Mini Project 3

Munachiso Nwadike, Romeno Wenogk and Takumi Miyawaki

The New York Times

Why Are Taxi Drivers in New York Killing Themselves?

Three taxi owners and five other professional drivers have died by suicide over the last year. It has prompted a flurry of legislation to improve working conditions for drivers.

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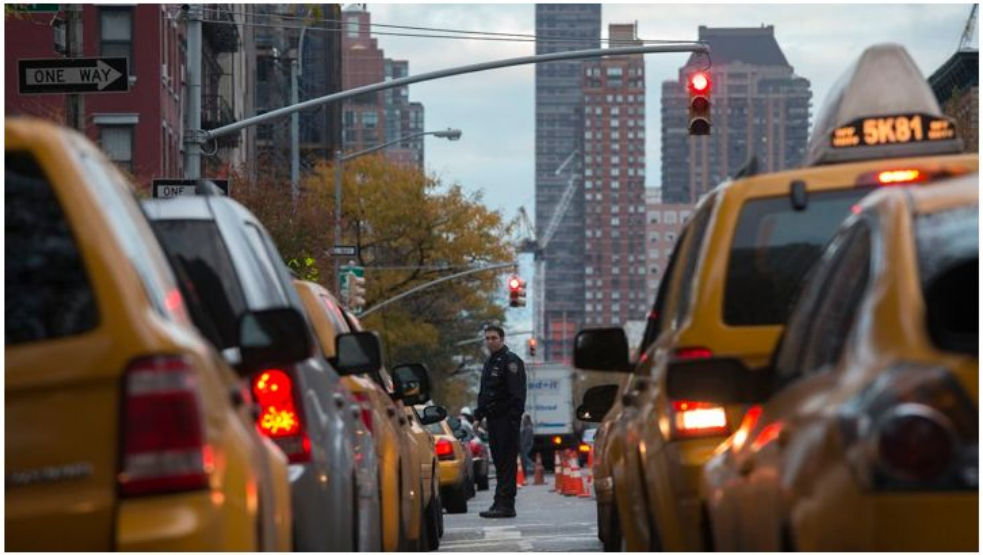
IDEAS

Taxi-Driver Suicides Are a Warning

Technology has pushed a vulnerable, largely immigrant, population into an economically precarious situation—even as its prospects of upward mobility dwindle.

