Avazu Click-Through Rate Prediction

Late submission solution by Pavel Troshenkov

Moscow, Russia, 2018

Table of contents

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

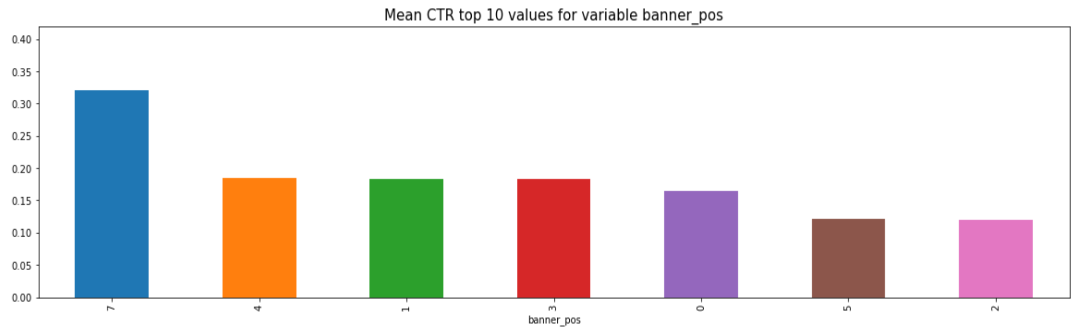
- 40 kk samples for train and 1 kk for test
- 22 categorical features

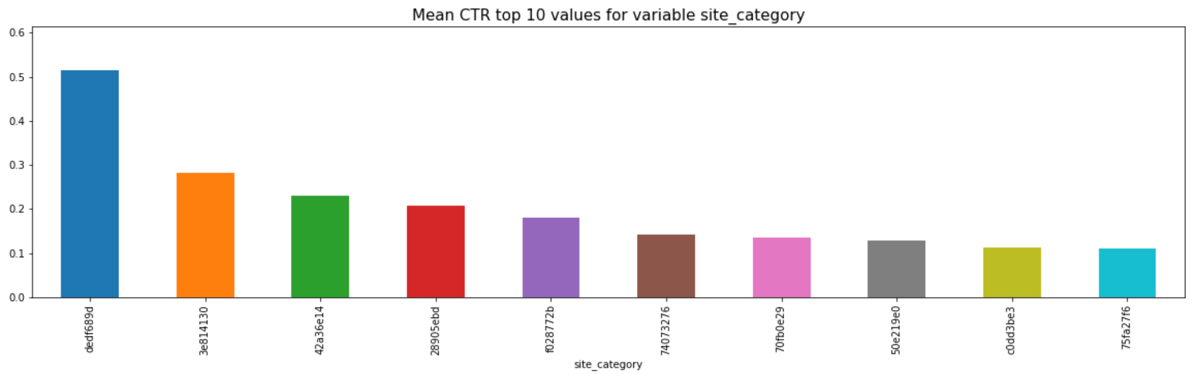
Feature space

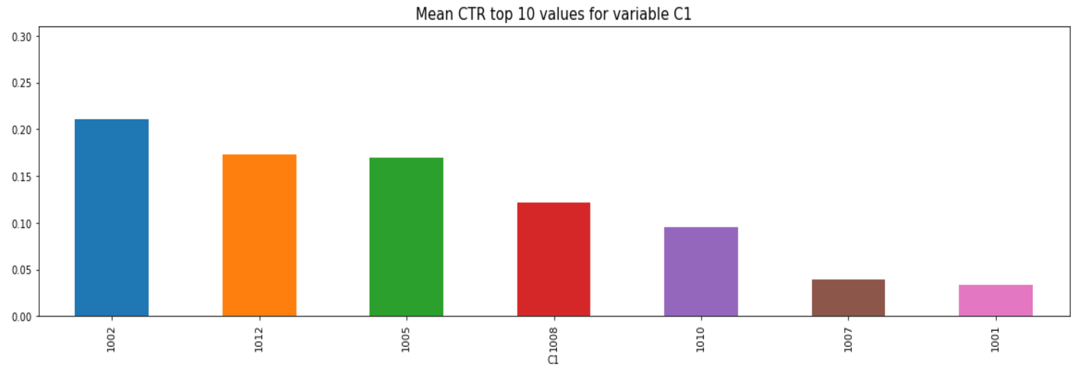
- We are given with only categorical features with thousands of unique values

