NTDS Project: Bike Sharing Demand

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Acquisition of Row data

On Kaggle, Dataset from 13/10/2014 to 31/08/2016 (689 days):

kaggle

- Station.csv (58 ,8)
- Trip.csv (236065, 14)
- Weather.csv (689, 20)

How to predict the bikes demand at each station of Seattle?

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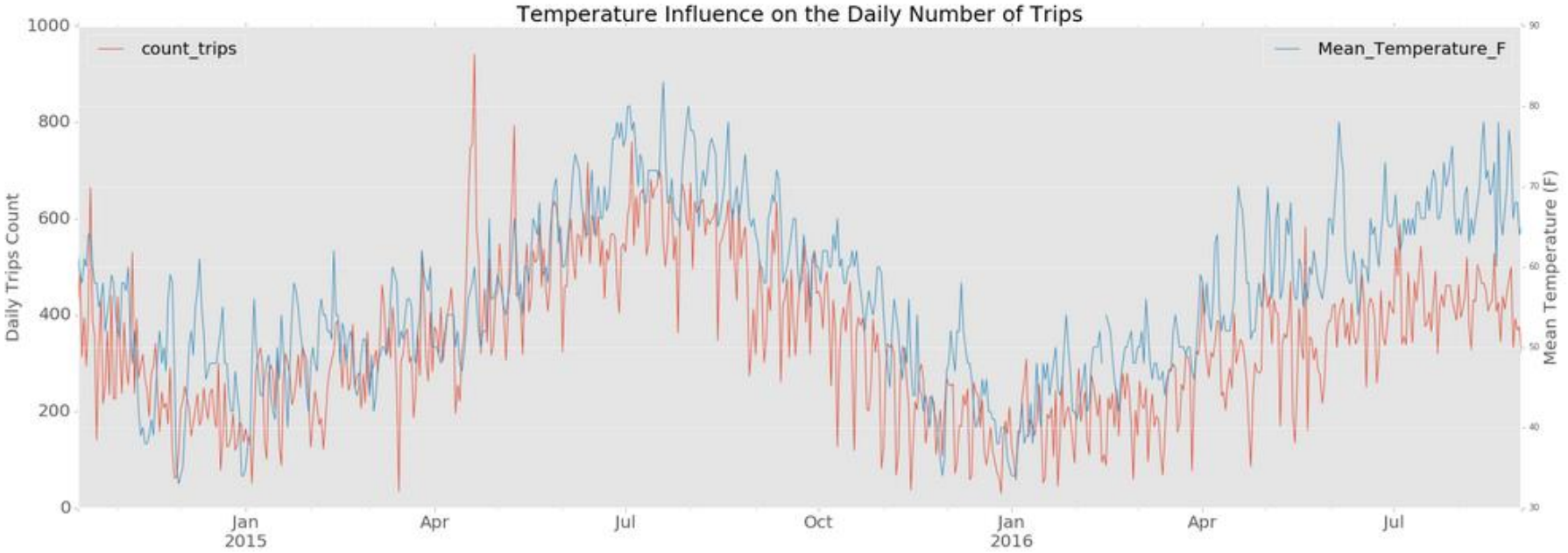
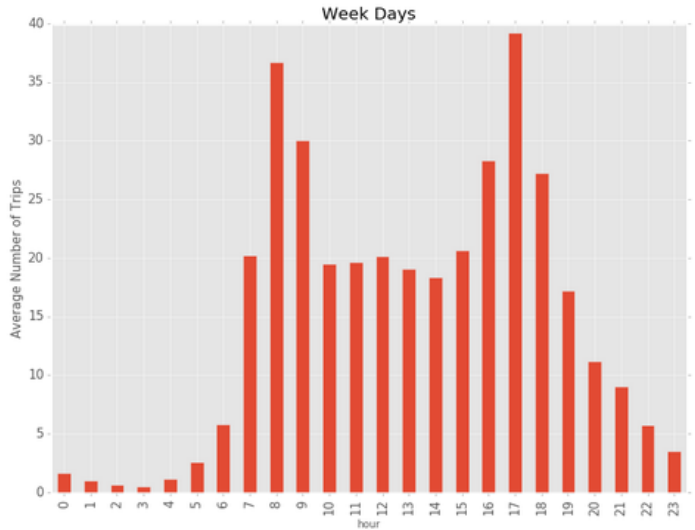
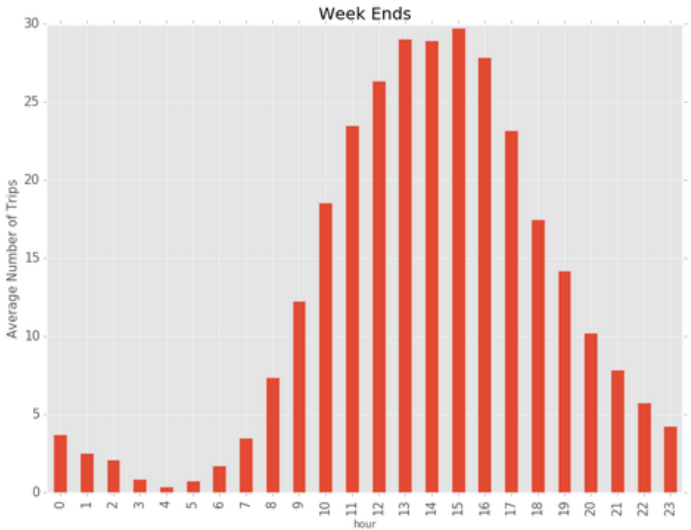
Exploration: Users Behaviors

