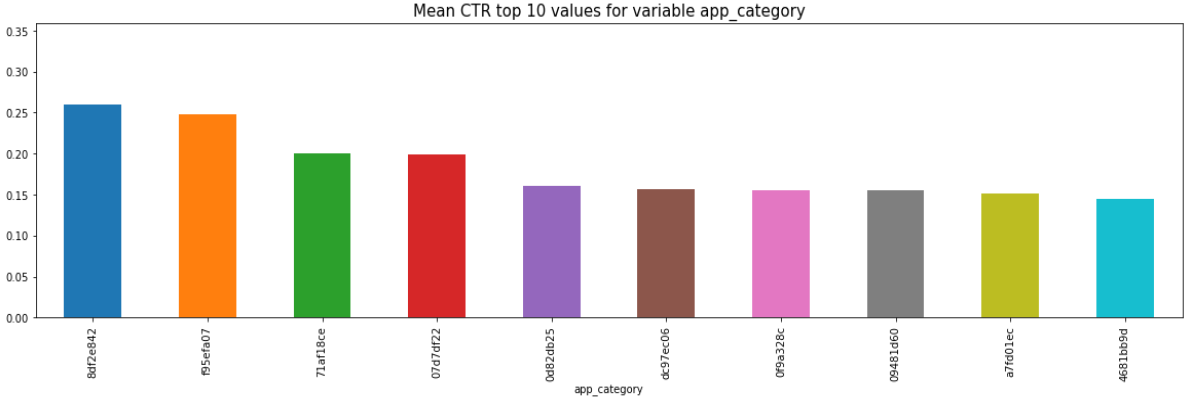
Data observation (1/3)