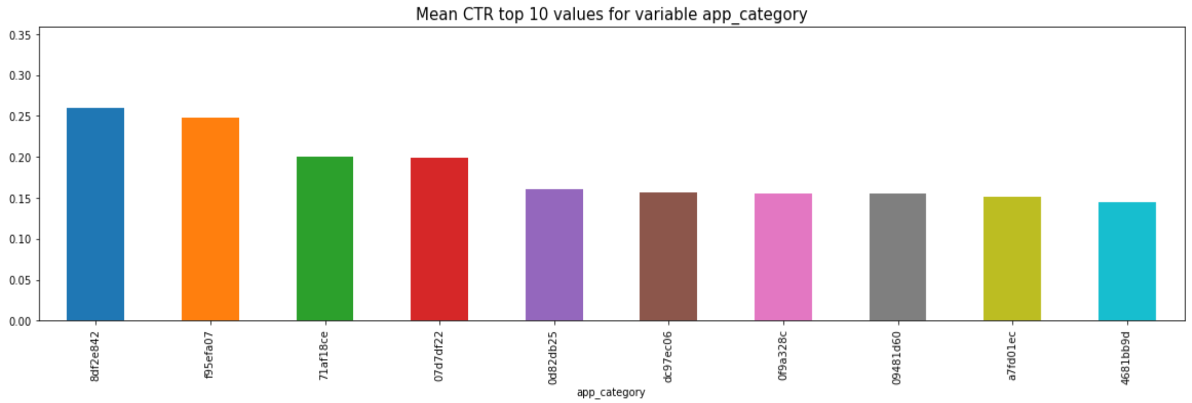
Data observation (1/3)