JUN 5, 2019

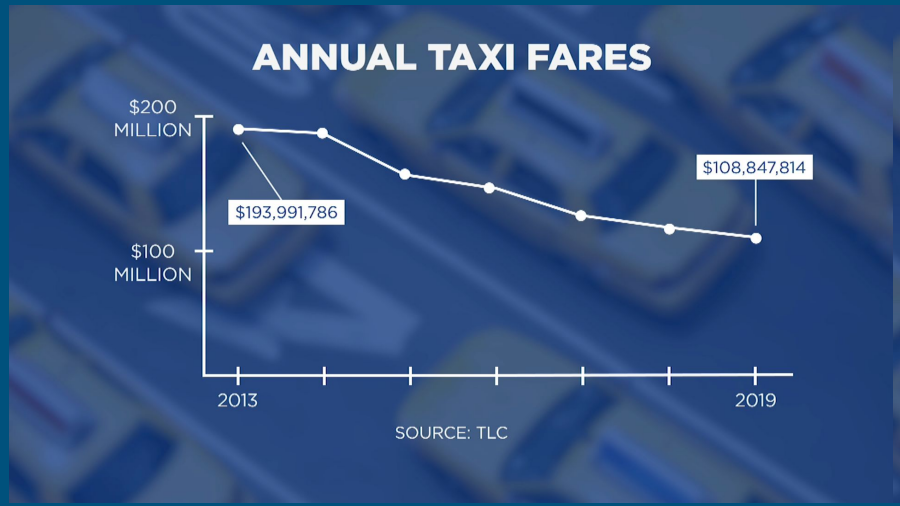


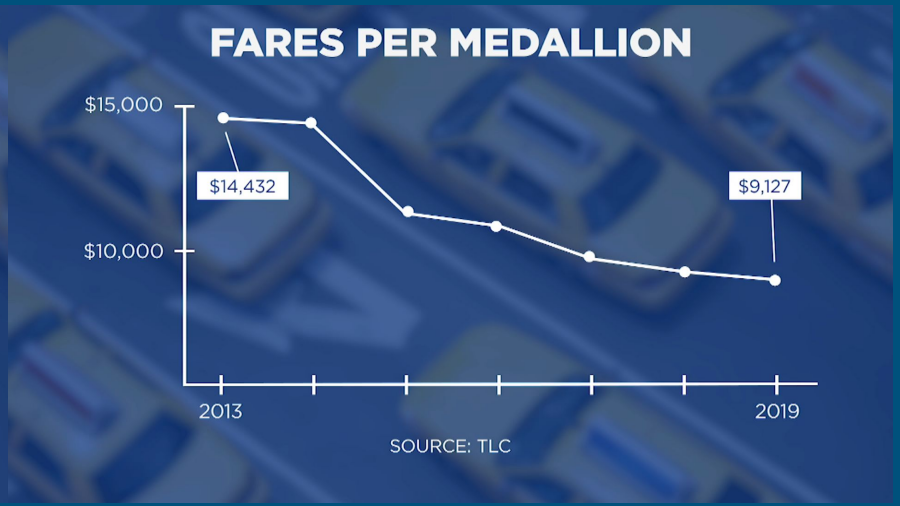
NYC Yellow Cab Drivers' Earnings Have Fallen 44 Percent Since 2013

