

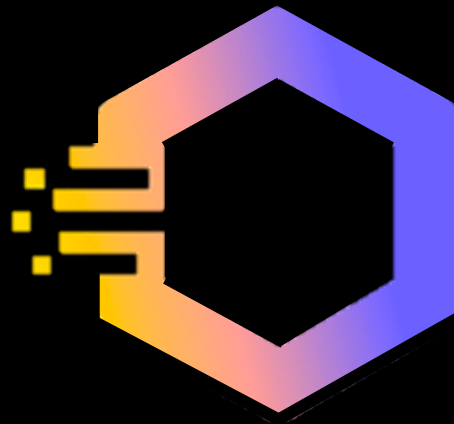
IoT Analytics

Evaluating Techniques for Wifi Locationing

ALESSANDRO ARNONE

INTRODUCTION **01**

PREPROCESSING **02**

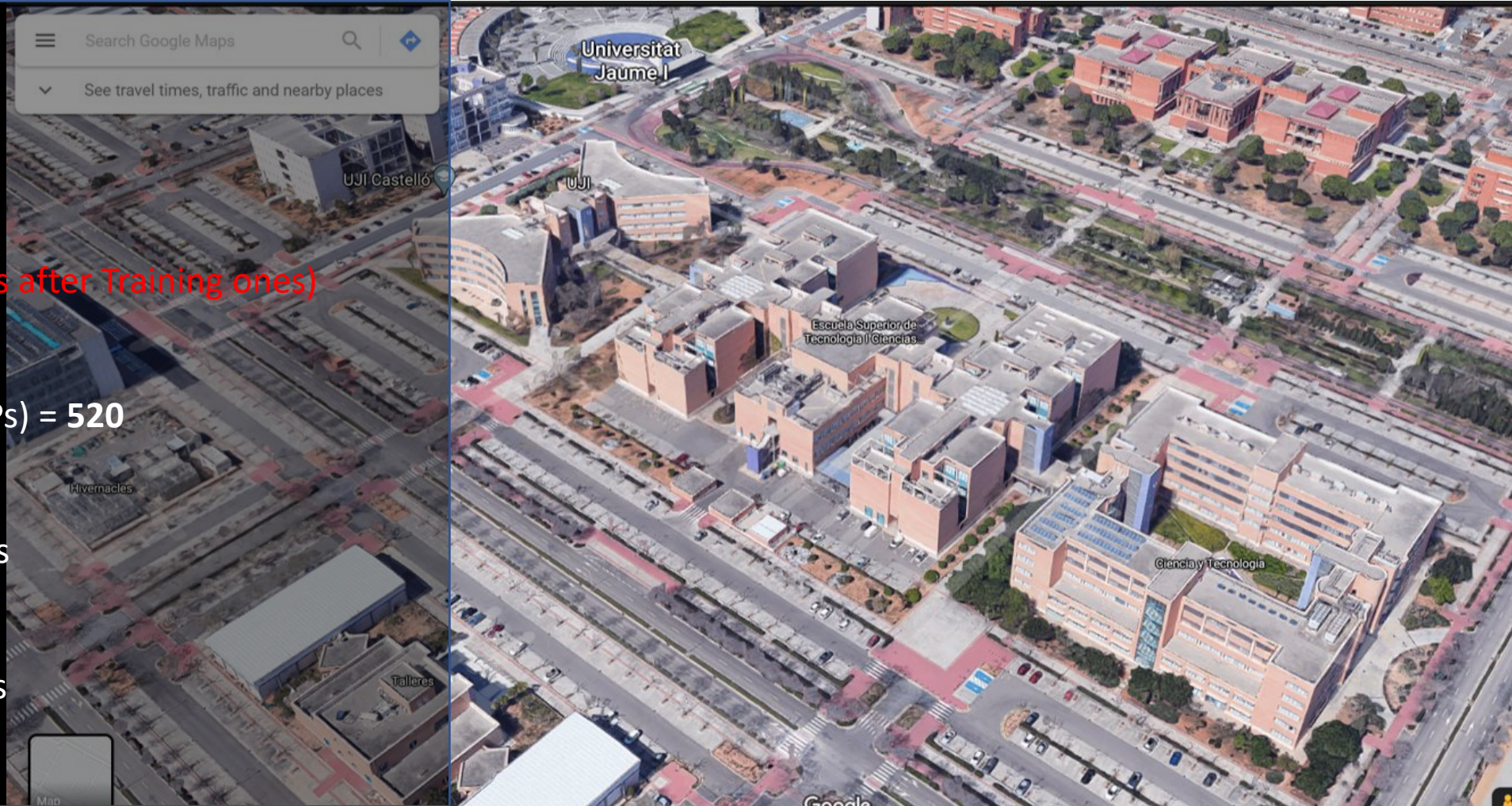


03 MODELLING AND
ERRORS

04 Q&A

Introduction

- 21049 observations
 - 19938 training
 - 1111 validation (4 months after Training ones)
- Wireless access points (WAPs) = 520
- 3 buildings - > 4/5 floors
- 20 users | 25 mobile devices