CTR average values differ by different categorical features



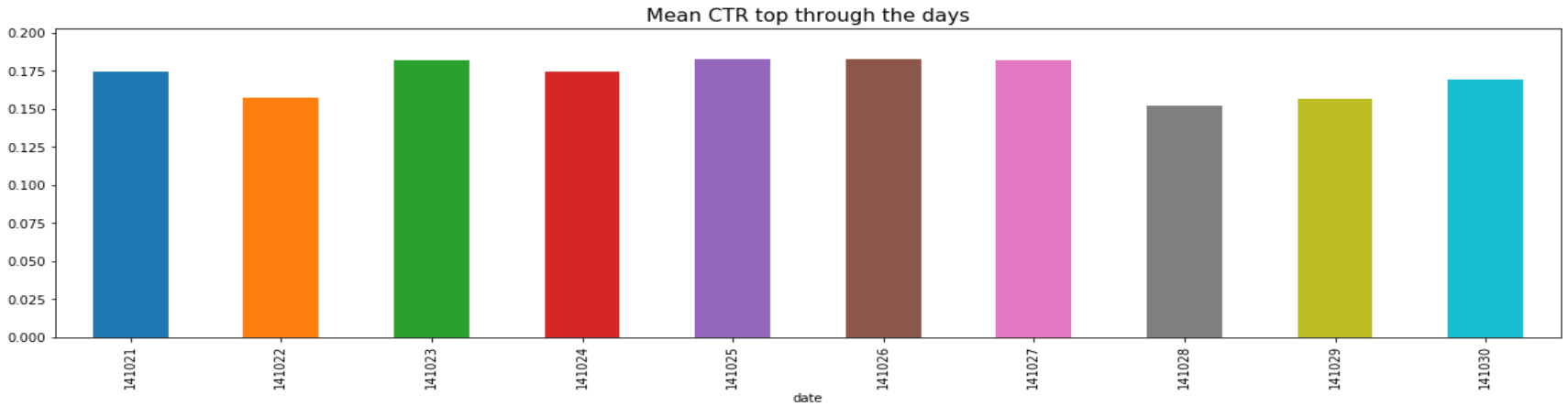




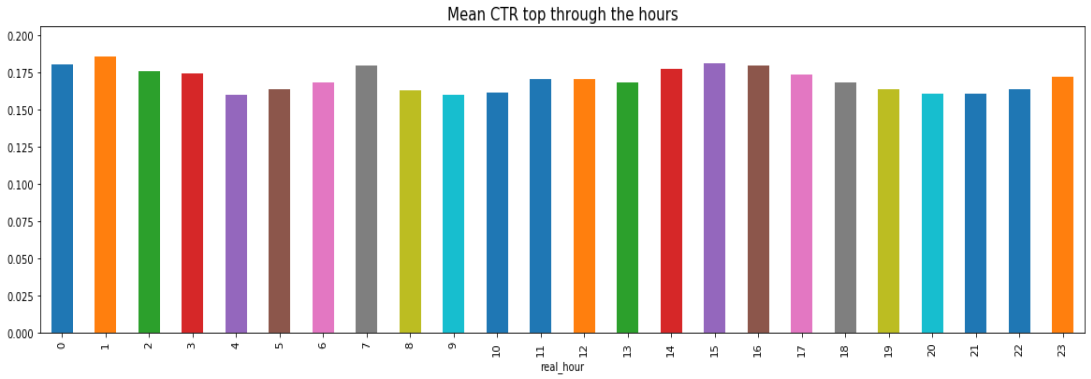


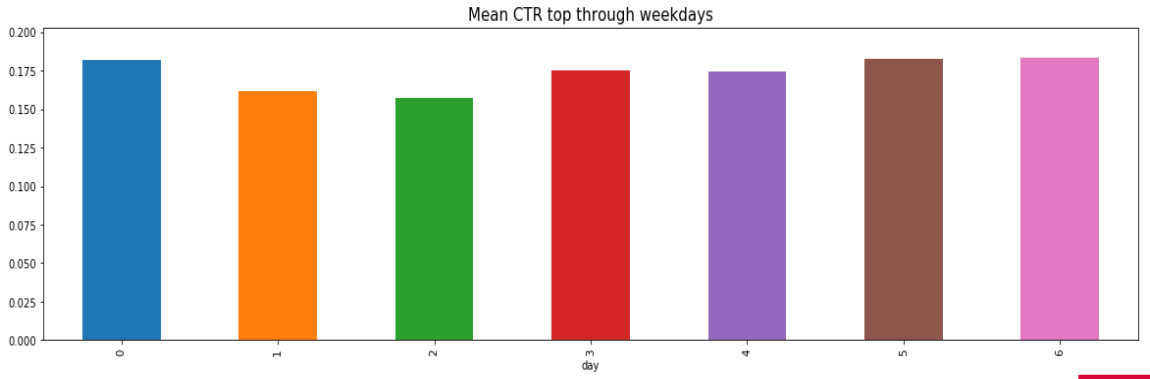
Data observation (2/3)

CTR average values through dates in train file



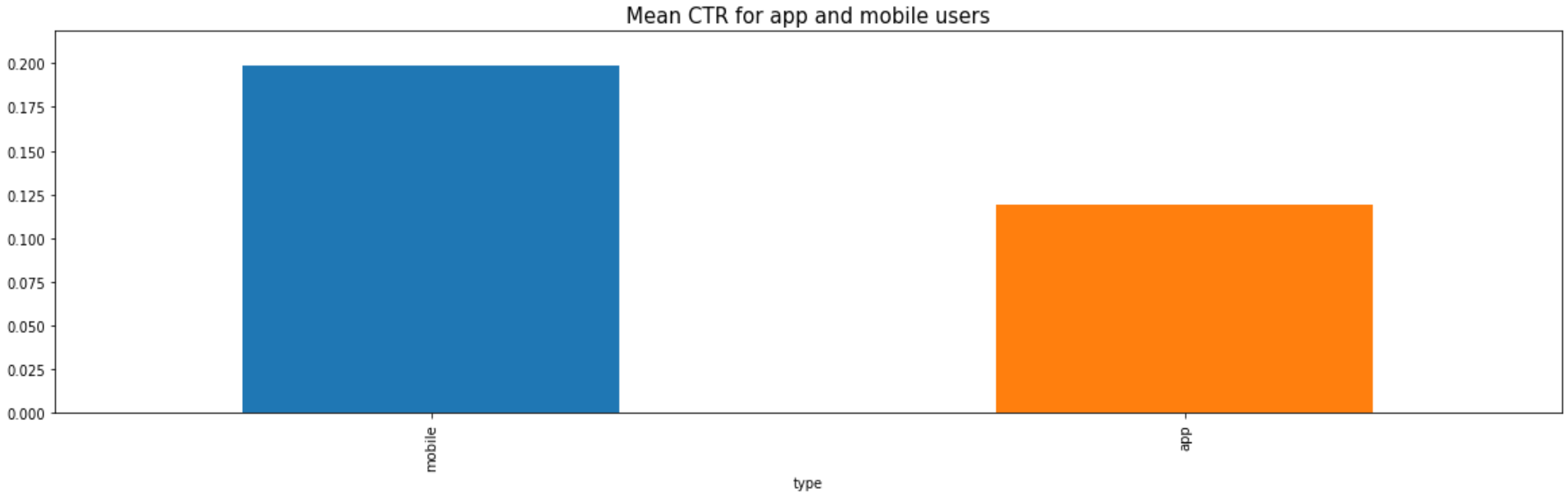
CTR seasonality by weekdays and hours





Data observation (3/3)

- ‘site_id’ == 85f751fd stands for app users
- Mobile and app users have a huge difference in average CTR