BY RUSCHELL BOONE | NEW YORK CITY

PUBLISHED 10:43 PM ET MAY. 30, 2019

Problem Statement



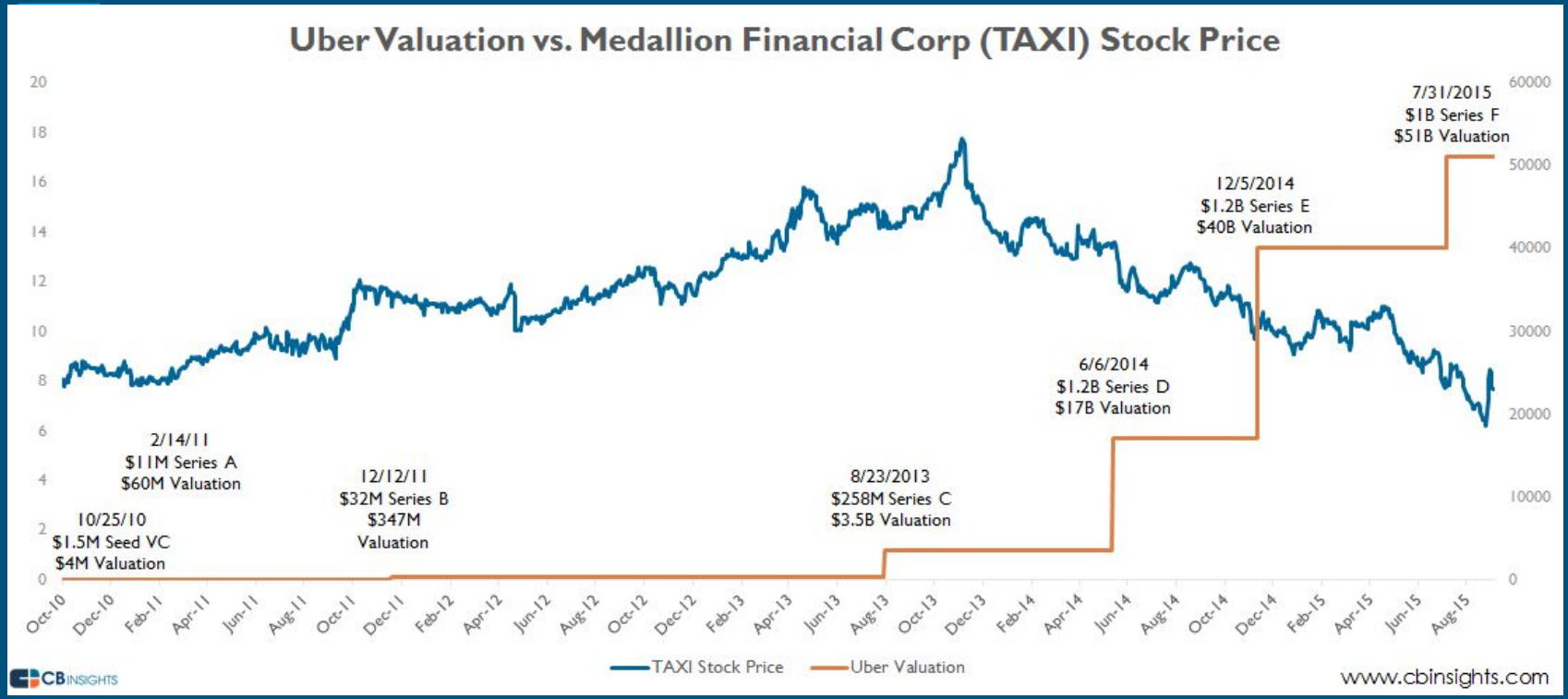


Solution

Standard Metered Fare

- **$2.50** initial charge.
- Plus **50 cents** per 1/5 mile when traveling above 12mph or per 60 seconds in slow traffic or when the vehicle is stopped.
- Plus **50 cents** MTA State Surcharge for all trips that end in New York City or Nassau, Suffolk, Westchester, Rockland, Dutchess, Orange or Putnam Counties.
- Plus **30 cents** Improvement Surcharge.
- Plus **50 cents** overnight surcharge 8pm to 6am.
- Plus **$1.00** rush hour surcharge from 4pm to 8pm on weekdays, excluding holidays.
- Plus New York State Congestion Surcharge of **$2.50** (Yellow Taxi) or **$2.75** (Green Taxi and FHV) or **75 cents** (any shared ride) for all trips that begin, end or pass through Manhattan south of 96th Street.