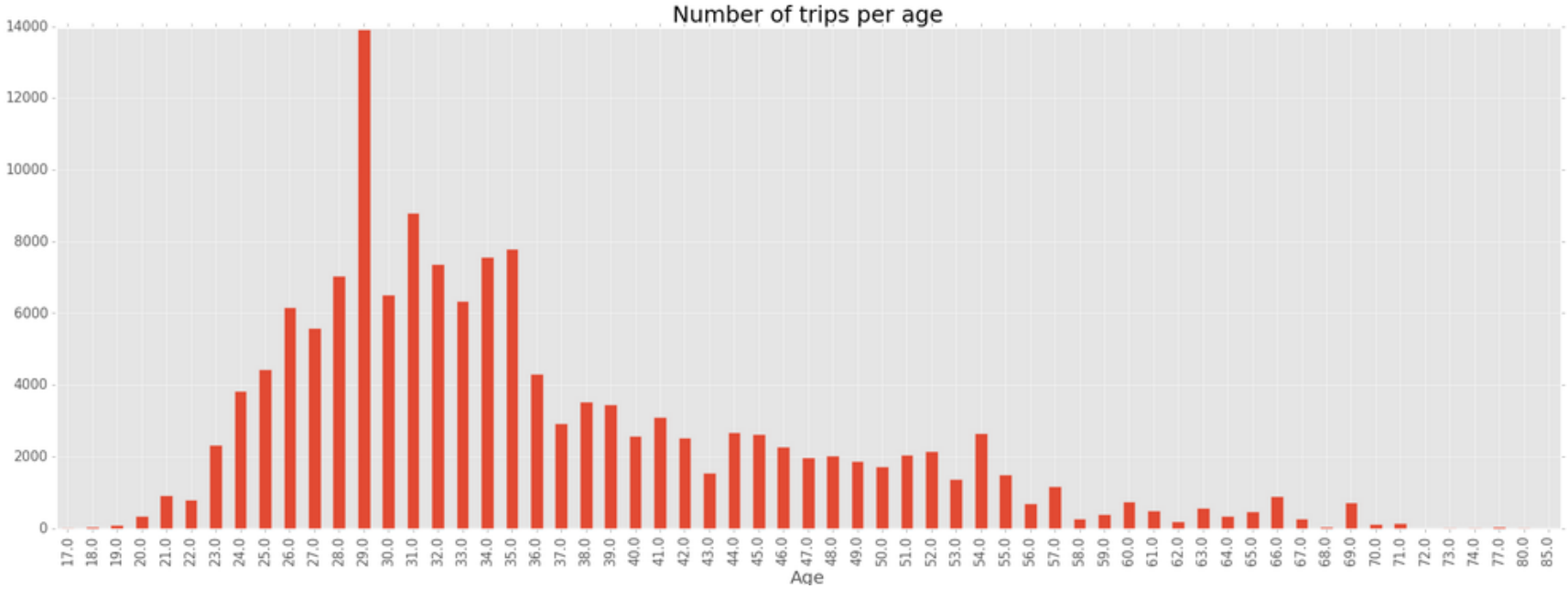
- Daily and Hourly Analysis



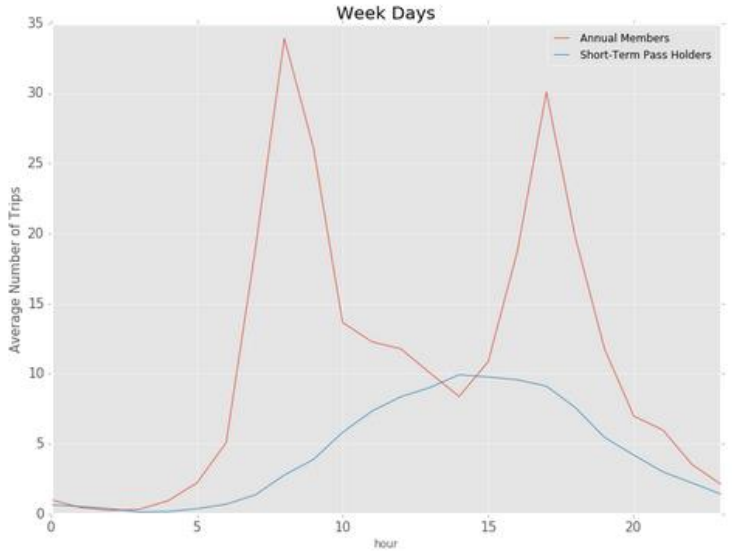


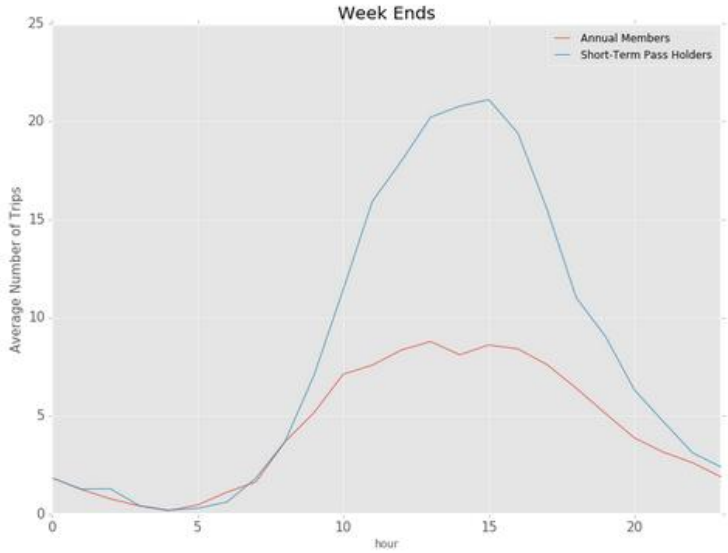


- Age Analysis



- Type of user: Annual Member or Short-Term Pass Holder (24H or 3D pass)