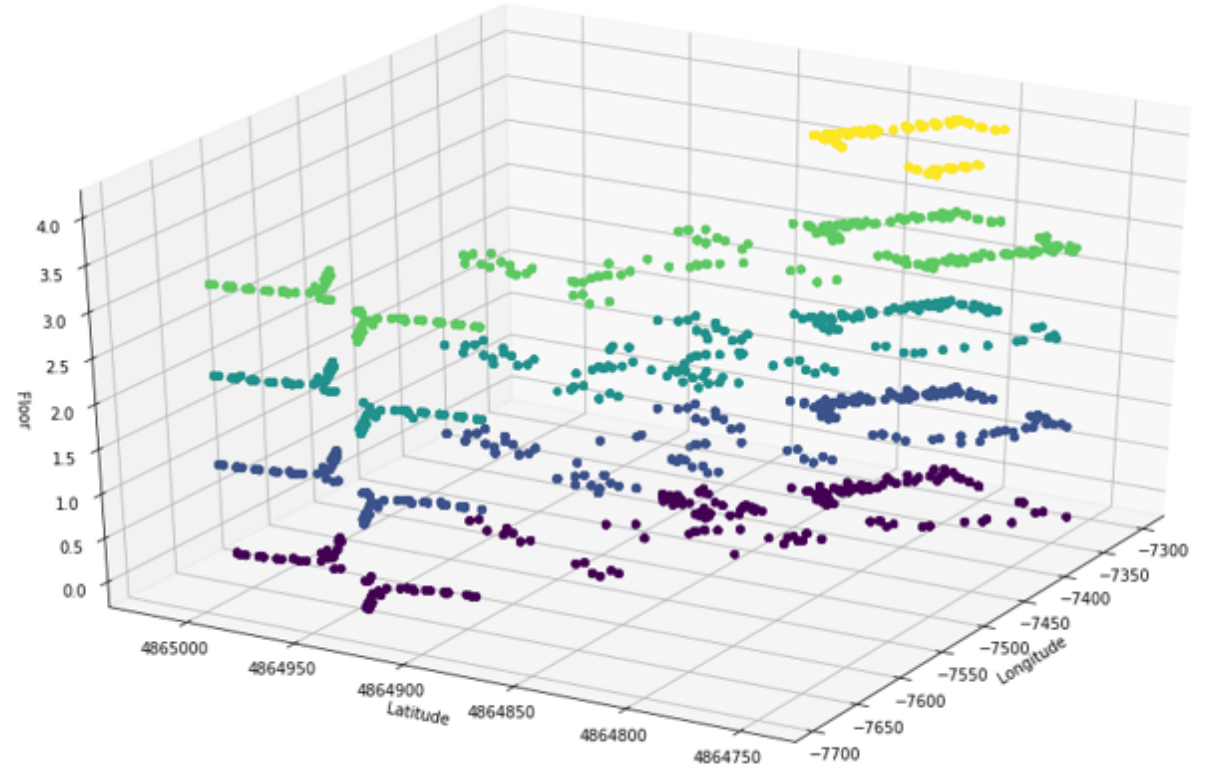
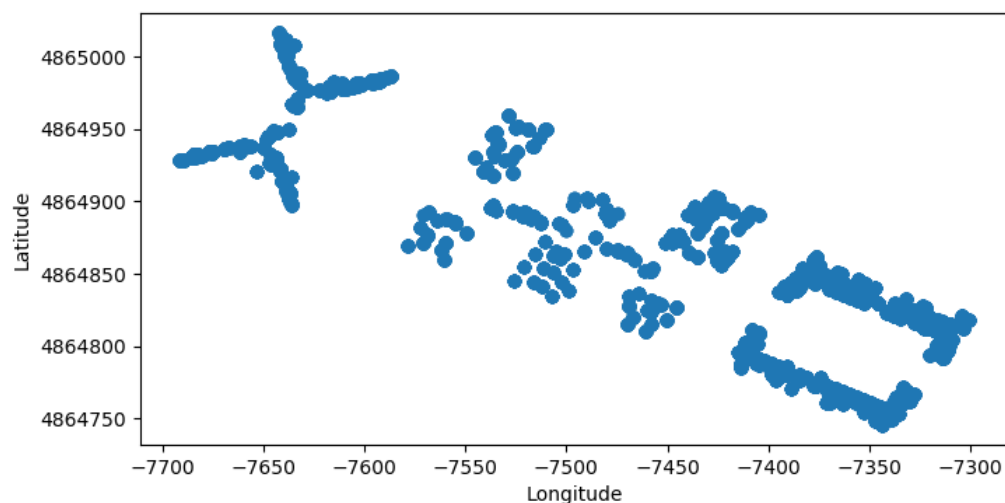