CTR average values differ by different categorical features



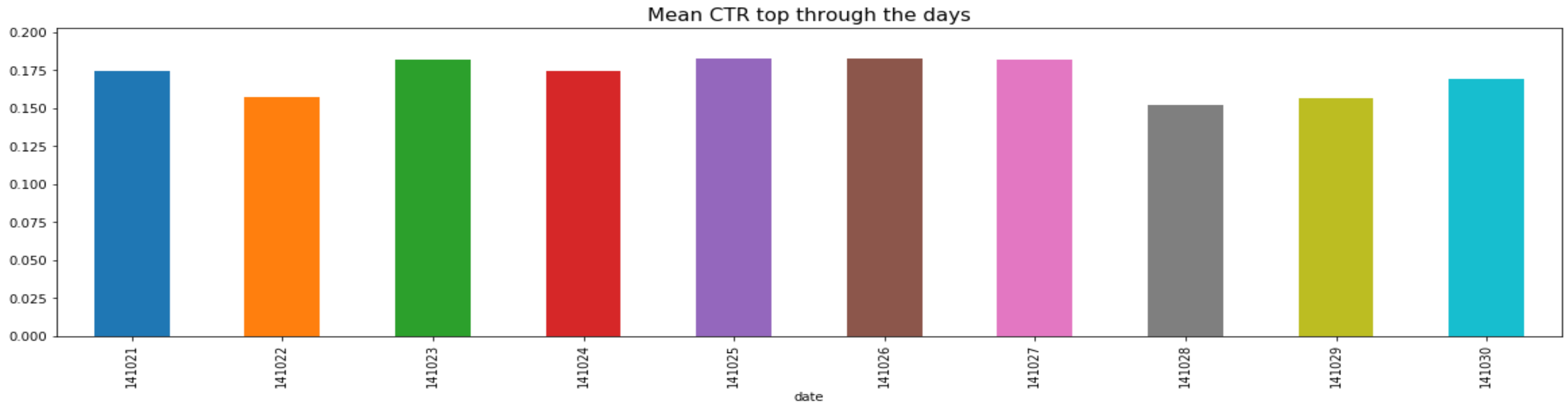




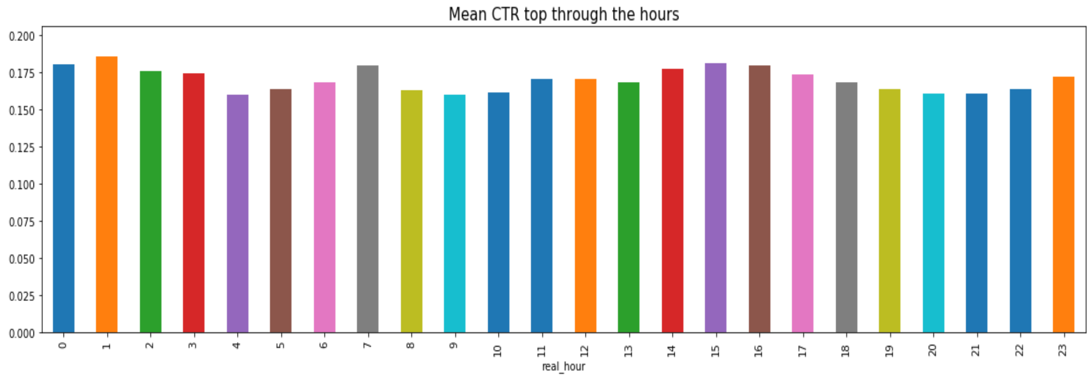


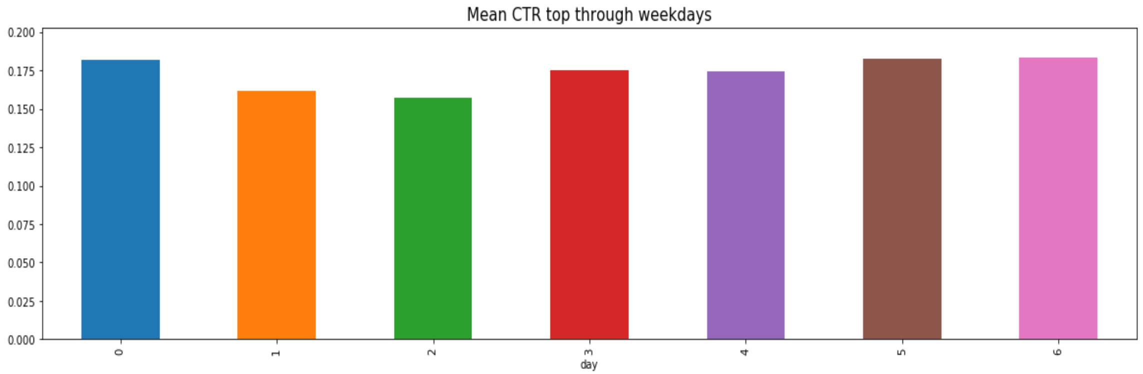
Data observation (2/3)