PCA Analysis on daily trends

- 25 dimensions and 4 labels

hour	0	1	2	3	4	5	6	7	8	9	...	19	20	21	22	23	Mean_Temperature_F	Precipitation_In	day_of_week	Events	total_trips
date																					
2014-10-13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	12.0	12.0	10.0	4.0	3.0	62.0	0.00	week	2	406.0
2014-10-14	0.0	0.0	0.0	0.0	0.0	1.0	5.0	22.0	35.0	25.0	...	28.0	17.0	13.0	6.0	2.0	59.0	0.11	week	2	489.0
2014-10-15	3.0	2.0	1.0	0.0	0.0	0.0	7.0	10.0	12.0	21.0	...	21.0	12.0	12.0	8.0	1.0	58.0	0.45	week	2	312.0
2014-10-16	4.0	1.0	0.0	0.0	0.0	2.0	7.0	14.0	35.0	25.0	...	22.0	21.0	8.0	6.0	6.0	61.0	0.00	week	2	389.0
2014-10-17	2.0	1.0	1.0	0.0	0.0	1.0	5.0	16.0	28.0	26.0	...	15.0	10.0	20.0	9.0	2.0	60.0	0.14	week	2	292.0

- Aim: reduce to 2 dimensions & identify similar patterns

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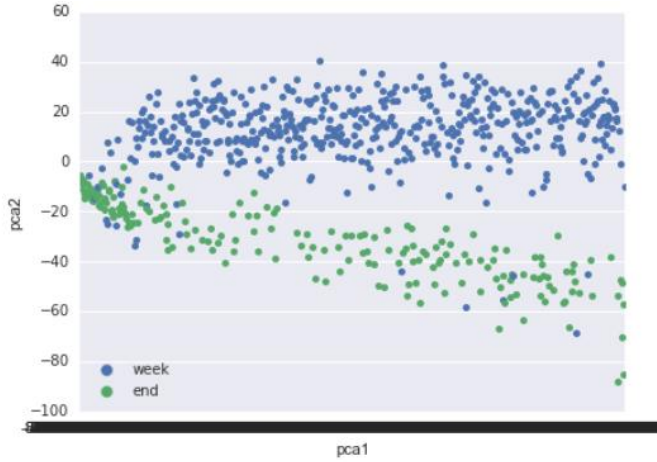
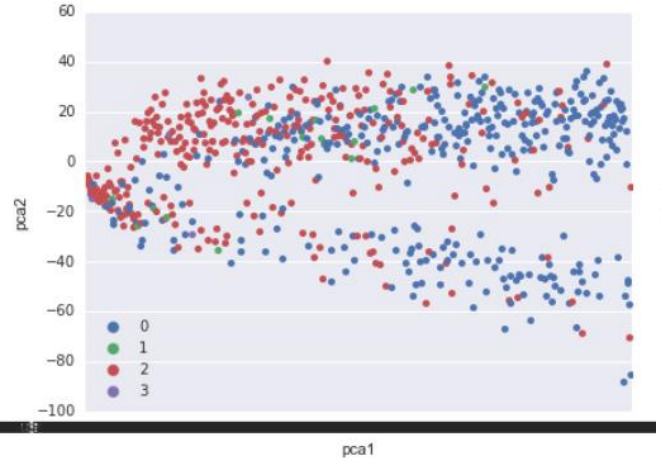
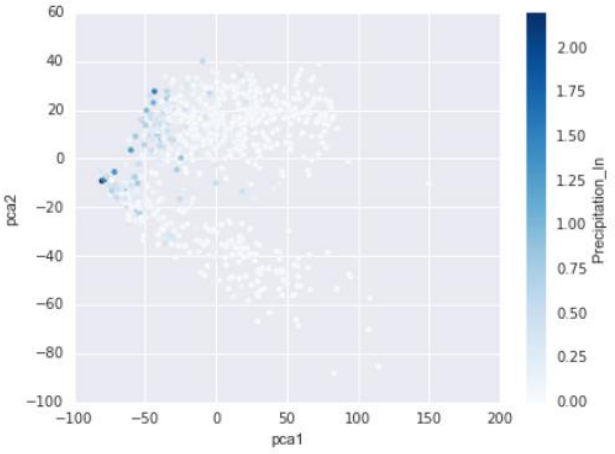
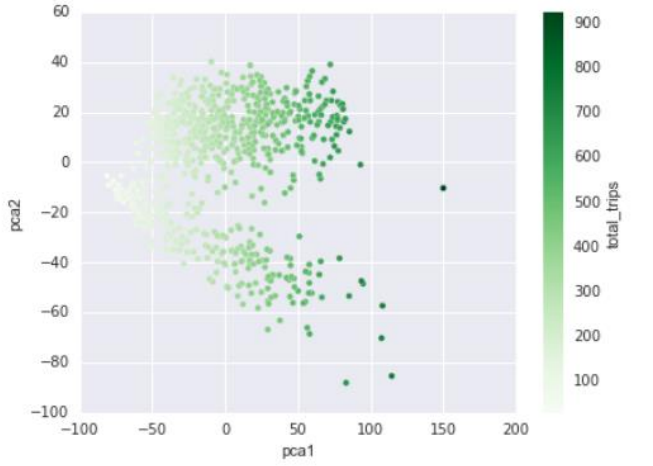
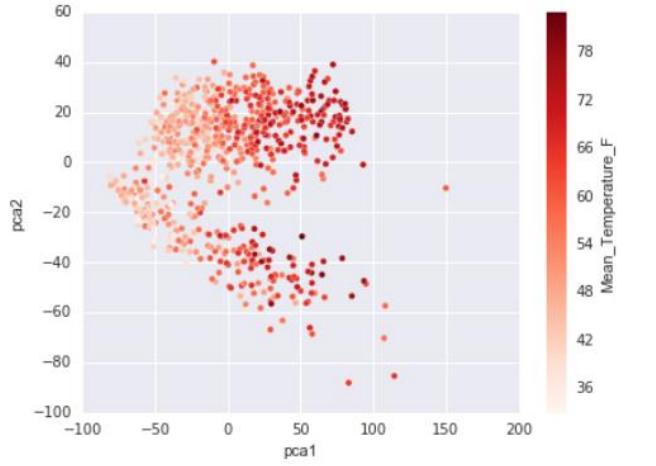
- Applying PCA & Visualization