Introduction

GOAL

To predict positioning regarding WAP signals

(BUILDING) + LONGITUDE + LATITUDE
+ FLOOR



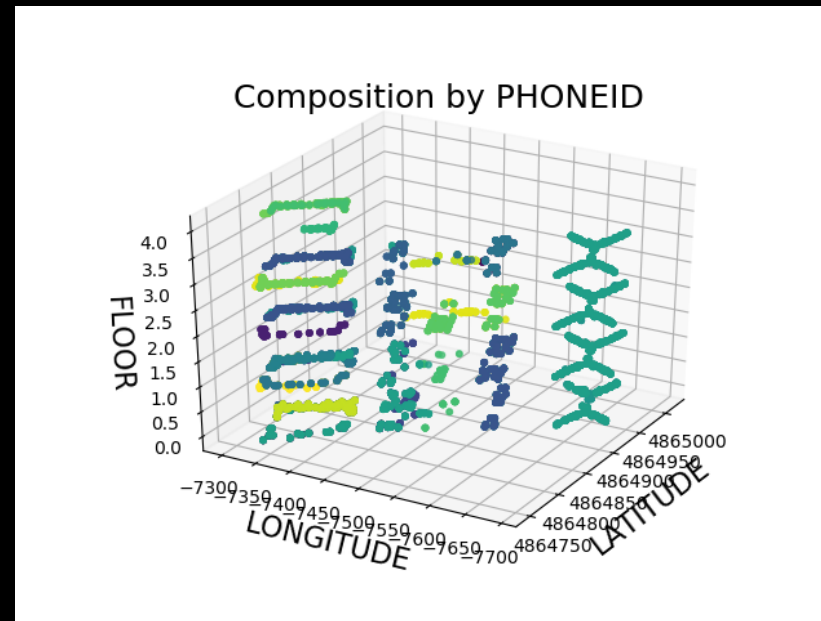
Known positions in training set

Introduction

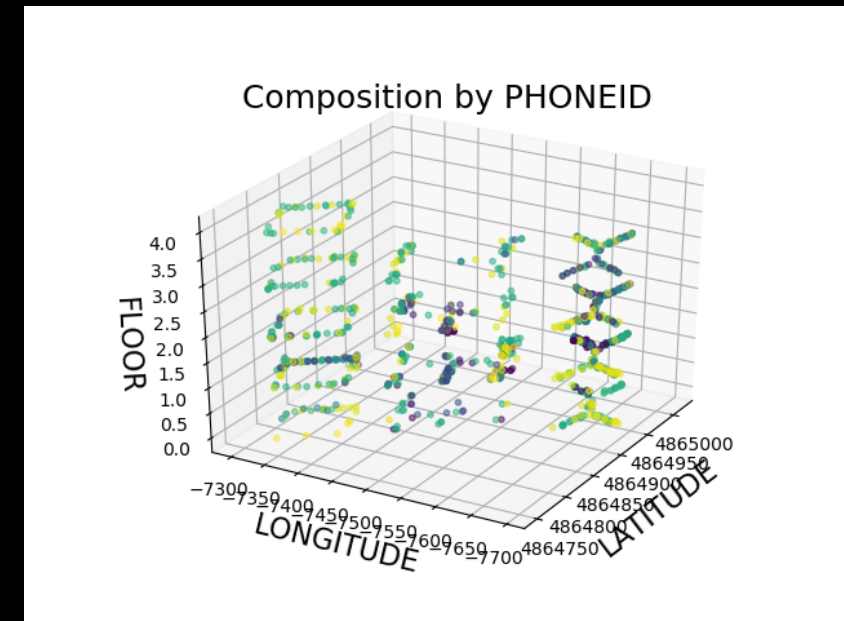
Challenges

- Training set not representative
- High number of predictors

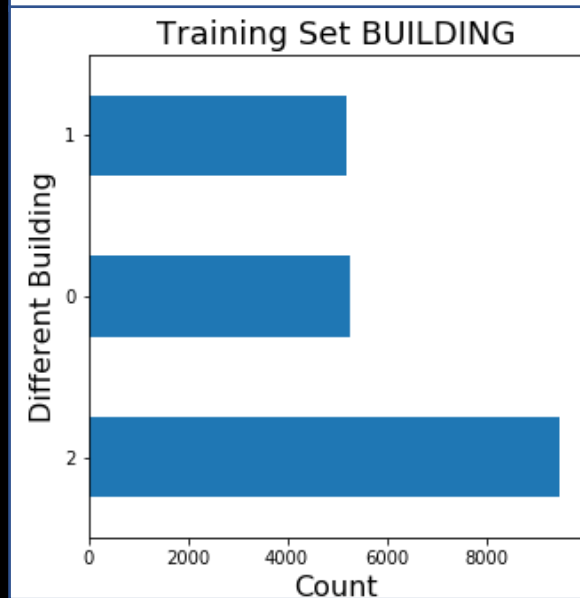
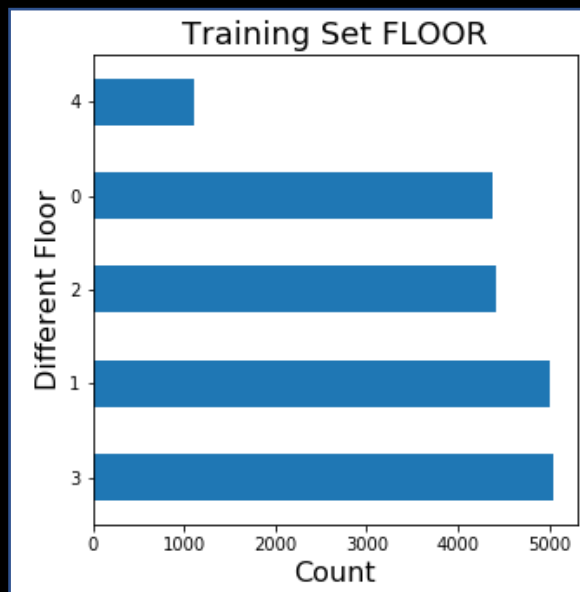
TRAINING



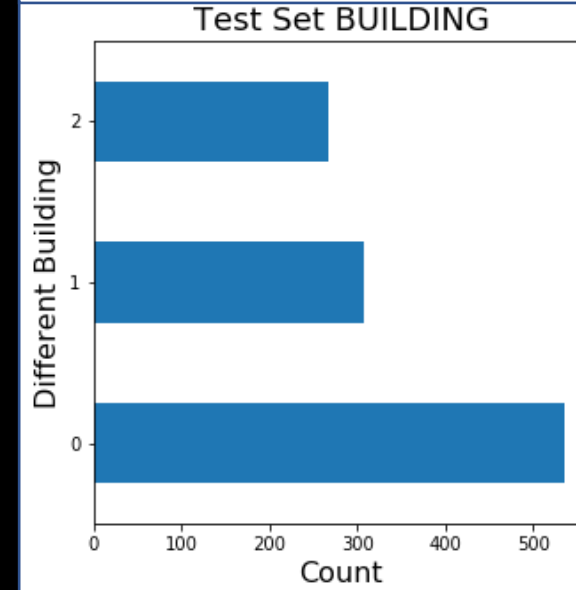
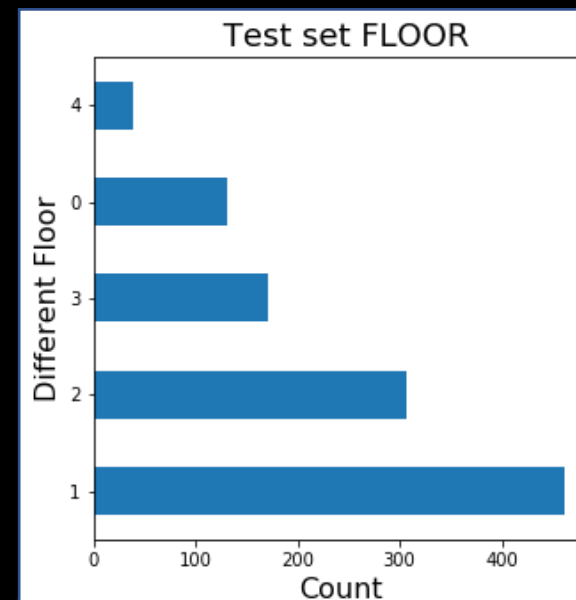
VALIDATION