Data observation: Conclusion

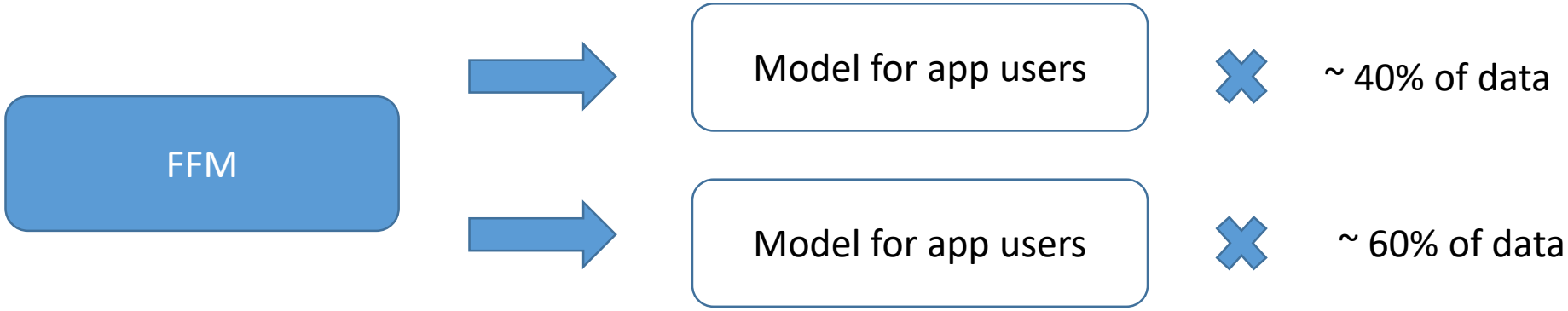
- Use factorization machines model as we have only categorical features with a lot of (> 2kk) unique values
- Since mobile and app users have a huge difference in average CTR, I will set up different models for them

Feature engineering

Feature	Comment
day	extracted from hour as a weekday number
time	extracted from hour
user	device_id + device_model + device_ip
user_count_hour	how many times times user appeared per hour
user_count_date	how many times times user appeared per date
user_nunique_hour_site_category	how many times site_category user visited per hour
user_nunique_hour_app_domain	how many times app_domain user visited per hour
user_nunique_hour_C15	how many times C15 user visited per hour
user_nunique_hour_C16	how many times C16 user visited per hour
user_nunique_hour_C17	how many times C17 user visited per hour
user_nunique_hour_C19	how many times C19 user visited per hour
user_nunique_hour_C21	how many times C21 user visited per hour
user_nunique_date_site_category	how many times site_category user visited per day
user_nunique_date_app_domain	how many times app_domain user visited per day
user_nunique_date_C15	how many times C15 user visited per day
user_nunique_date_C16	how many times C16 user visited per day
user_nunique_date_C17	how many times C17 user visited per day
user_nunique_date_C19	how many times C19 user visited per day
user_nunique_date_C21	how many times C21 user visited per day
place_id	site_id + app_id
place_genre_id	site_id + app_id + site_category + app_category
tech_position	banner_pos + device_conn_type
add_position	place_id + banner_pos
union_category	site_category + app_category
ultra_C_type	C1 + C14 + … + C21
user_history	cumulative sum of visits of user per day
place_history	cumulative sum of visits of place per day

Models structure

!!! Both models were trained only on 40% of data due to technical reasons



Models based on LibFFM[1]

Model for app users was trained with 10 latent features and gave local CV around 0.372 logloss

```
C:\Users\user>"D:\Downloads\avazu_feedzai\libffm-ftrl-master\libffm-ftrl-master\ffm-train.exe"  -p "D:\Downloads\avazu_f
eedzai\ffm_txt\val_app_ffm.txt" -s 4 -k 10 -t 200  --no-rand --on-disk --auto-stop  "D:\Downloads\avazu_feedzai\ffm_txt\
train_app_ffm.txt"
iter   tr_logloss   va_logloss
   1      0.29883      0.37209
   2      0.27931      0.38885
Auto-stop. Use model at 1th iteration.
```

Model for mob users was trained with 6 latent features and gave local CV around 0.412 logloss

```
Командная строка - D:\Downloads\avazu_feedzai\libffm\ffm-train.exe  -p D:\Downloads\avazu_feedzai\val_ffm.txt -s 6 -k 6 -l 2e-0...
Microsoft Windows [Version 10.0.16299.192]
(c) Корпорация Майкрософт (Microsoft Corporation), 2017. Все права защищены.

C:\Users\user>D:\Downloads\avazu_feedzai\libffm\ffm-train.exe -p D:\Downloads\avazu_feedzai\val_ffm.txt -s 6 -k 6 -l 2e-
05 -t 200 -r 0.2 --auto-stop D:\Downloads\avazu_feedzai\train_ffm.txt

iter   tr_logloss   va_logloss
   1      0.44178      0.43197
   2      0.43134      0.42887
   3      0.42875      0.42664
   4      0.42669      0.42475
   5      0.42496      0.41285
   6      0.42314      0.42439
Auto-stop. Use model at 1th iteration.
```