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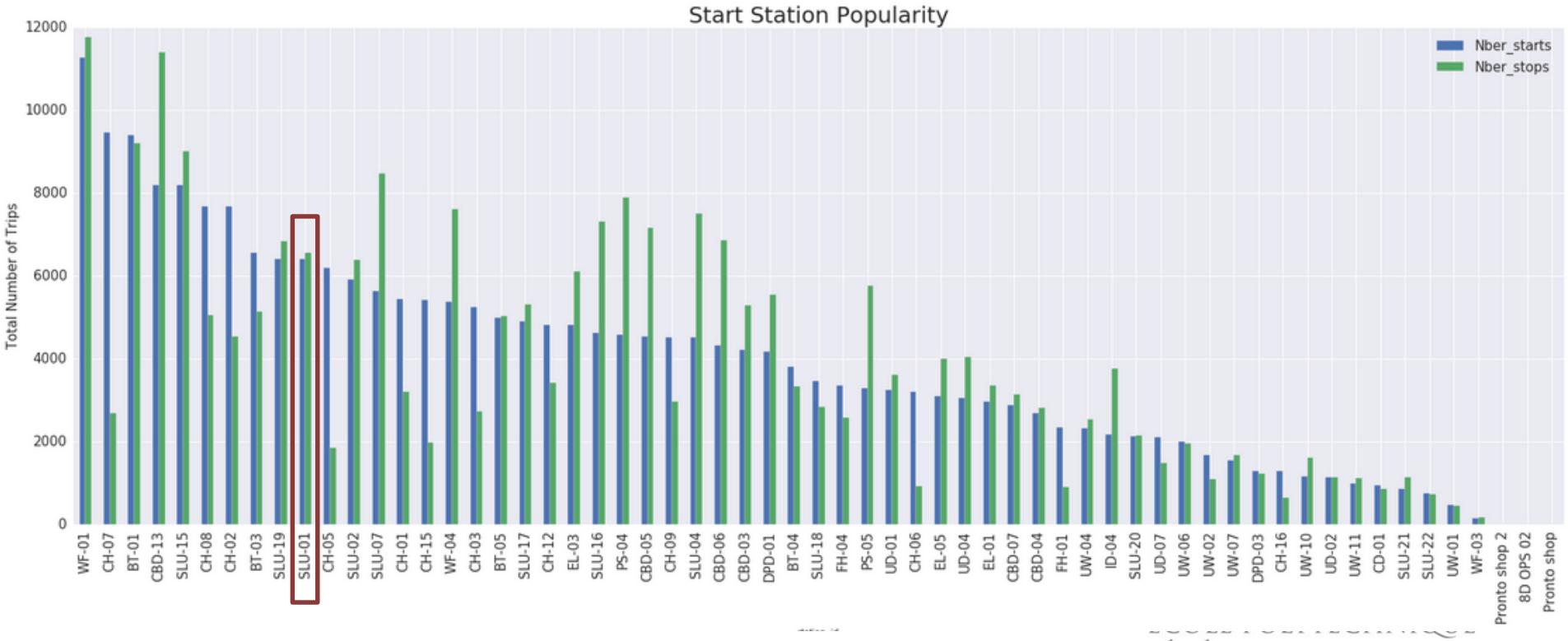
Bikes Variation Analysis Per Station

- Which are the most popular start/stop stations?



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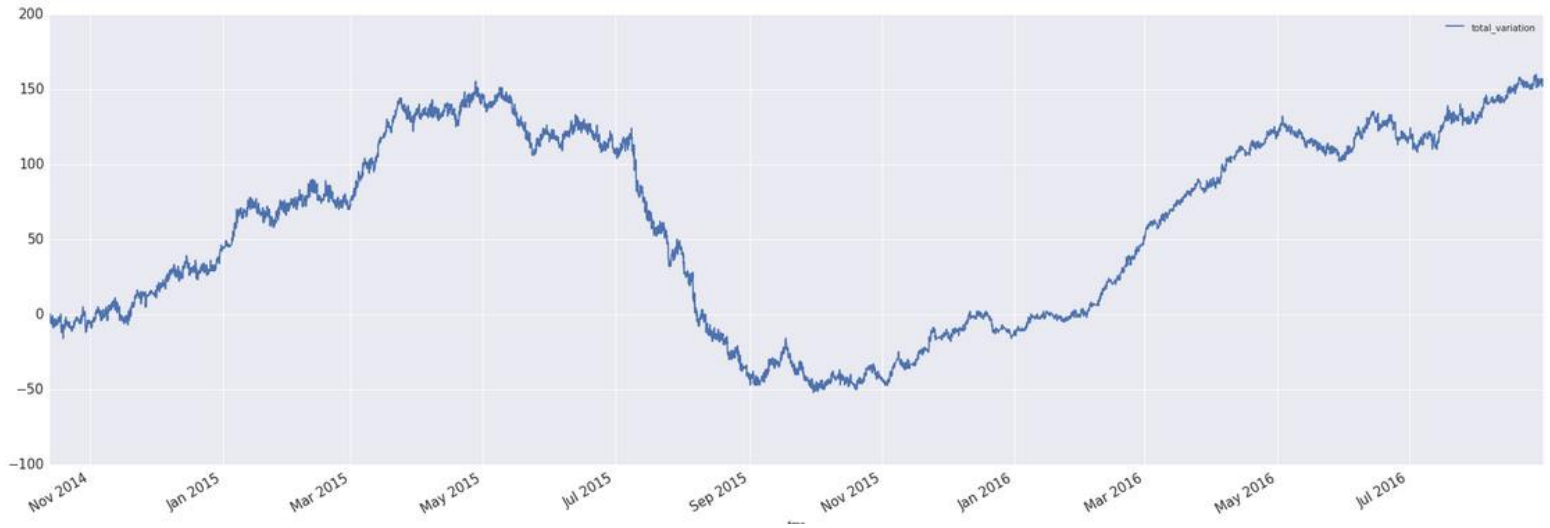
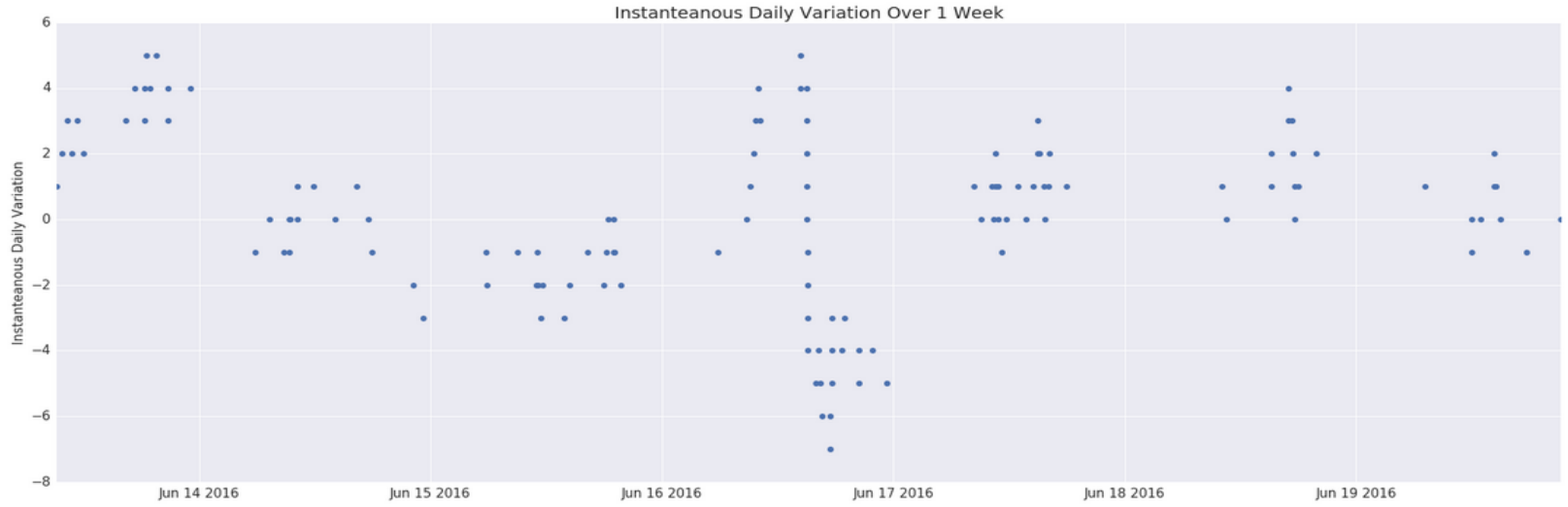
- Analysis at station SLU-01