Introduction



Class Imbalance



Preprocessing results

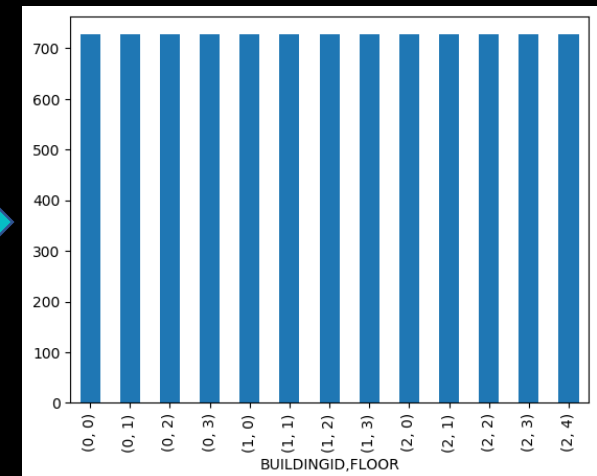
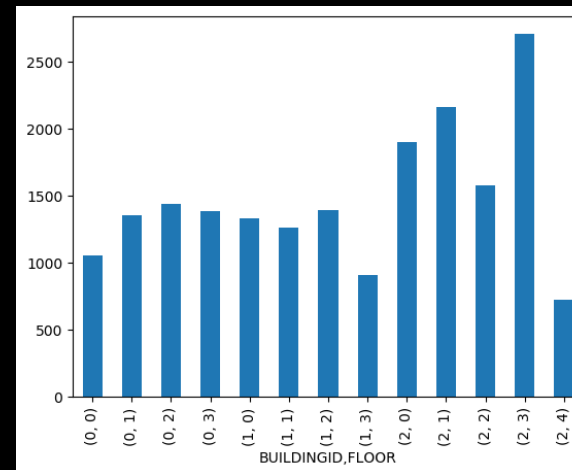
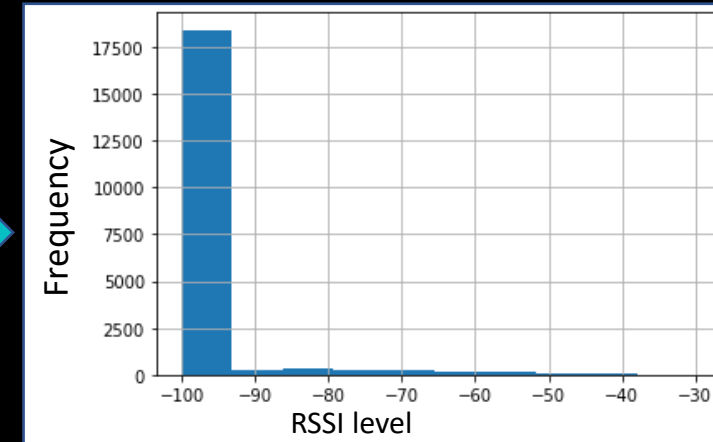
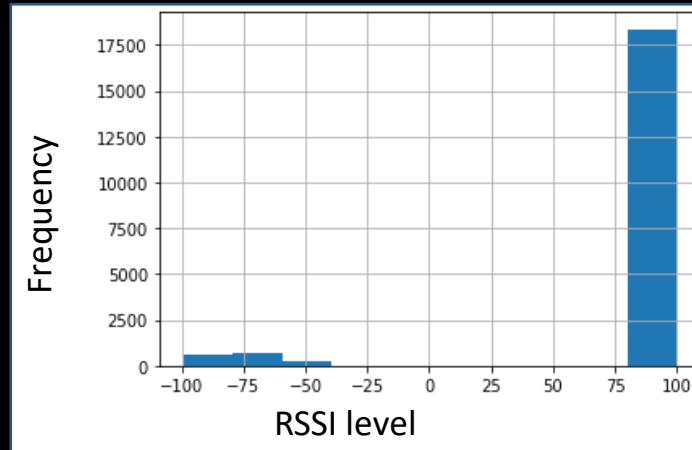
Drop duplicates
100 = - 100

Remove low variance rows
Remove low variance columns

Balance classes

- From 520 to 260 predictors
- From 19937 rows to 15053

Normalize data

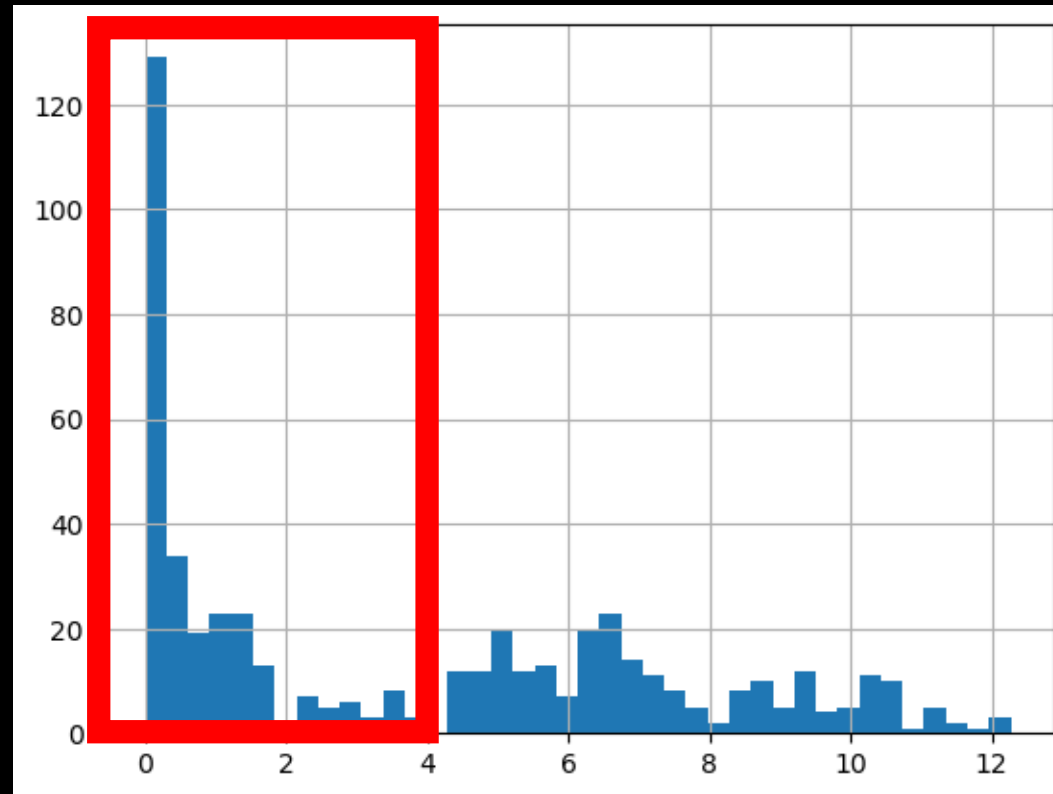


Preprocessing results

REMOVE LOW
VARIANCE COLUMNS

SD DISTRIBUTION

REMOVED VARIABLES



MODELS

Building Prediction

PREDICTORS

maximum WAP observed

ACCURACY

1

MODEL

Logistic Reg.

