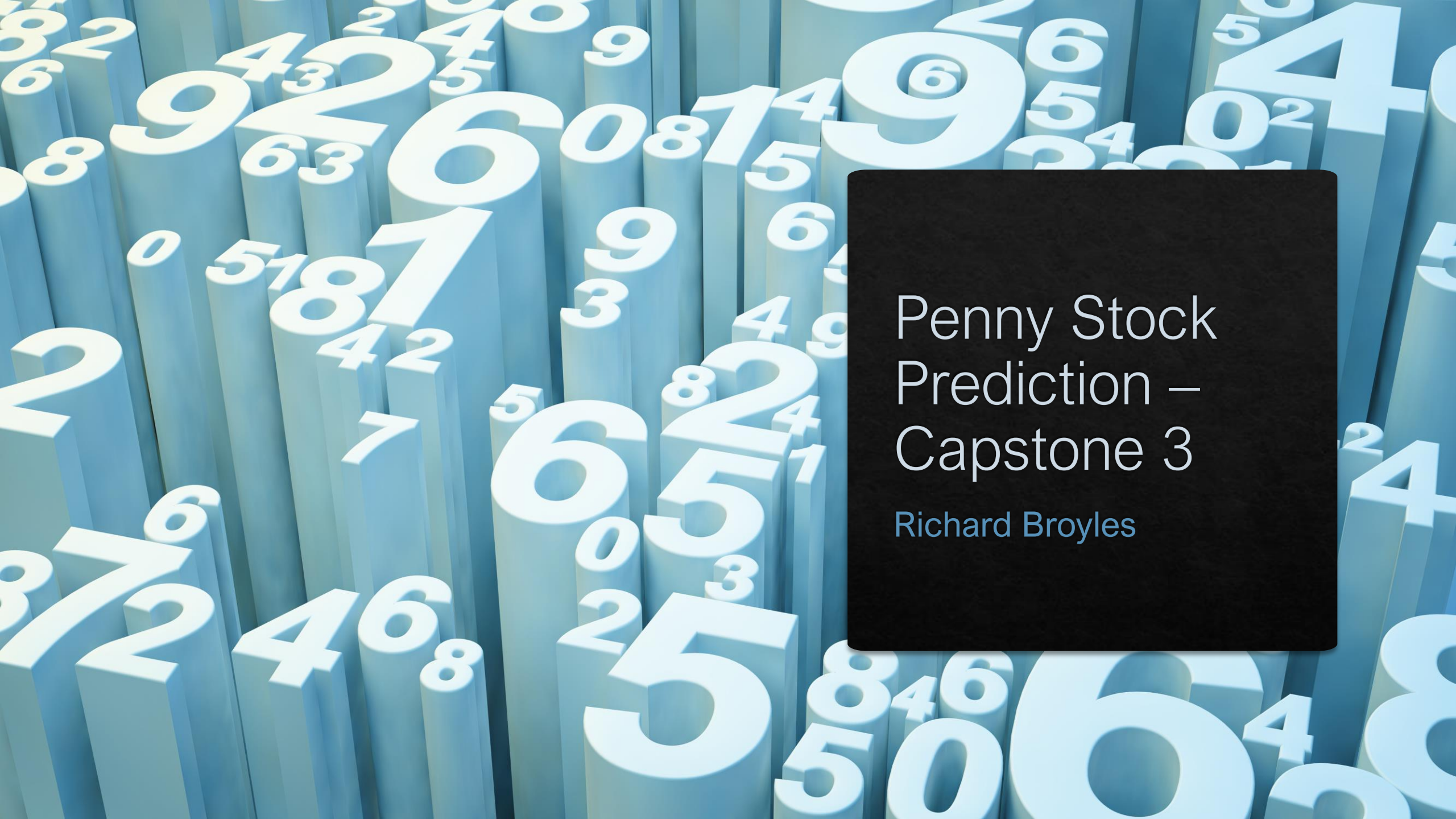


# Penny Stock Prediction – Capstone 3

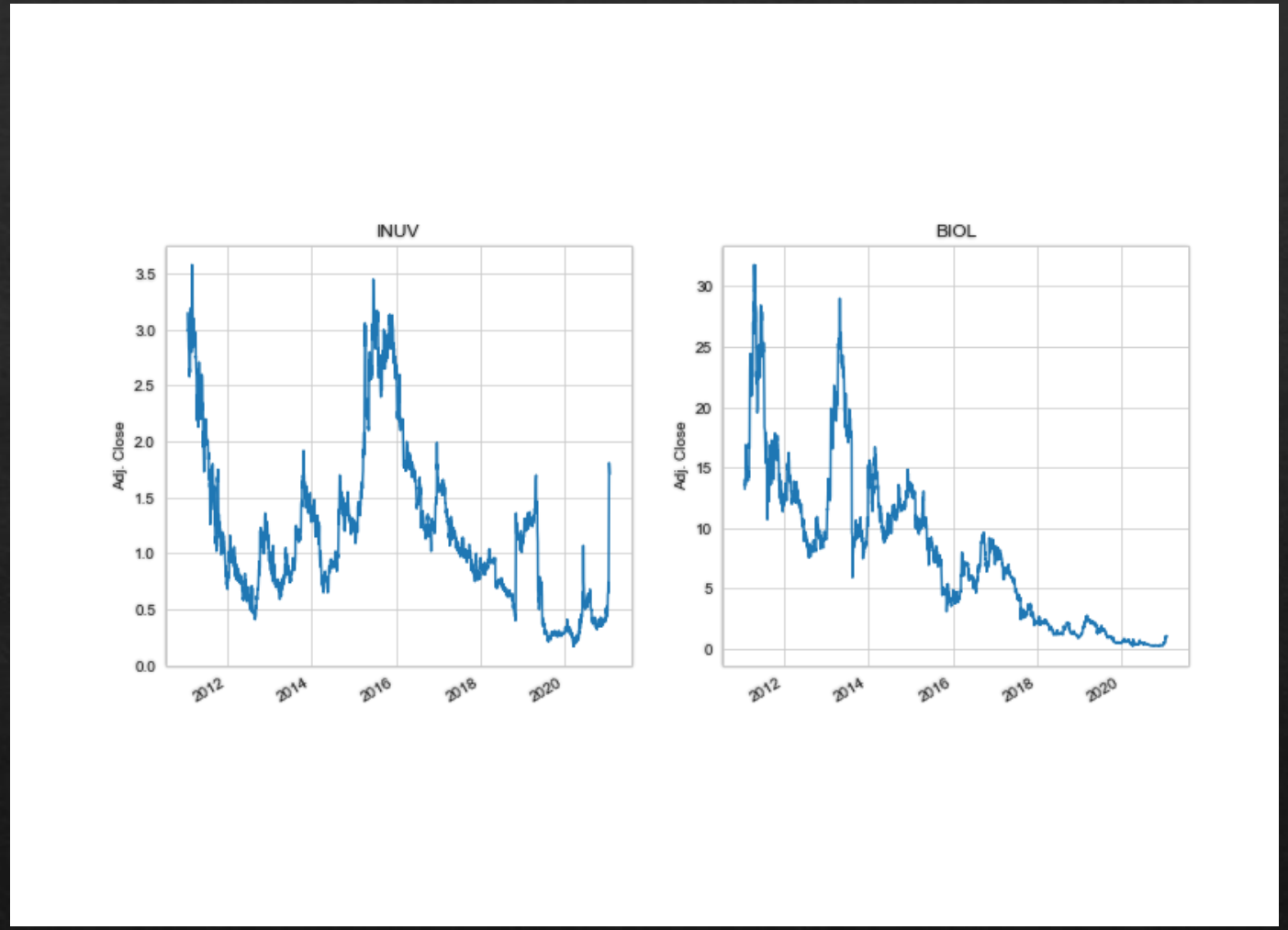
Richard Broyles

# Introduction

- Goal of this project is to predict the price of a couple of penny stocks from various sectors.
- Two stocks used
  - Inuvo – develops and sells information tech solutions for online audiences.
  - Biolase – develops, markets, and sells dental laser systems.
- Ten years of stock data was collected.
- Six attributes for each stock.
- ARIMA model used to predict the future value of these stocks.