CTR average values through dates in train file



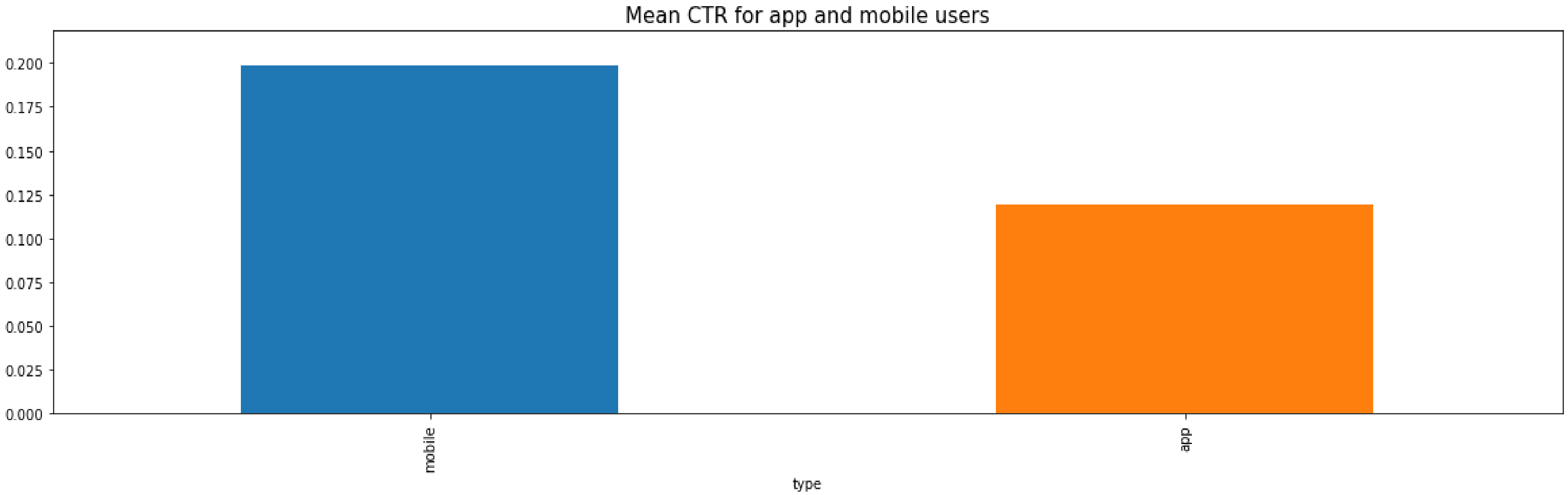
CTR seasonality by weekdays and hours





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

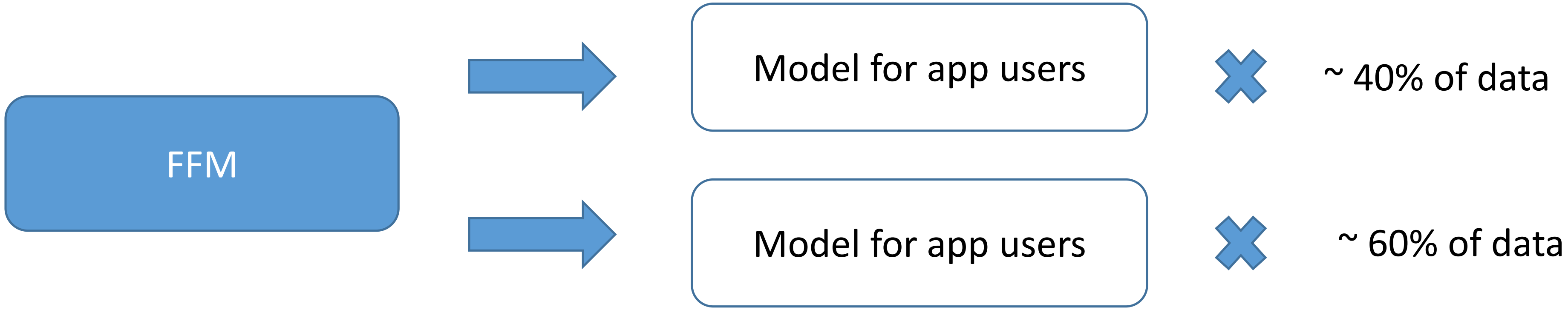
- Since mobile and app users have a huge difference in average CTR, I will set up different models for them