	Prediction B0	Prediction B1	Prediction B2
B0	536	0	0
B1	0	307	0
B2	0	0	268

ADDITIONAL INFO

Only 8 WAP were the best
over multiple buildings
amongst 9k+ observation

Floor Prediction

PREDICTORS

260 WAPS intensity

ACCURACY
0.90

MODEL

kNN

ADDITIONAL INFO

Worst Accuracy in Building 1

FLOOR	B0					Total Observation	ACCURACY
1	75	0	0	0		78	0,97
2	4	203	1	0		208	
3	2	4	159	0		165	
4	0	0	2	83		85	
B1							
1	22	3	5	0		30	0,758
2	4	89	42	1		136	
3	0	0	73	6		79	
4	0	0	2	45		47	
B2							
1	21	3	0	0	0	24	0,93
2	0	107	4	0	0	111	
3	0	3	47	2	2	54	
4	0	0	2	35	3	40	
5	0	0	0	4	35	39	

Longitude/Latitude Prediction

PREDICTORS

260 WAPS intensity

ACCURACY

LATITUDE: 8.25
LONGITUDE: 8.18

MODEL

kNN

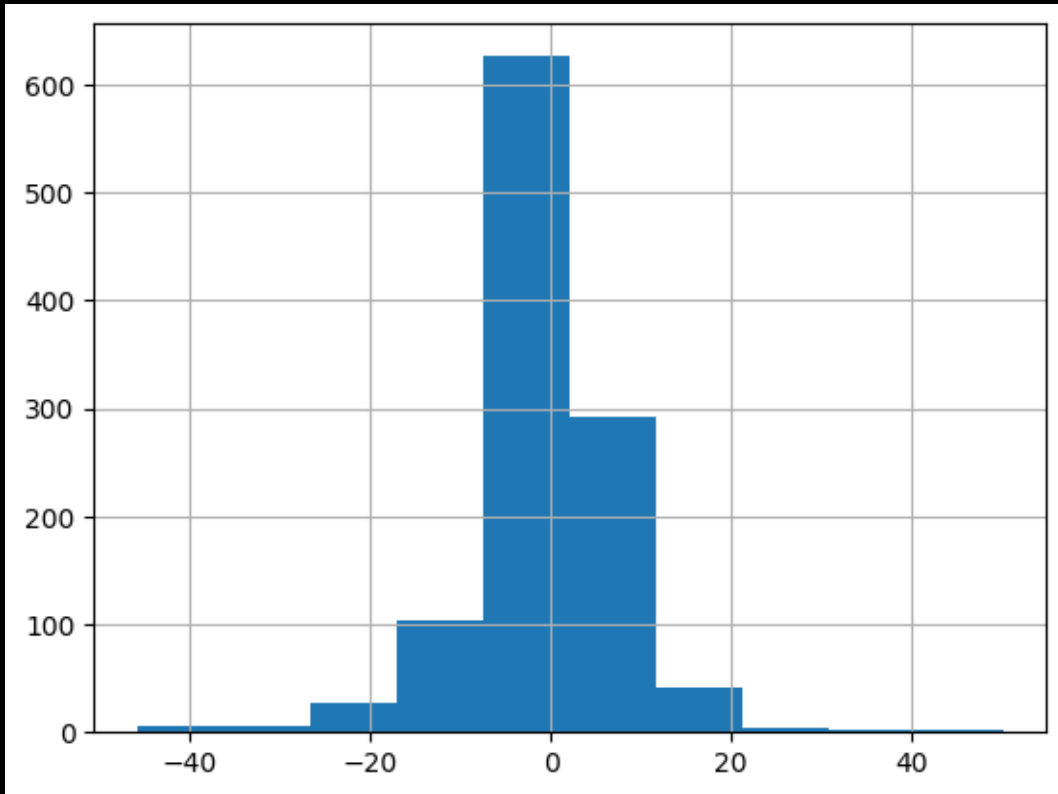
Predictor	Building	Method	HyperParameters	Score	RMSE
Longitude	0	k-NN	3n	0,978	6.60
Longitude	1	k-NN	3n	0,982	8.32
Longitude	2	k-NN	4n	0,962	10,6
Latitude	0	k-NN	2n	0,99	5,72
Latitude	1	k-NN	3n	0,98	10,77
Latitude	2	k-NN	2n	0,957	9,04