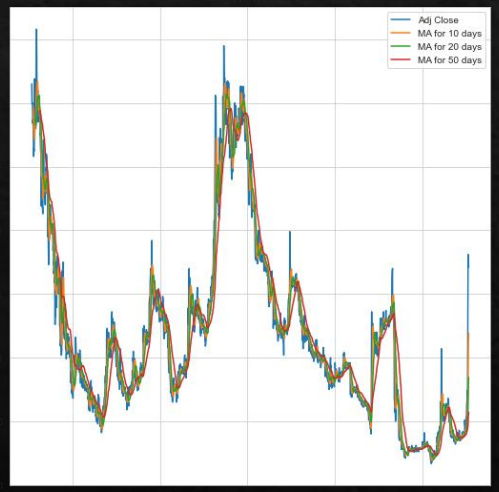
# Exploratory Data Analysis

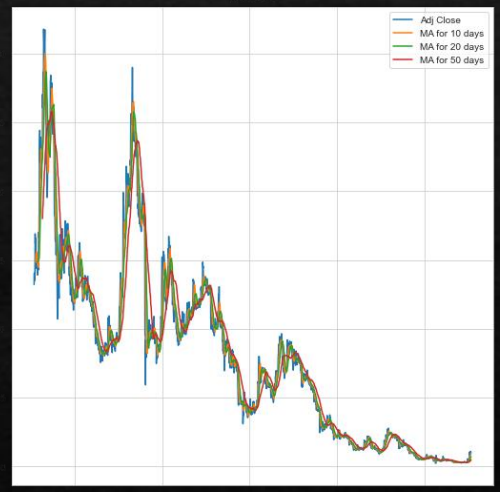
- Data is live from Yahoo! Finance.
- Data is from 2010-2020.
- No data cleaning is necessary.
- Plots at right show adjusted close of both stocks.



# EDA - continued

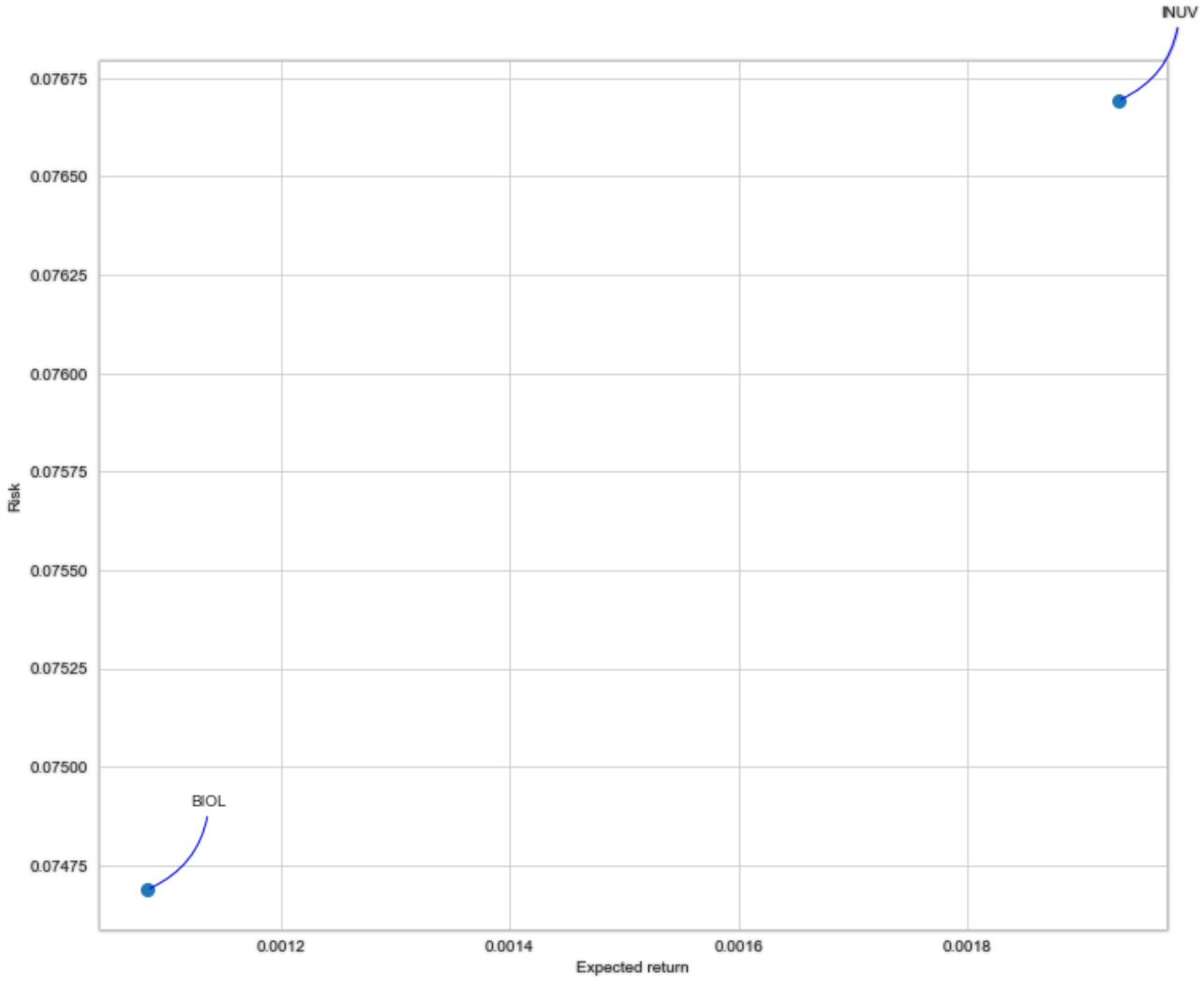
- Plots at right show the moving average for both stocks
  - 10-day
  - 20-day
  - 50-day
- Data for these plots are as of 1/25/21.