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 where train 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 where train 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.
```

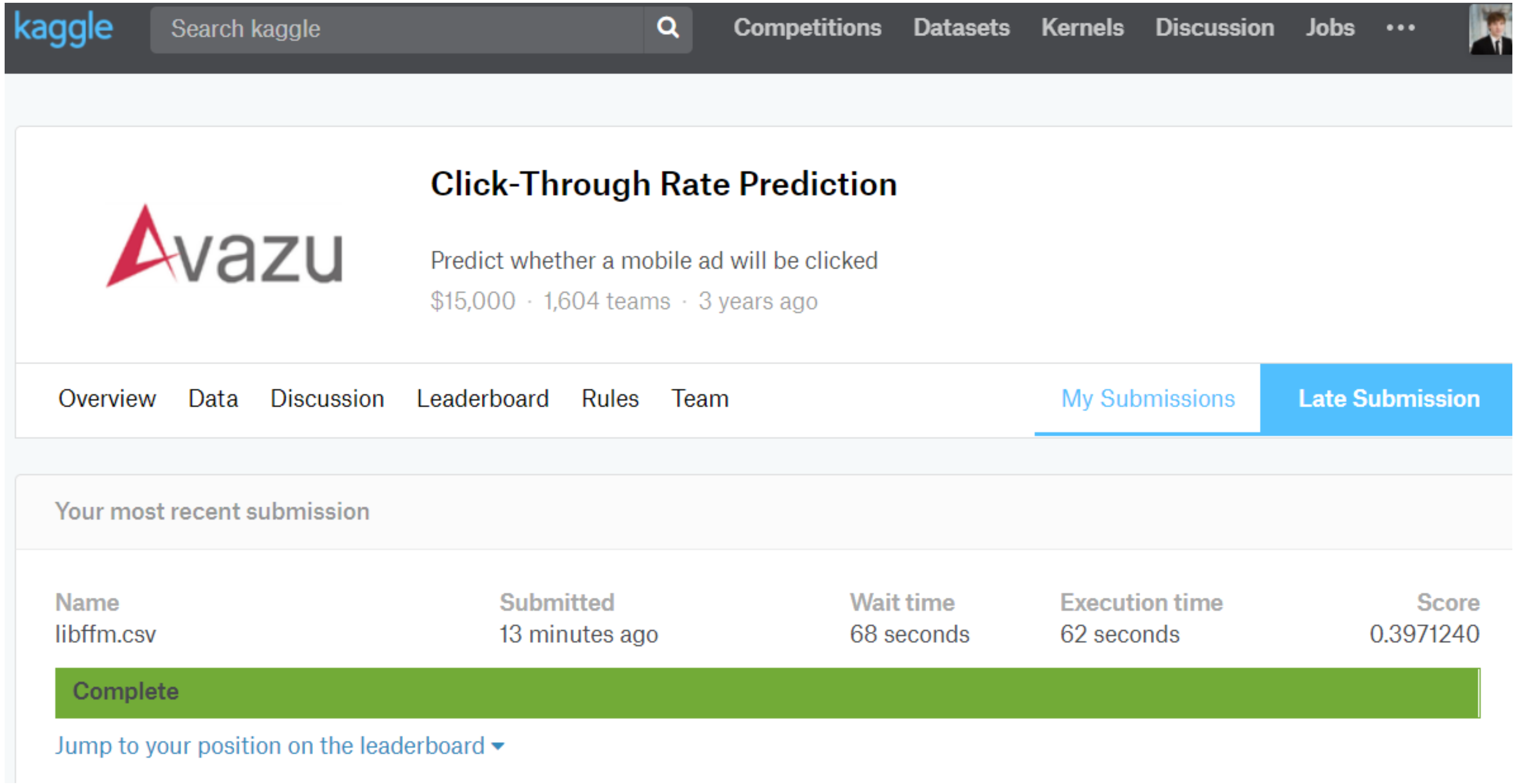
CV validation

- 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