ADDITIONAL INFO

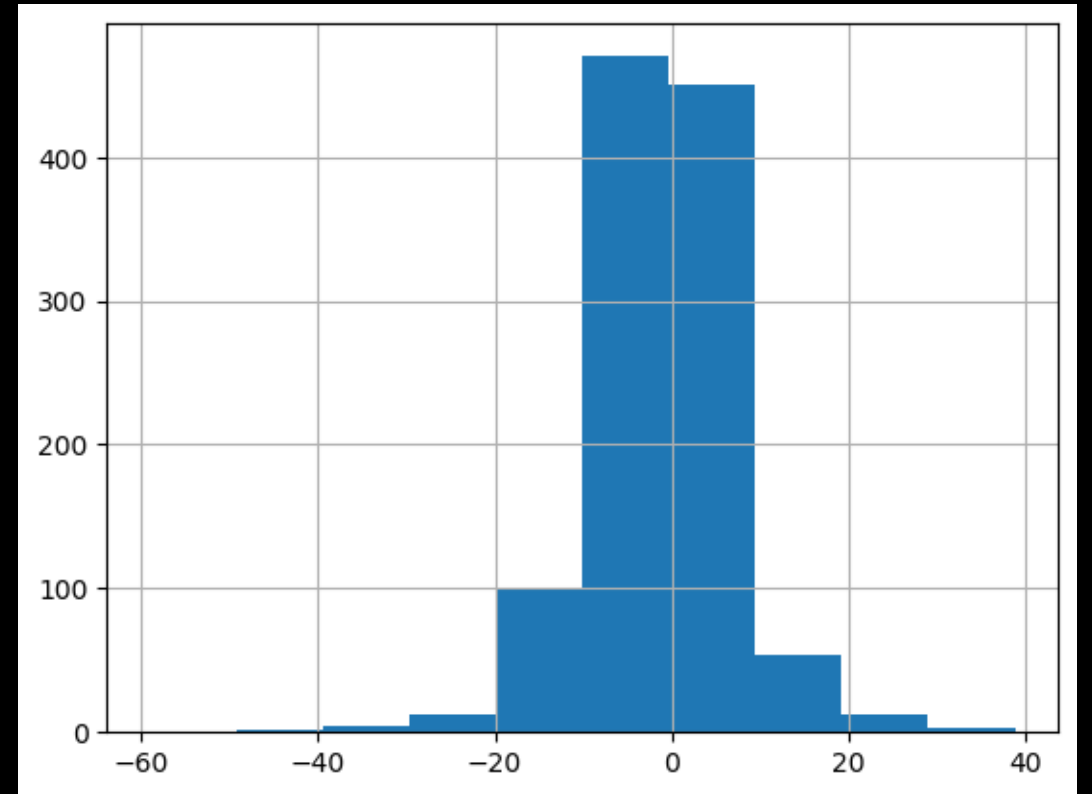
Worst Accuracy in Building2
and Building 3

