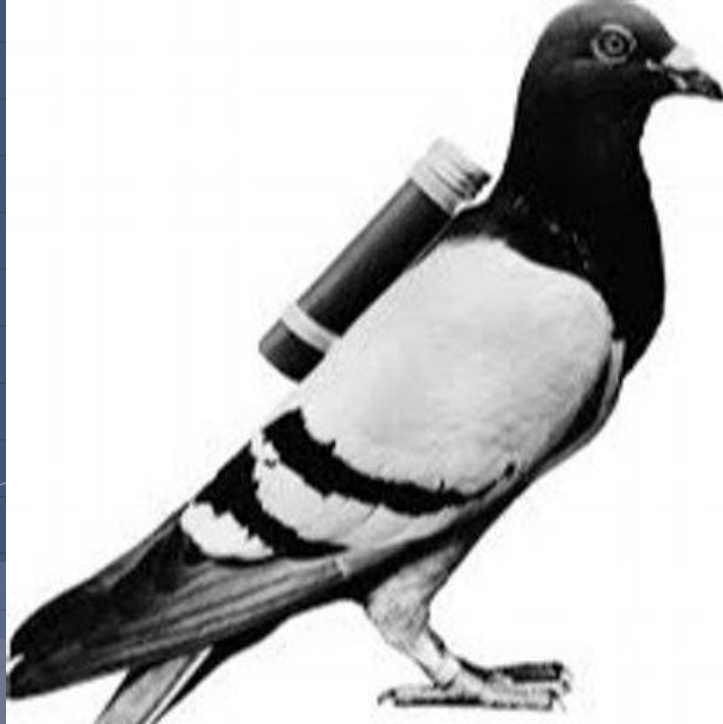


An Exploration in Minute by Minute Trading

Subramanian Iyer

Brief History of High Frequency Trading (HFT)

1851 : Julius Reuter transitions from carrier pigeons to telegraph cables




Deutsche Börse Data

1 month (Feb 2018) of minute by minute trading data put in Amazon S3 Bucket

Kept data on the 10 most frequently traded Companies on the exchange

We have minute by minute data, so we'll trade minute by minute



Companies

BASF SE (Chemicals)

Bayer AG (Pharmaceuticals)

E.ON SE (Energy)

BMW (Automotive)

SAP SE (Software)

Volkswagen (Automotive)

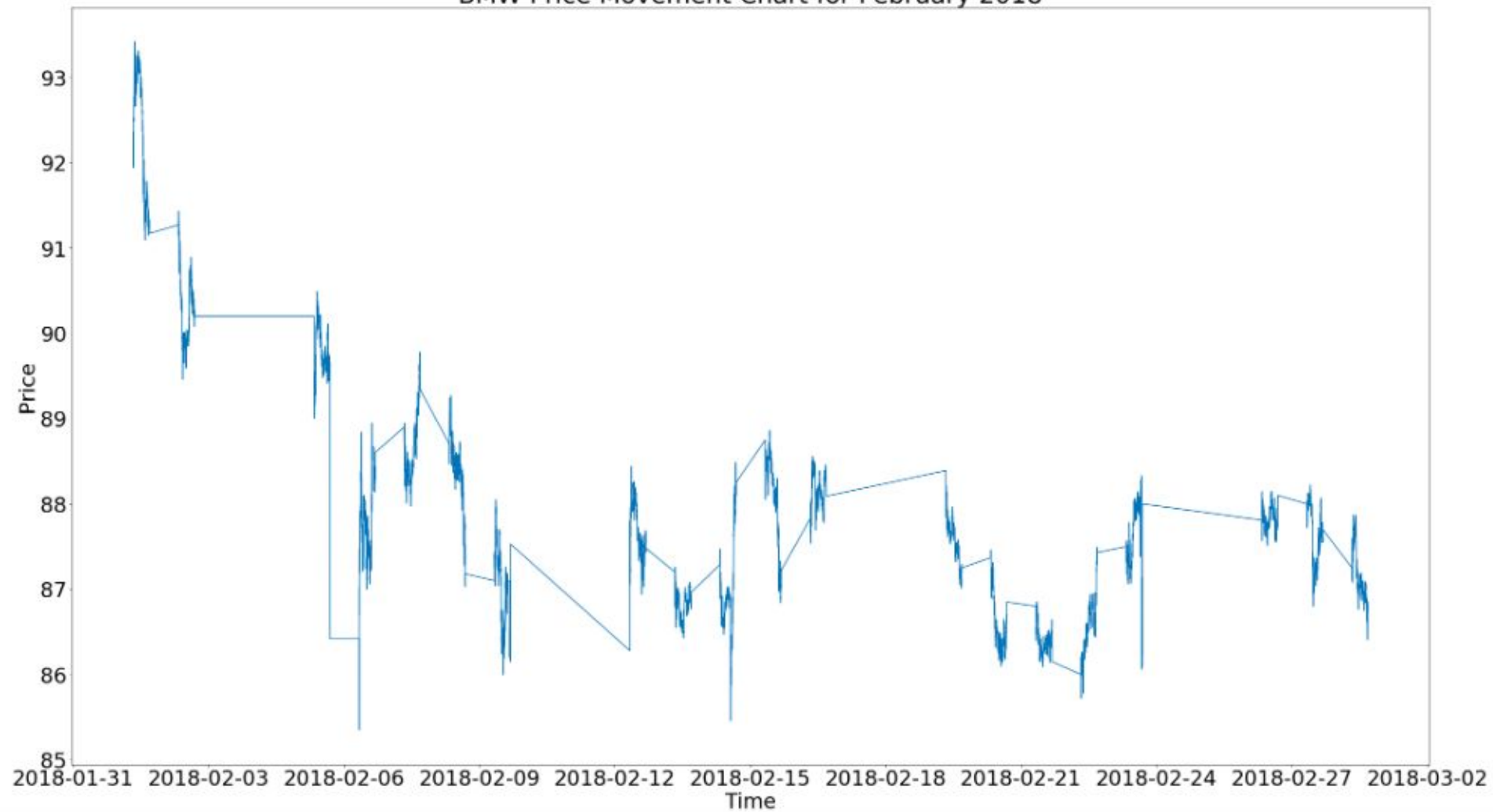
Allianze SE (Financial Services)