A first Look - Uber Vs. Taxis



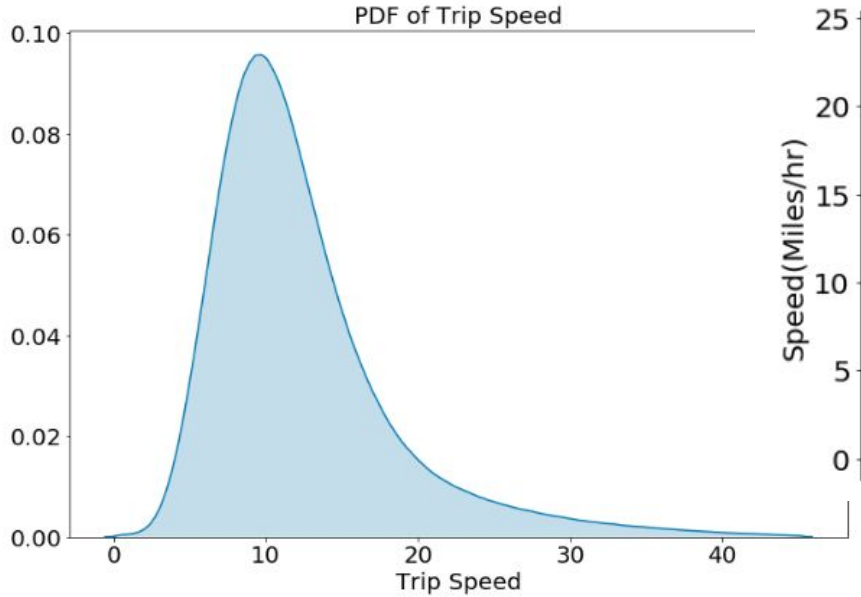
Raw Data

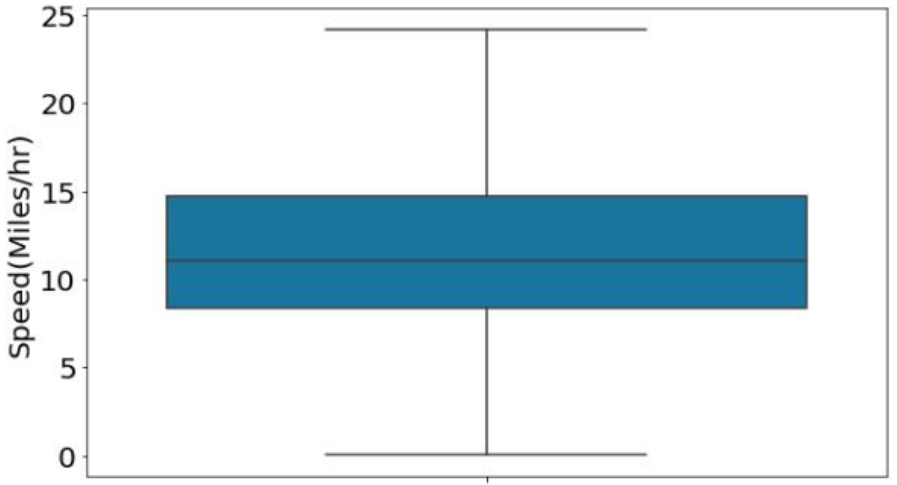
Outliers!

- Example 1: 99.9th percentile value of speed is 45.31miles/hr. 100th percentile value of a speed is 192 Million miles/hr.
- Example 2: ->

Data Cleaning (Speed)

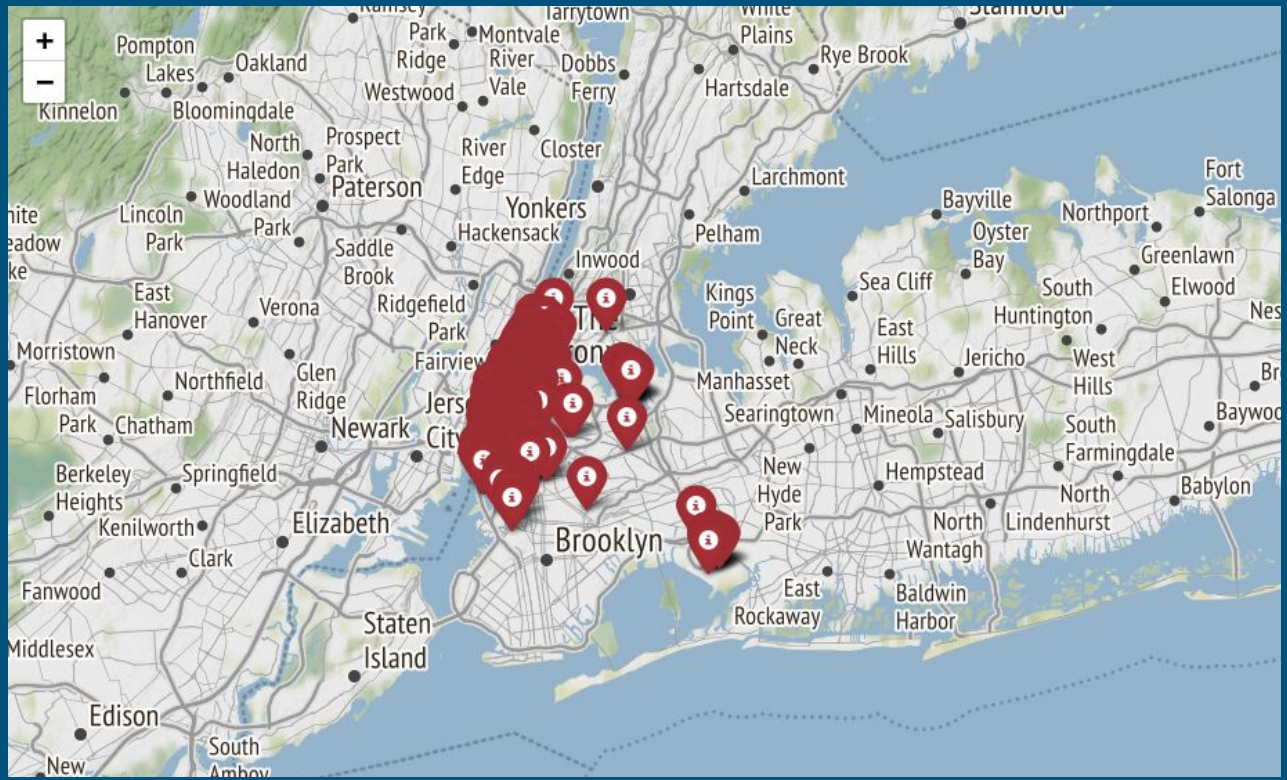
```
new_frame_cleaned = new_frame_cleaned[(new_frame_cleaned.speed>0) & (new_frame_cleaned.speed<45.31)]
print("Speed Outliers removed")
print("-"*35)
```