ERROR ANALYSIS

Error Analysis

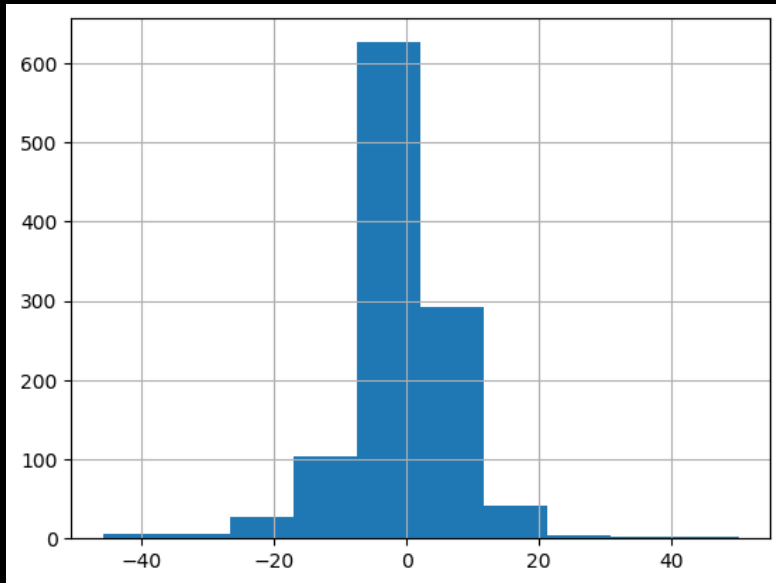


ERROR DISTRIBUTION LATITUDE

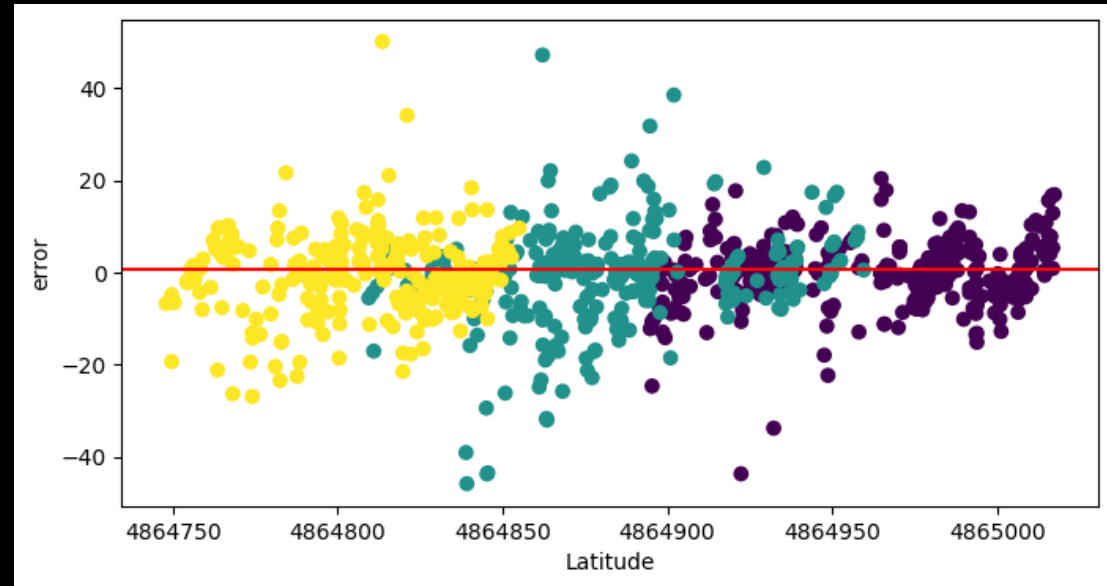


ERROR DISTRIBUTION LONGITUDE

Error Latitude

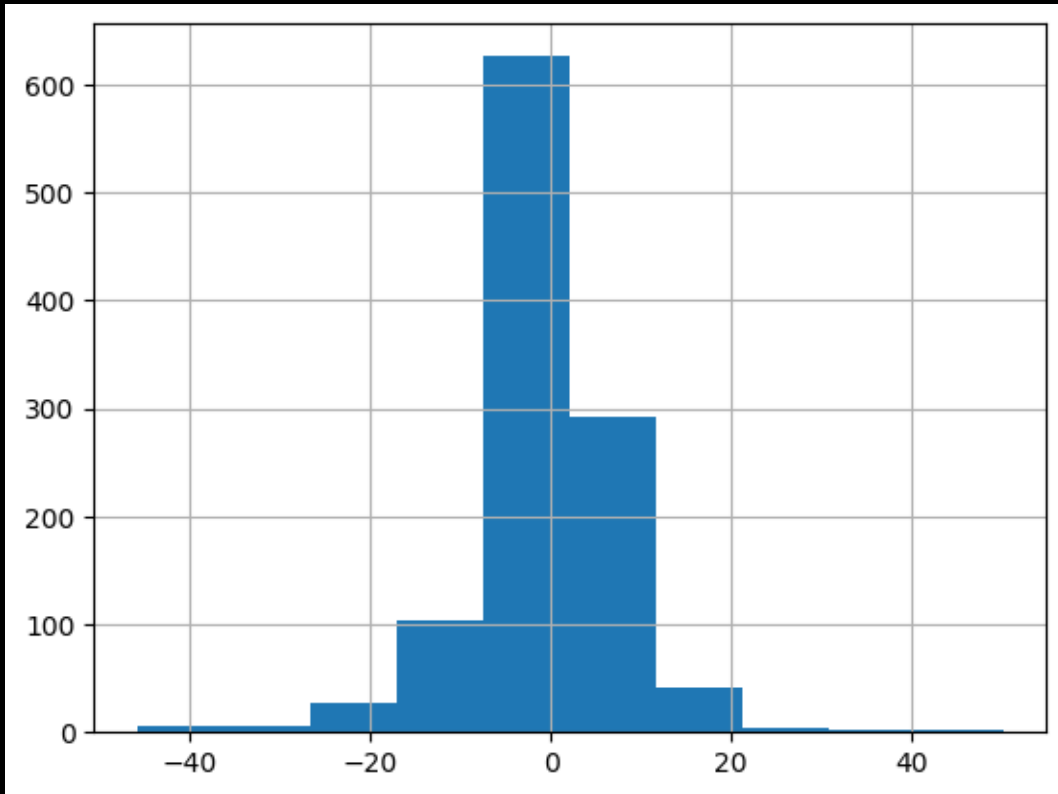


ERROR DISTRIBUTION LATITUDE

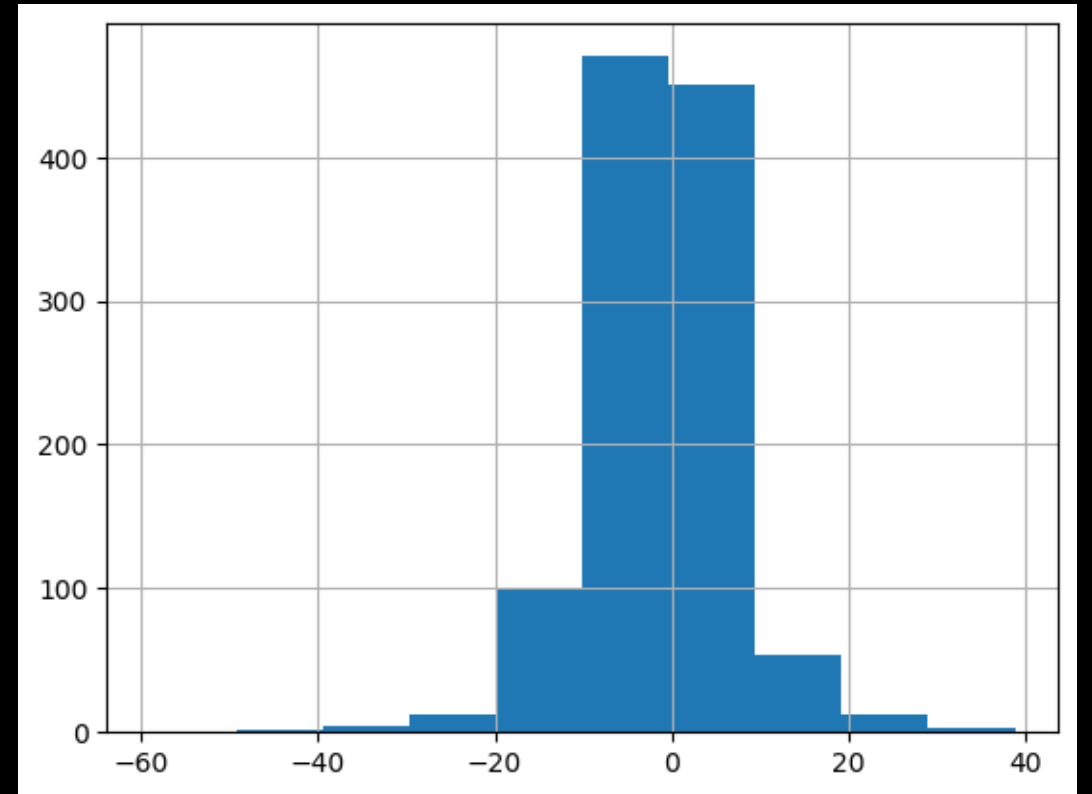


BUILDING 1 BUILDING 2 BUILDING 3