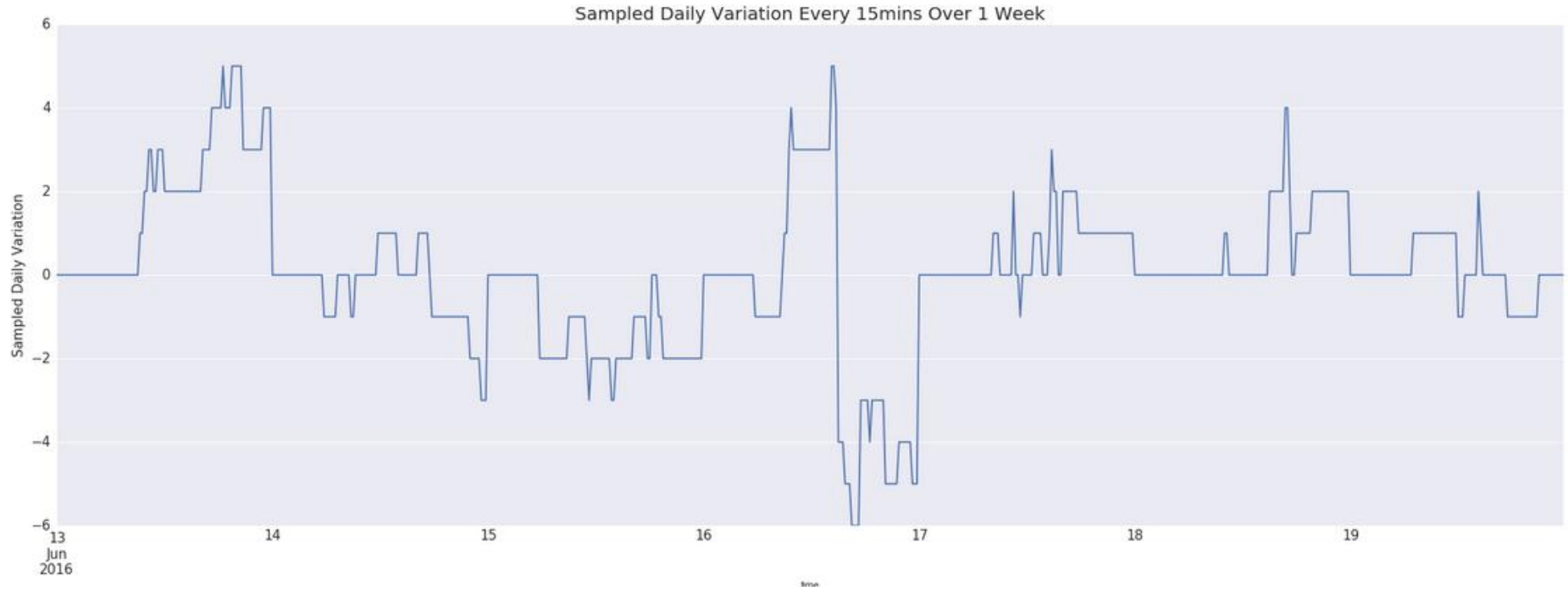
Is it possible to infer the bike availability?



… No but daily bikes variation YES!



But regression purpose requires a resampling of this daily variation:



- Computation of daily variation at large scale:
  - 45 stations
  - From 14/10/2014 to 17/03/2016
  - Number of data computed: 2 246 400

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Regression on the Daily Bikes Variation

- Knowing a dataset **X**, we would like to predict the daily variation **y** such that **f(X) = y**
- Which features choose to compose X? How to represent them?