- 30 clusters, 4464 time bins

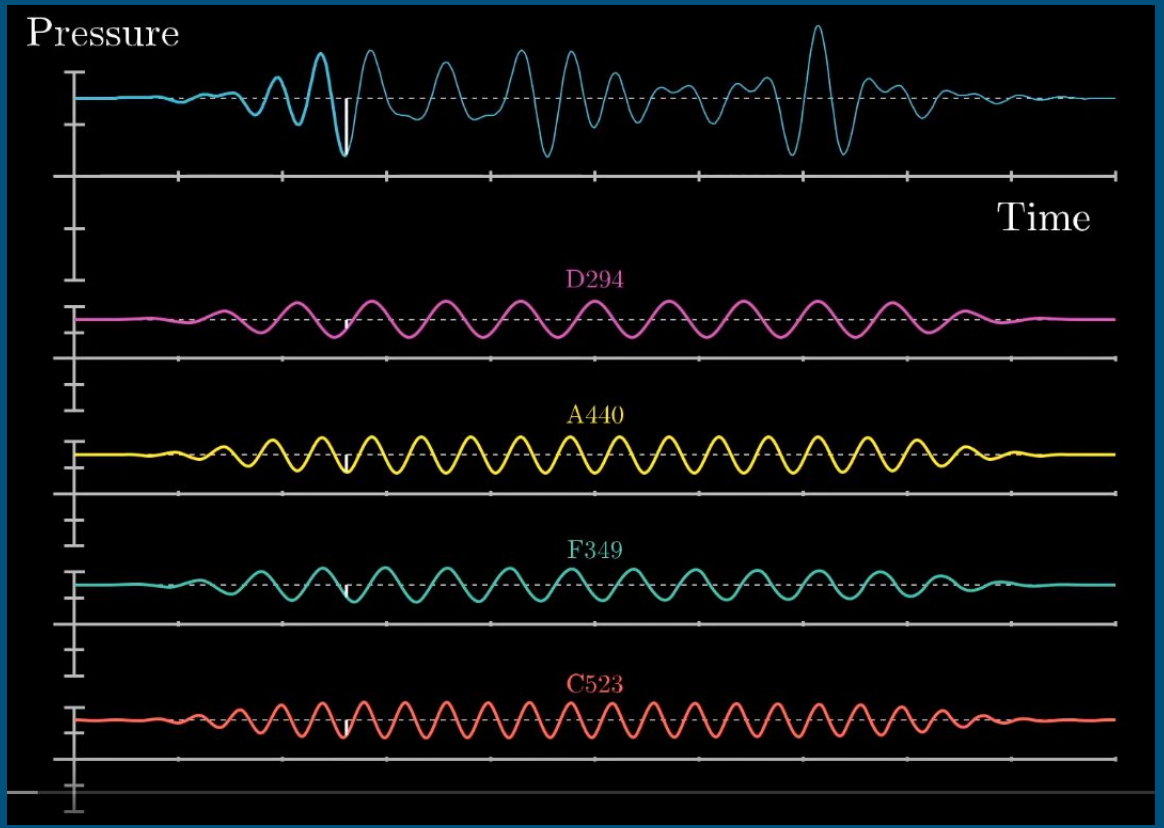
Data Cleaning (location)



Data Features

[Goal: Predict Speed at Given Pickup Location]

- Previous Pickups
- Day of the week
- Location of the Pickup cluster (Lat, Long)
- *Fourier Frequency & Amplitude?*