Error Analysis

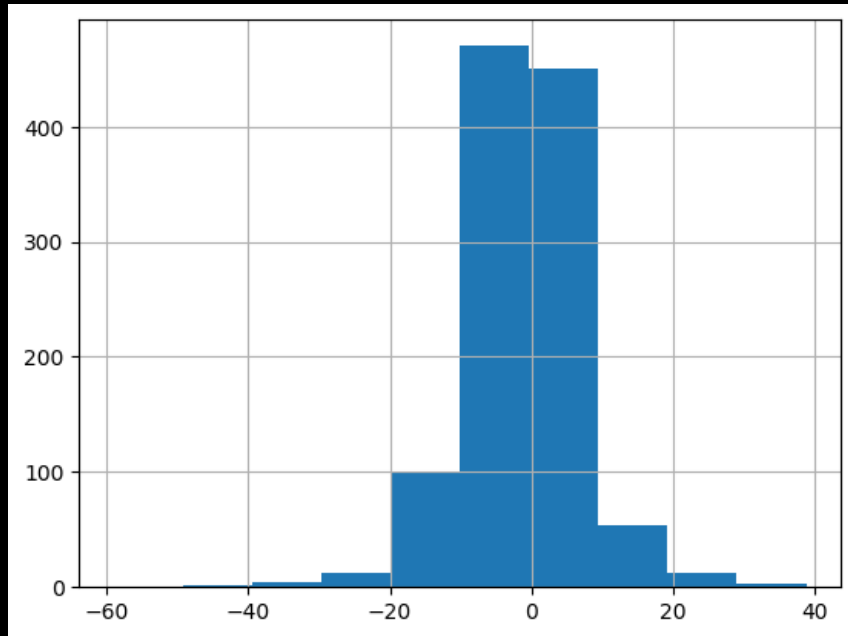


ERROR DISTRIBUTION LATITUDE

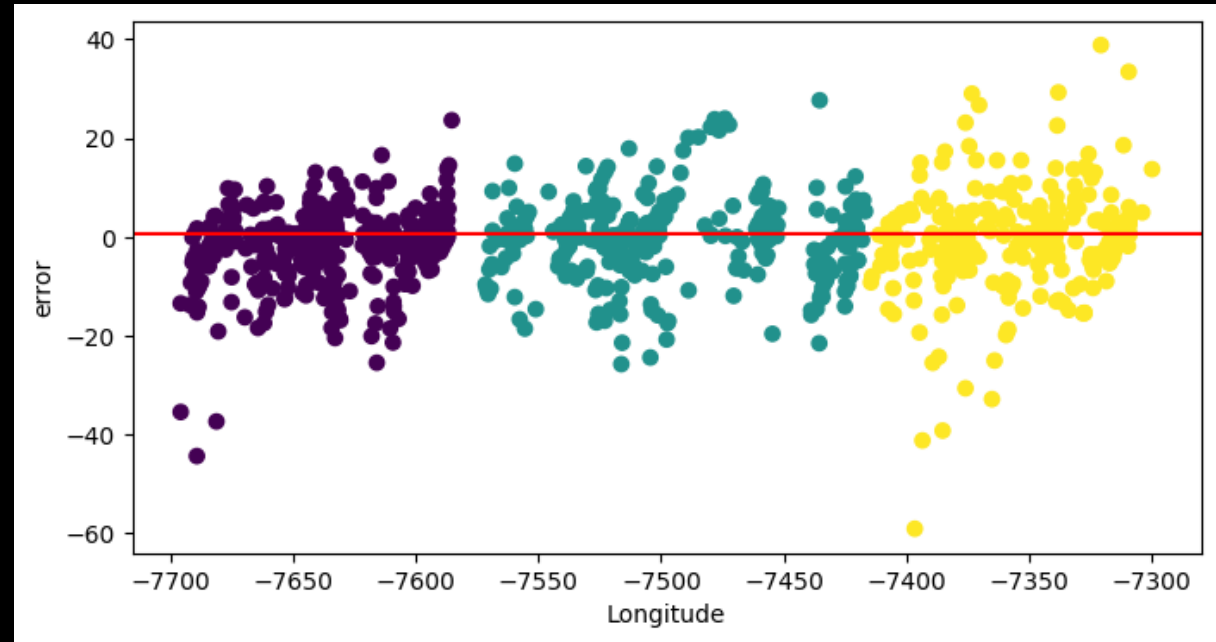


ERROR DISTRIBUTION LONGITUDE

Error Longitude



ERROR DISTRIBUTION LONGITUDE

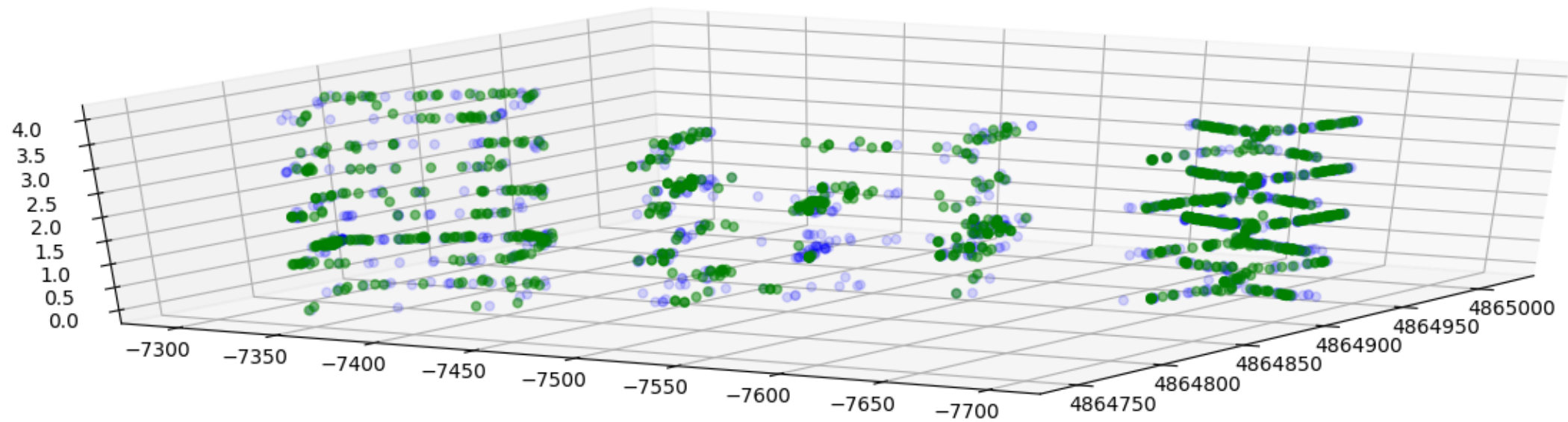


BUILDING 2

BUILDING 1

BUILDING 0

Final Prediction



OBSERVED VALUES

PREDICTIONS