X

y

	Events	Mean_Temperature_F	Precipitation_In	daily_variation	station_id	month	weekday	hour
2014-10-14 00:00:00	Rain	59.0	0.11	0.0	SLU-07	10	1	0.00
2014-10-14 00:15:00	Rain	59.0	0.11	0.0	SLU-07	10	1	0.25
2014-10-14 00:30:00	Rain	59.0	0.11	0.0	SLU-07	10	1	0.50
2014-10-14 00:45:00	Rain	59.0	0.11	0.0	SLU-07	10	1	0.75
2014-10-14 01:00:00	Rain	59.0	0.11	0.0	SLU-07	10	1	1.00

- Size of **X** : 2 242 080 x 7
- Size of **y** : 2 242 080 x 1
- Evaluation criteria: MSE & MAE

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One model for all the stations

- Which regressor to use?

Model (default HPs)	MSE	MAE
Linear regression	10,73	1,90
Ridge regression	10,72	1,89
SGD regression	15,36	2,74
Bayesian Ridge	10,75	1,90
Logistic regression	/// too computationally	Consuming //////
Random Forest (RF) regression	0,51	0,30

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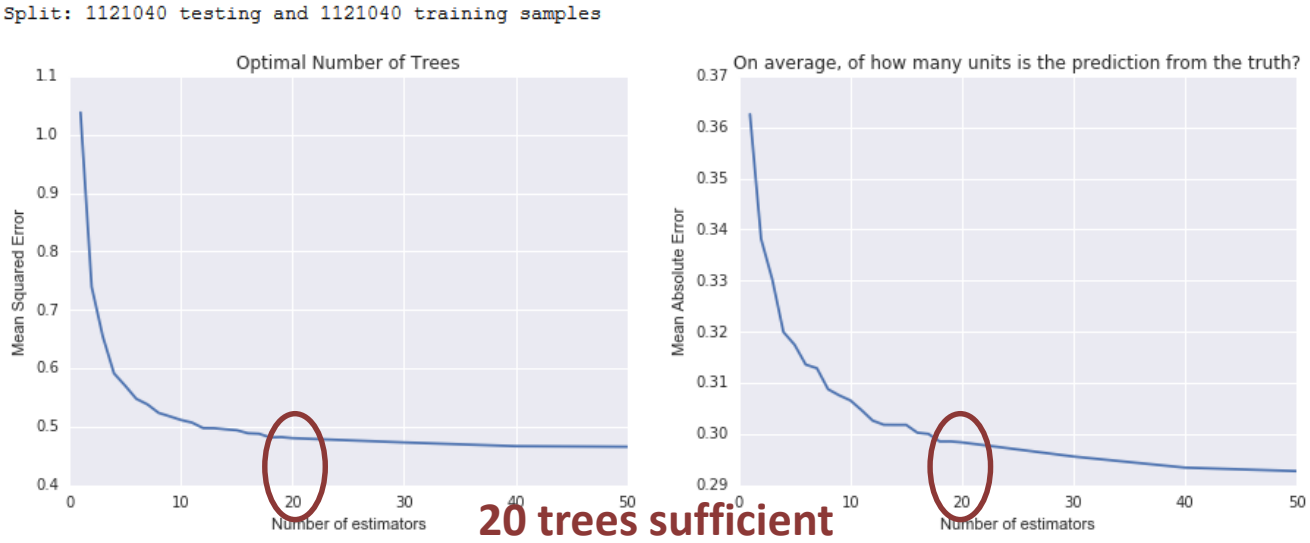
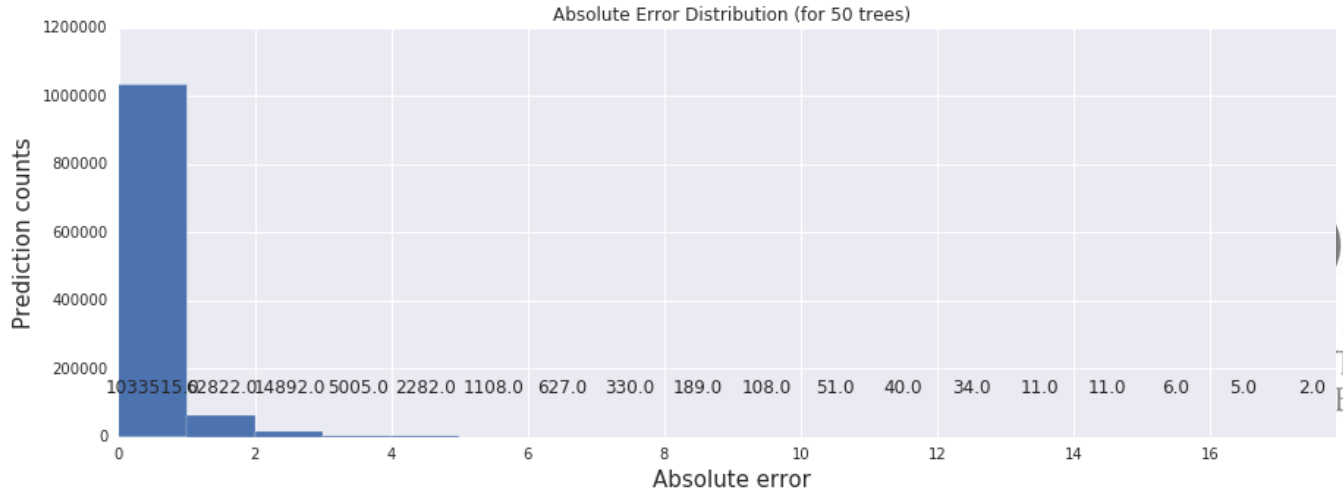
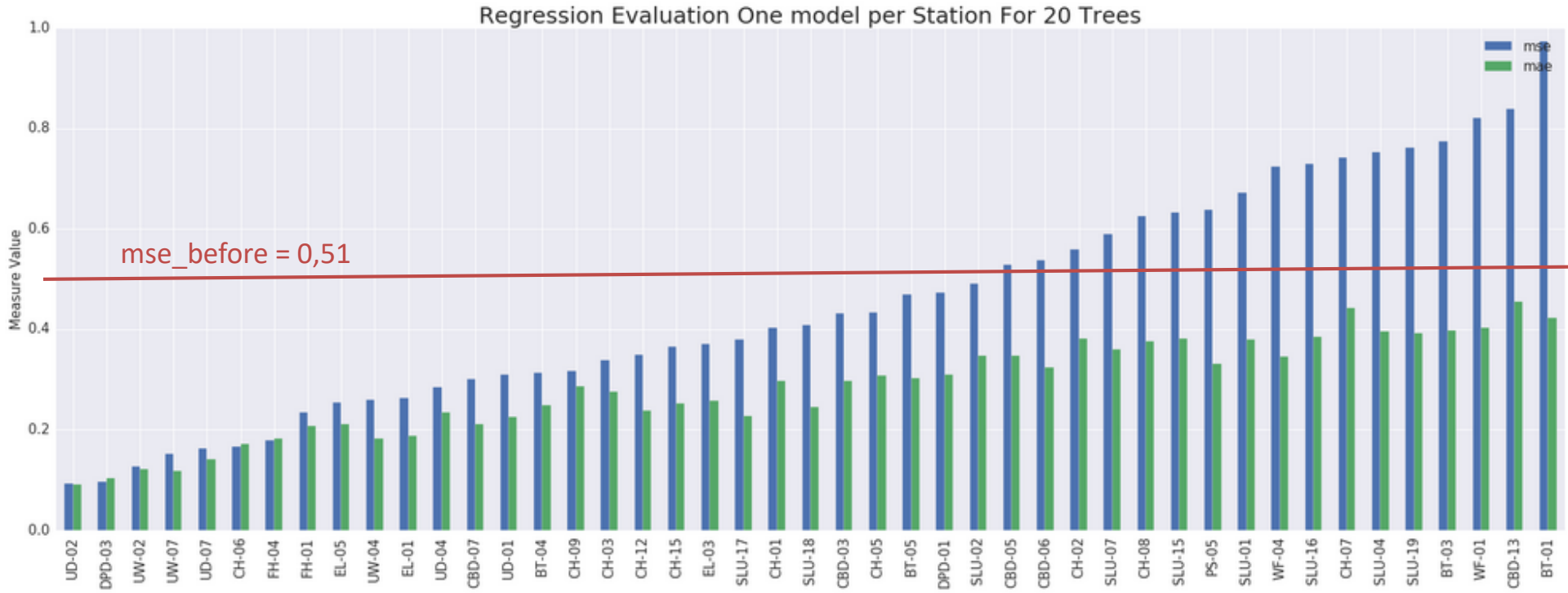
- Choice of hyperparameters: which number of trees to use?