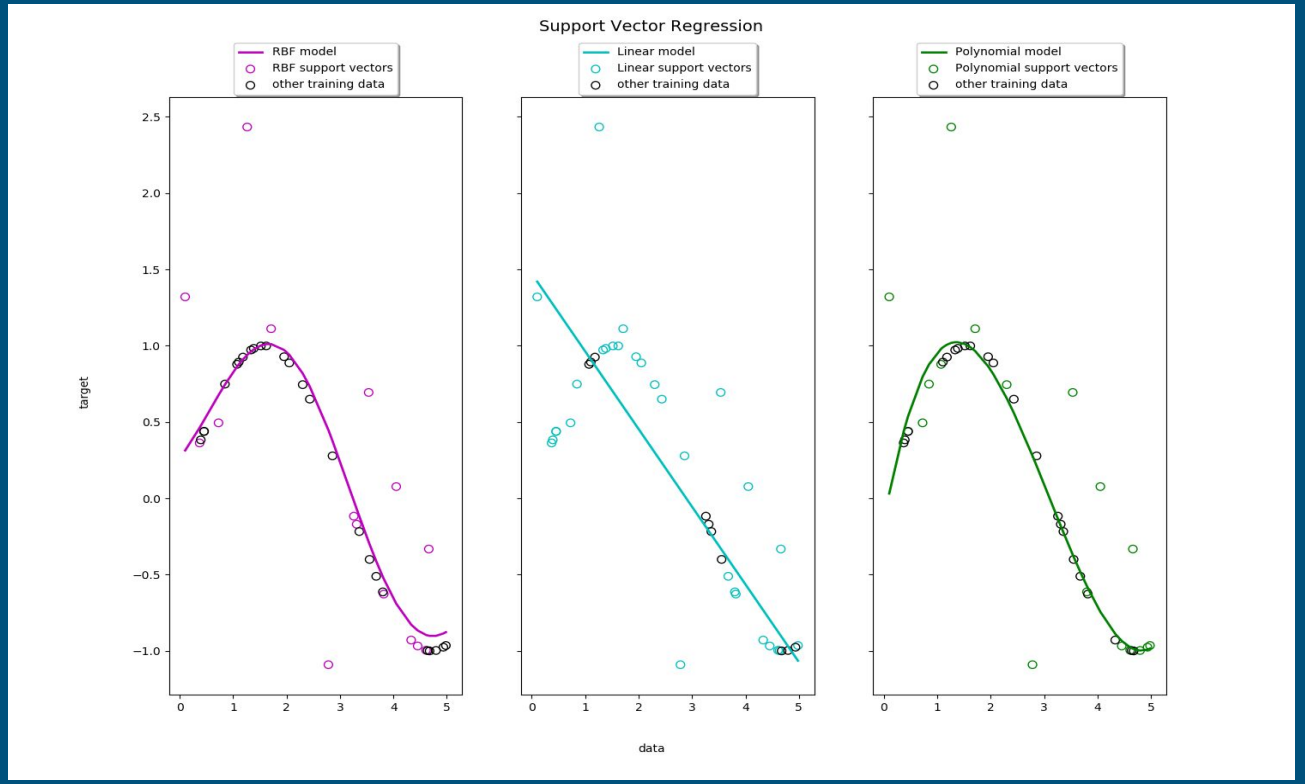


class `sklearn.svm.` **SVR** (*kernel='rbf', degree=3, gamma='auto_deprecated', coef0=0.0, tol=0.001, C=1.0, epsilon=0.1, shrinking=True, cache_size=200, verbose=False, max_iter=-1*) [source]