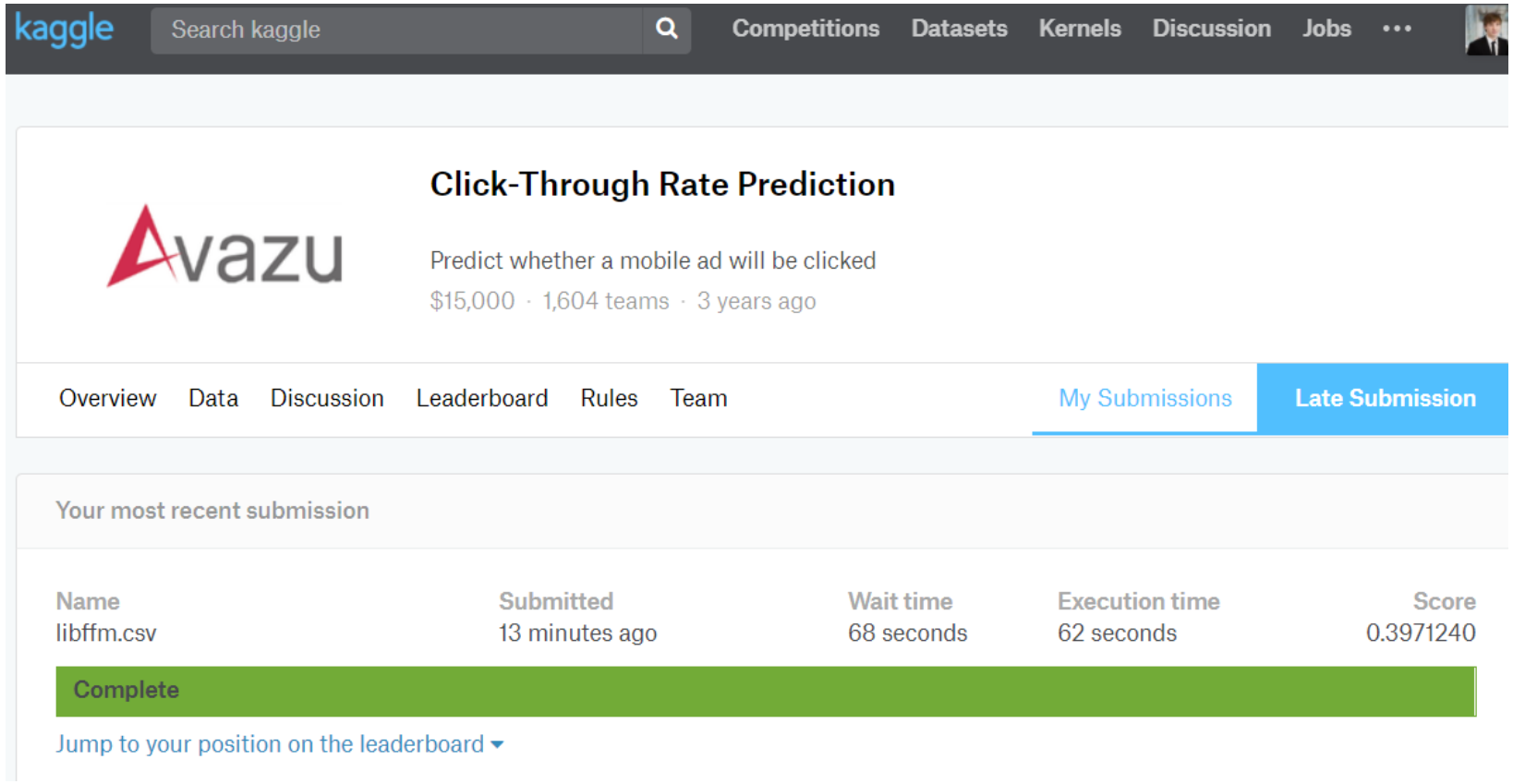
CV validation

- Same features were generated separately for mobile and app users
- Test size was set as 20%

[1] Library can be found at https://github.com/CNevd/libffm-ftrl

Results[1]

Private LB 0.397 Logloss (~990 place)



[1] This result was obtained on 40% of training data. Using full set should improve accuracy

Area for improvement

- Parameter tuning (latent features and regularization)
- More feature engineering
- More data
- More models (additional splits by other categorical features besides site_id)

Thank you

- Code https://github.com/paveltr/avazu_late_submission
- My profile https://www.linkedin.com/in/paveltr