One model per station



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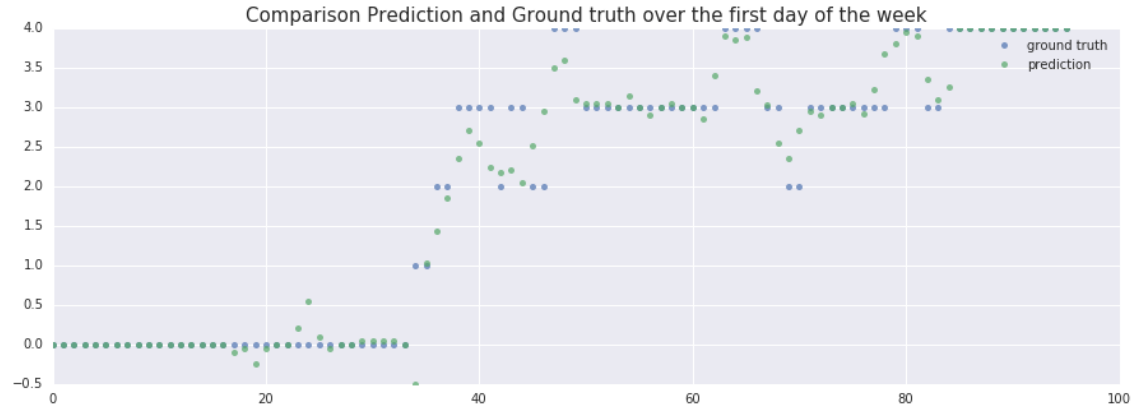
Practical application for Pronto

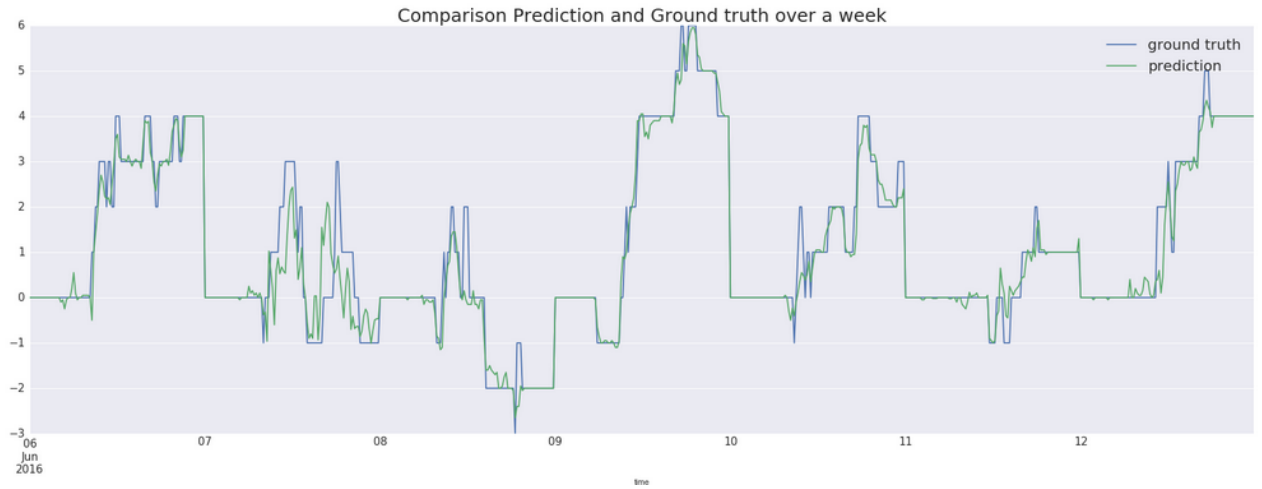
We are the weekend and given the weather forecast, what are the predictions of demand for next week at a given station?