SV-Regression

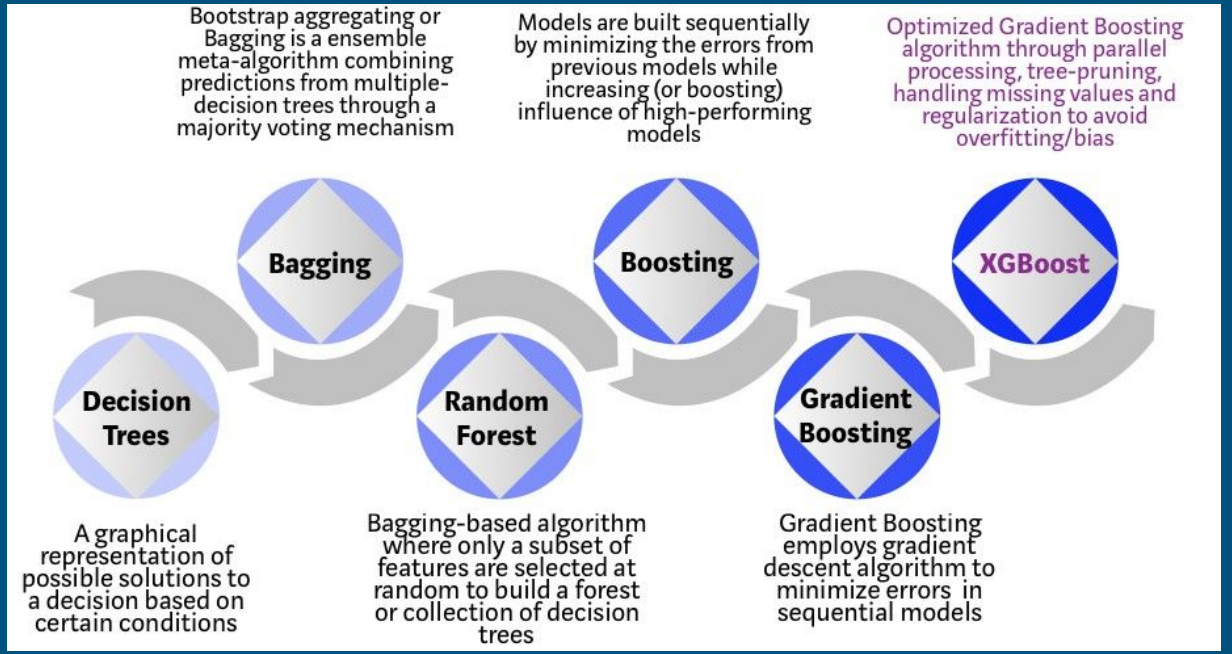
Similar to SVC.

Differs from other regression models as it is non-parametric [relies on Kernel functions]



XGBoost

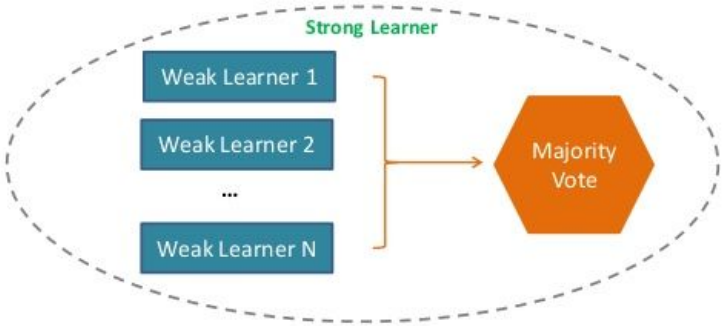
- Extreme Gradient Boosting
- Boosting -> new models added to correct the errors made by existing models. Models added sequentially.
- Gradient boosting -> gradient descent algorithm to minimize the loss when adding new models.



Ensemble Learning

Weak Learners

- In an Ensemble method, one combines multiple weak learners to make a strong learning model.
- A weak learner is any model that has an accuracy of better than random, even if it is just slightly better (e.g., 0.51).



