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Predicting Future Sales

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Agenda

1. Overview
2. Critique of Other Competition Submissions
3. Our Solution
4. Final Prediction

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Overview

Objective: Predict total sales (quantity) for every product and store in the next month (November 2015)

Dataset: includes 6 csv files from 1C company (Russian software company)

- items:

	A	B	C
1	item_name	item_id	item_category_id
2	ÐÐ¡Ð¢Ð˜ ÐÐÐ’ÐÐ–Ð”Ð•ÐÐ˜Ð¯ (ÐŸÐ›ÐÐ	0	40
3	Professional Edition Full [PC, Ð¦Ð¸Ñ„Ñ€Ð	1	76
4	Ð’ Ð›Ð£Ð§ÐÐ¥ Ð¡Ð›ÐÐ’Ð« (UNV)	2	40
5	“ÐžÐ›Ð£Ð‘ÐÐ¯ Ð’ÐžÐ›ÐÐ (Univ)	3	40
6	ÐšÐžÐ ÐžÐ‘ÐšÐ (Ð¡Ð¢Ð•ÐšÐ›Ðž)	4	40
7	œÐ•Ð Ð˜ÐšÐÐÐ¡ÐšÐ˜Ð• Ð“Ð ÐÐ¤ÐФÐ˜Ð	5	40

- item_categories:

	A	B
1	item_category_name	item_category_id
2	PC - Ð“Ð°Ñ€Ð½Ð¸Ñ‚ÑƒÑ€Ñ‹/ÐÐ°ÑƒÑˆÐ½Ð¸ÐºÐ¸	0
3	ÐÐºÑÐµÑÑÑƒÐ°Ñ€Ñ‹ - PS2	1
4	ÐÐºÑÐµÑÑÑƒÐ°Ñ€Ñ‹ - PS3	2
5	ÐÐºÑÐµÑÑÑƒÐ°Ñ€Ñ‹ - PS4	3
6	ÐÐºÑÐµÑÑÑƒÐ°Ñ€Ñ‹ - PSP	4
7	ÐÐºÑÐµÑÑÑƒÐ°Ñ€Ñ‹ - PSVita	5

- shops:

	A	B
1	shop_name	shop_id
2	ÑƒÑ‚Ñ‚Ðº ÐžÑ€Ð´Ð¶Ð¾Ð½Ð¸ÐºÐ¸Ð´Ð·Ðµ, 56 Ñ„Ñ€	0
3	ƒÑ‚Ñ‚Ðº Ð¢Ð¦ "Ð¦ÐµÐ½Ñ‚Ñ€Ð°Ð»ÑŒÐ½Ñ‹Ð¹" Ñ„	1
4	ÐÐ´Ñ‹Ð³ÐµÑ Ð¢Ð¦ "ÐœÐµÐ³Ð°"	2
5	Ñˆ Ð¸Ñ…Ð° Ð¢Ð Ðš "ÐžÐºÑ‚Ñ Ð±Ñ€ÑŒ-ÐšÐ¸Ð½Ð¾	3
6	Ð¾Ð»Ð¶ÑÐºÐ¸Ð¹ Ð¢Ð¦ "Ð’Ð¾Ð»Ð³Ð° ÐœÐ¾Ð»Ð	4
7	Ð’Ð¾Ð»Ð¾Ð³Ð´Ð° Ð¢Ð Ð¦ "ÐœÐ°Ñ€Ð¼ÐµÐ»Ð°Ð´	5

Overview

- sales-train: training set

	A	B	C	D	E	F
1	date	date_block_num	shop_id	item_id	item_price	item_cnt_day
2	02.01.2013	0	59	22154	999	1
3	03.01.2013	0	25	2552	899	1
4	05.01.2013	0	25	2552	899	-1
5	06.01.2013	0	25	2554	1709.05	1
6	15.01.2013	0	25	2555	1099	1
7	10.01.2013	0	25	2564	349	1

- test: test set

	A	B	C
1	ID	shop_id	item_id
2	0	5	5037
3	1	5	5320
4	2	5	5233
5	3	5	5232
6	4	5	5268
7	5	5	5039

- sample: sample submission file in the correct format

	A	B
1	ID	item_cnt_month
2	0	0.5
3	1	0.5
4	2	0.5
5	3	0.5
6	4	0.5
7	5	0.5
8	6	0.5
9	7	0.5
10	8	0.5
11	9	0.5
12	10	0.5
13	11	0.5
14	12	0.5

Critique of Other Competition Submissions

```
#Random forest regressor model building
from sklearn.ensemble import RandomForestRegressor

RF_model = RandomForestRegressor()
RF_model.fit(X_prepared, y)
```

Random Forest

- **Pros**:
  - Suitable for large dataset
  - Easy data preparation comparing to other algorithms
- **Cons**:
  - Did not tune the hyperparameter
  - Computationally intense when number of trees is big
  - Will cause overfitting when noise is large
  - Lower output accuracy because it cannot guarantee the best tree
- **RMSE: 2.0182**

Critique of Other Competition Submissions

LightGBM (Light Gradient Boosting Machine)