station_id = SLU-01

- **Partially** trained during the week predicted

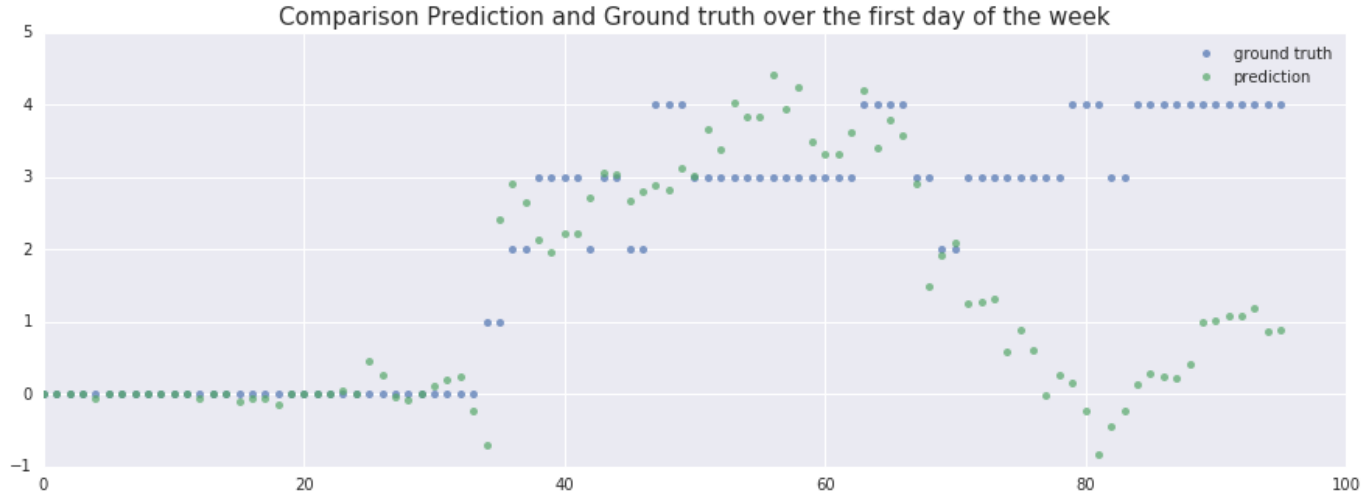
```
Split: 32928 testing and 32928 training samples
mse: 0.2346
mae: 0.2422
```

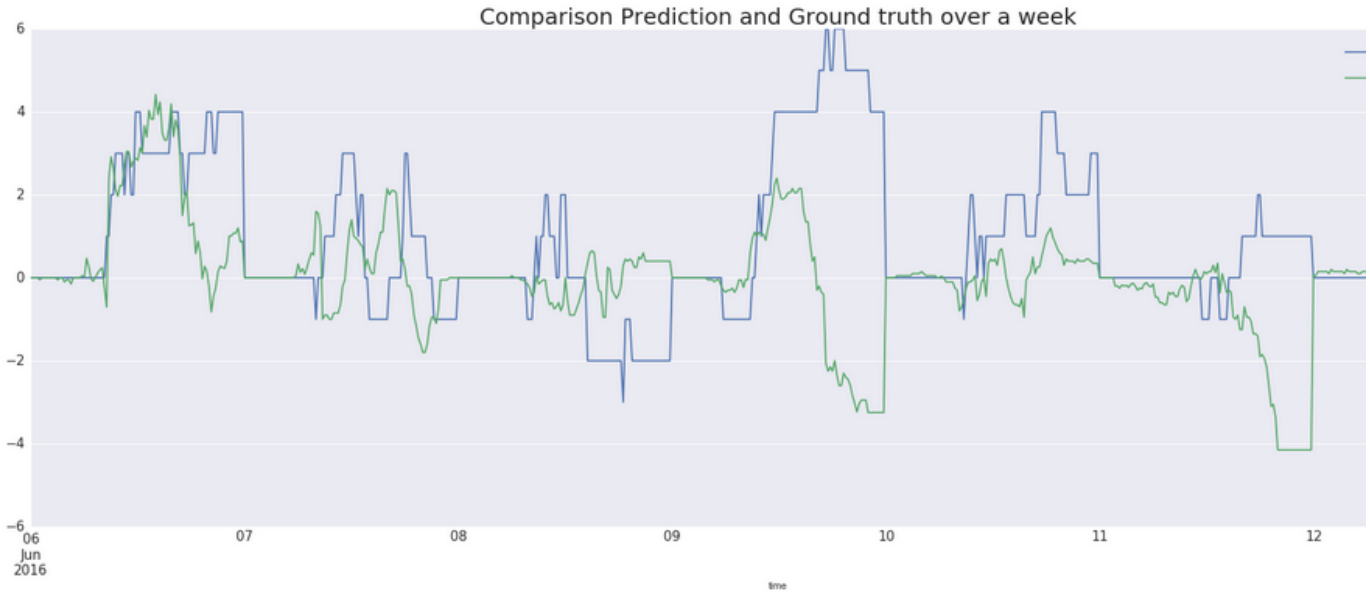




- **Not** trained during the week predicted

```
Split: 32592 testing and 32592 training samples
mse: 6.1937
mae: 1.5991
```





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Conclusion

- Exploration of users trends allowed an efficient exploitation of data with PCA
- RF regressions on the daily bikes variation provided encouraging and quite precise predictions
- However this prediction tool does not seem perfectly optimized for online applications

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