XGBoost

XGBoost Regressor

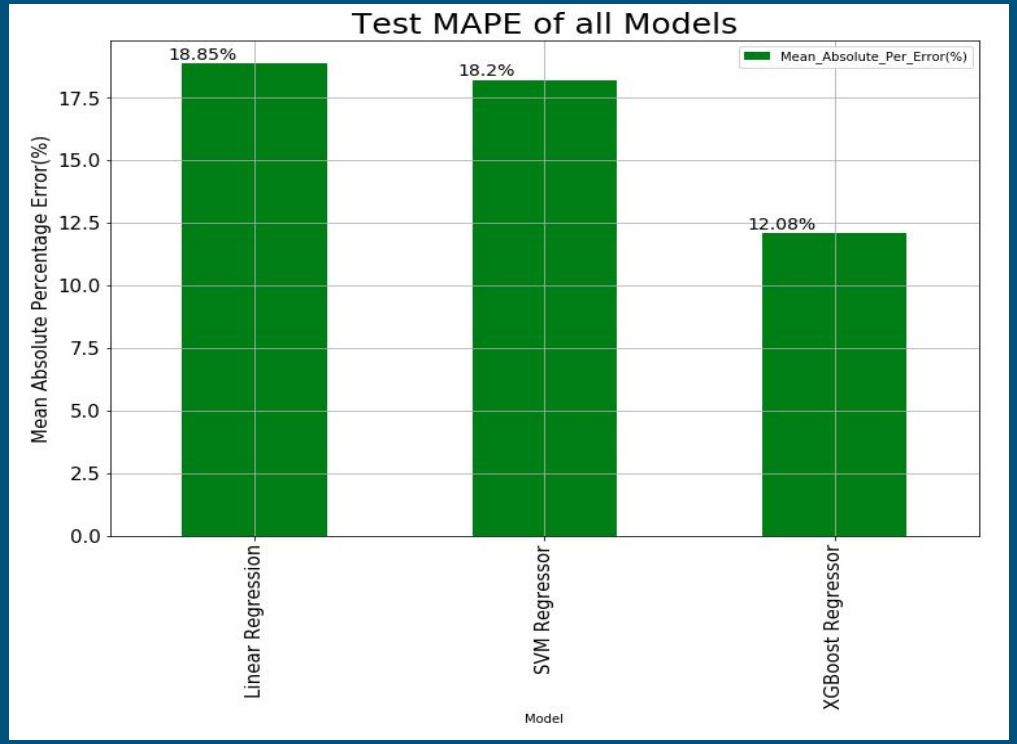
```
def xgboost_reg(train_data, train_true, test_data, test_true):
    #hyper-parameter tuning
    hyper_parameter = {"max_depth":[1, 2, 3, 4], "n_estimators":[40, 80, 150, 600]}
    clf = xgb.XGBRegressor()
    best_parameter = GridSearchCV(clf, hyper_parameter, scoring = "neg_mean_absolute_error", cv = 3)
    best_parameter.fit(train_data, train_true)
    estimators = best_parameter.best_params_["n_estimators"]
    depth = best_parameter.best_params_["max_depth"]

    #applying xgboost regressor with best hyper-parameter
    clf = xgb.XGBRegressor(max_depth = depth, n_estimators = estimators)
    clf.fit(train_data, train_true)
    train_pred = clf.predict(train_data)
    train_MAPE = mean_absolute_error(train_true, train_pred)/ (sum(train_true)/len(train_true))
    train_MSE = mean_squared_error(train_true, train_pred)
    test_pred = clf.predict(test_data)
    test_MAPE = mean_absolute_error(test_true, test_pred)/ (sum(test_true)/len(test_true))
    test_MSE = mean_squared_error(test_true, test_pred)

    return train_MAPE, train_MSE, test_MAPE, test_MSE
```

Results

	Model	TrainMAPE(%)	TrainMSE	TestMAPE(%)	TestMSE
0	Linear Regression	11.772115	9.662512	19.533328	10.811107
1	SVM Classifier	10.475732	8.884453	18.694722	10.301545
2	XGBoost Regressor	10.801919	8.556740	12.195017	7.416899



	Model	Mean_Absolute_Per_Error(%)
0	Linear Regression	19.5333
1	SVM Regressor	18.6947
2	XGBoost Regressor	12.195

Resources

- https://blog.goodaudience.com/taxi-demand-prediction-new-york-city-5e7b12305475
- https://towardsdatascience.com/https-medium-com-vishalmorde-xgboost-algorithm-long-she-may-rein-edd9f99be63d
- https://www.datacamp.com/community/tutorials/xgboost-in-python