- **Pros:**
  - Faster training speed, Light GBM uses a histogram-based algorithm i.e it buckets continuous feature values into discrete bins which fasten the training procedure
  - Replaces continuous values to discrete bins which results in lower memory usage
- **Cons:**
  - Light GBM split the tree leaf-wise which can lead to overfitting as it produces much complex trees
  - Did not do cross validation for hyperparameters
- **RMSE: 0.9610**

```
evals_result = {}
gbm = lgb.train(
        params,
        lgb_train,
        num_boost_round=3000,
        valid_sets=(lgb_train, lgb_eval),
        feature_name = feature_name,
        #categorical_feature = categorical_features,
        verbose_eval=5,
        evals_result = evals_result,
        early_stopping_rounds = 10)
```

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Our Solution

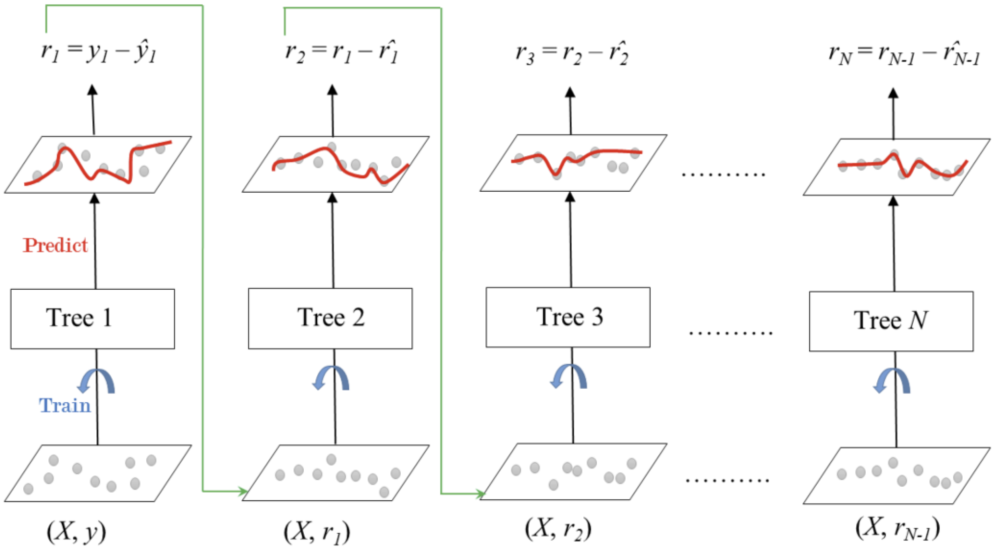
XGBoost: eXtreme Gradient Boosting--"ALL in One" algorithm

As a popular supervised-learning algorithm, XGBoost uses decision trees as base learners; combining many weak learners to make a strong learner to speed up and increase the performance of gradient boosted decision trees

- Regularization
- Parallel Processing
- Handling Missing Values
- Effective Tree Pruning

Our Solution

How does XGBoost work?



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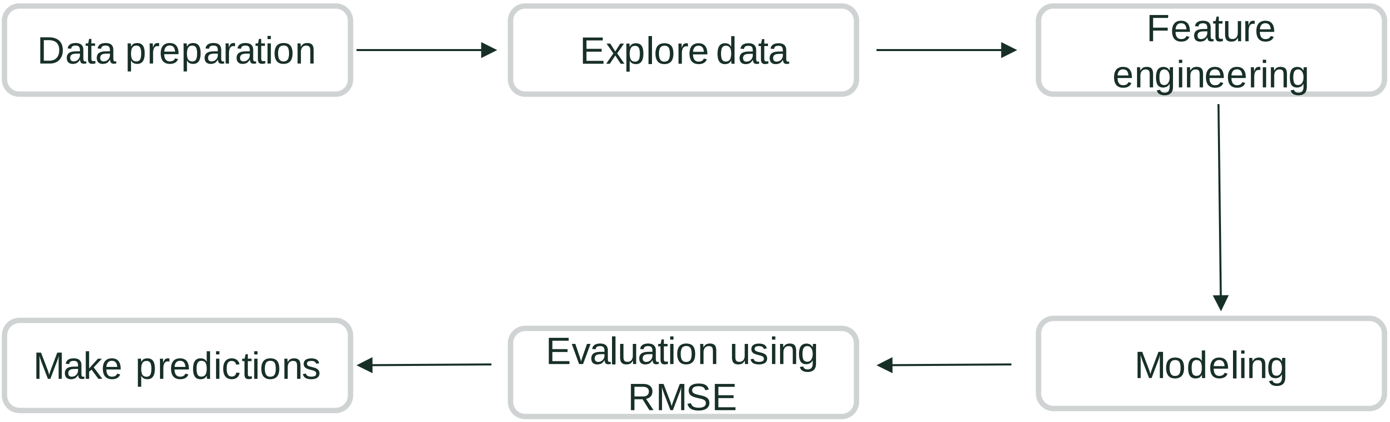
Our Solution

Flow chart



Final Prediction

Performance: RMSE=0.877

Final prediction results:

ID	item_cnt_month
33050	0.01800462
32455	0.003886187
35412	0.019796828
32228	0.020295562
35385	0
32229	0.073716491
33048	0.007104043
32454	0
32446	0.036807135
33047	0.215048745
31748	0.042575739
33046	0.073391959
32370	0.073716491
34153	0.073716491
33045	0.027066618
30784	0.031092696
34150	0.073716491
31880	0.036855627
32286	0.121237382
30785	0.008510824
33044	0.015567578
32371	0.004501749

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