Deutsche Bank (Financial Services)

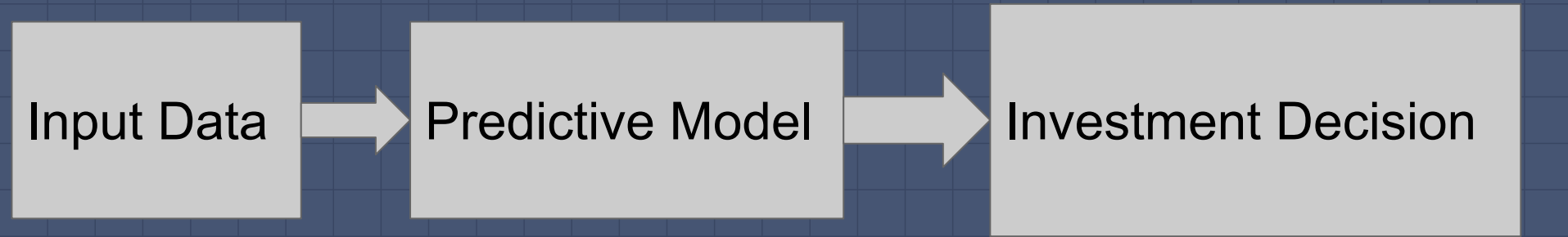
Daimler AG (Automotive)

Siemens (Conglomerate)

BMW Price Movement Chart for February 2018



The Plan



Assumptions

- Can enter and exit positions without moving price
- Transaction Costs



Baseline

Average Annualized Movement:
-17.7%



Baseline Models

Random Forest Model:

Avg. Return of: -1.16% over 6
day test set

(-37.4% Annualized)

Logistic Regression Model:

Avg. Return of 0.41% over 6 day
test set

(17.7% Annualized)



Logistic Regression Investigation

Positive Returns On:

BASF SE

Bayer AG

E.ON SE

BMW

SAP SE

Allianze SE

Daimler AG

Negative Returns On:

Volkswagen

Deutsche Bank

Siemens

LSTM Neural Network

LSTM NN – Ideal for predicting time series data

1.4% average return over 6 day test set

(74% Annualized)



LSTM Neural Network

Positive Returns On:

BASF SE

Bayer AG

E.ON SE

BMW

SAP SE

Volkswagen

Allianze SE

Daimler AG

Siemens

Negative Returns On:

Deutsche Bank



Adding Transaction Costs

Tried LSTM again with spread of .2 cents

Tried predicting forward 10 minutes to trade less

With 10 minute look ahead period, 24.62% annualized return

Thank you.

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