# Risk vs. Return

- Plot shows risk vs. return values for both stocks.
- Note the scale on both axes of the plot.
  - Smaller value stocks have small risk vs. return values.
  - Since these stocks can move monumentally, a shift in this plot can easily occur.



# Modeling

## Time series has three systematic and one non-systematic component

- Noise
- Level
- Trend
- Seasonality

## Augmented Dickey-Fuller test

- Test to see if series is stationary
- Null hypothesis – Series has a unit root; is stationary.
- Alternate hypothesis – Series has no unit root; is not stationary.

# Modeling – ADF test

- Inuvo stock result
  - p-value = 0.026
  - Null hypothesis is rejected
    - No unit root in series.
- Biolase stock result
  - P-value = 0.26
  - Null hypothesis cannot be rejected.
  - Critical values are less than test statistic.
    - Series is non-stationary.

# Prediction

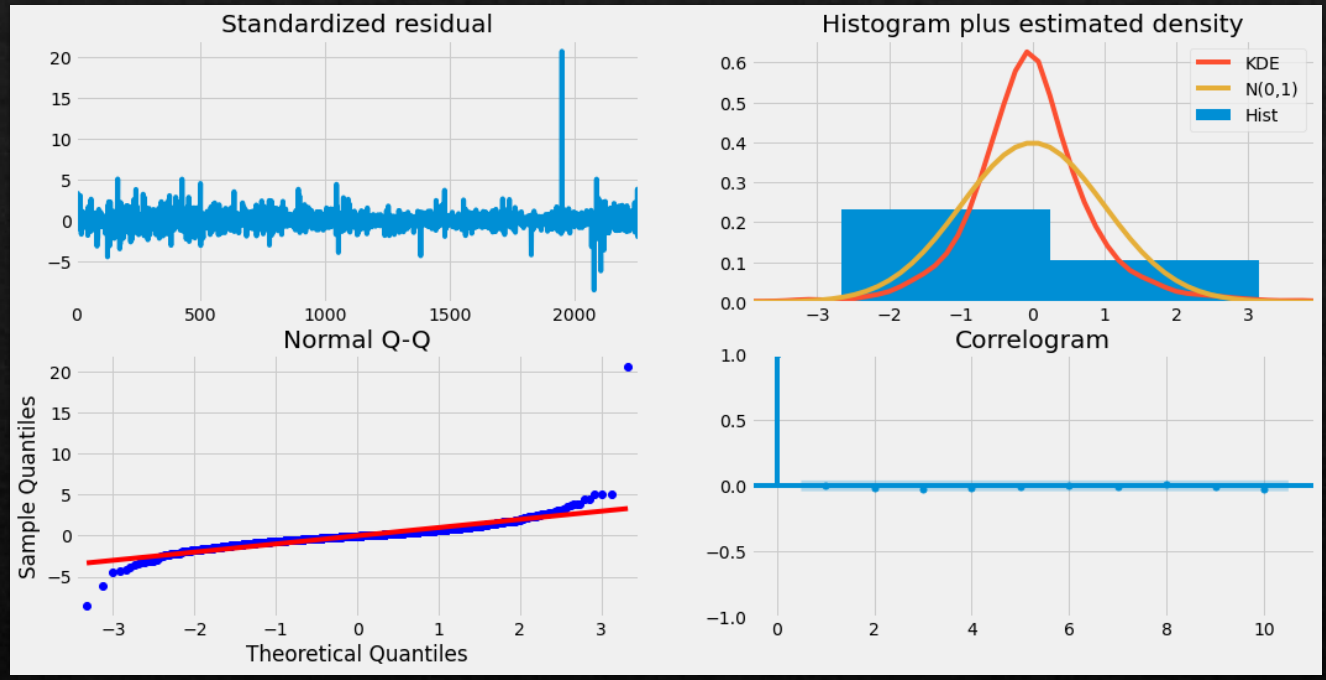
**Training and test data sets were created by log normalization of the mean and standard deviation of both stocks.**

**Used Auto-ARIMA function to determine best parameter for model.**

**Residual plots for both stocks.**

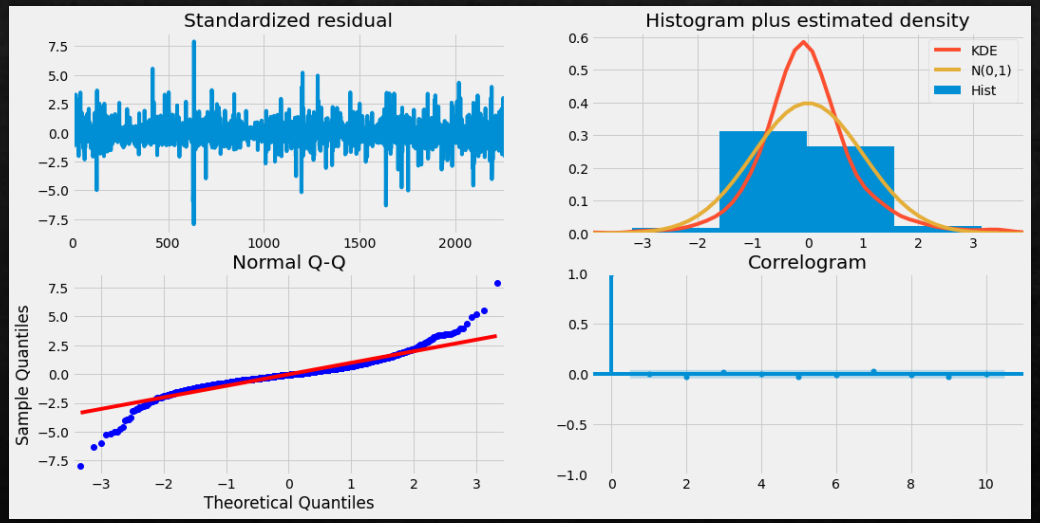
Standard residual – uniform variance
Histogram plus density – normal distribution
Quantiles – shape of distribution
Correlogram – finds correlations in the errors.

# Prediction – cont'd Inuvo diagnostic plots.



# Prediction – cont'd (2)

- Plot is diagnostic plot for Biolase.

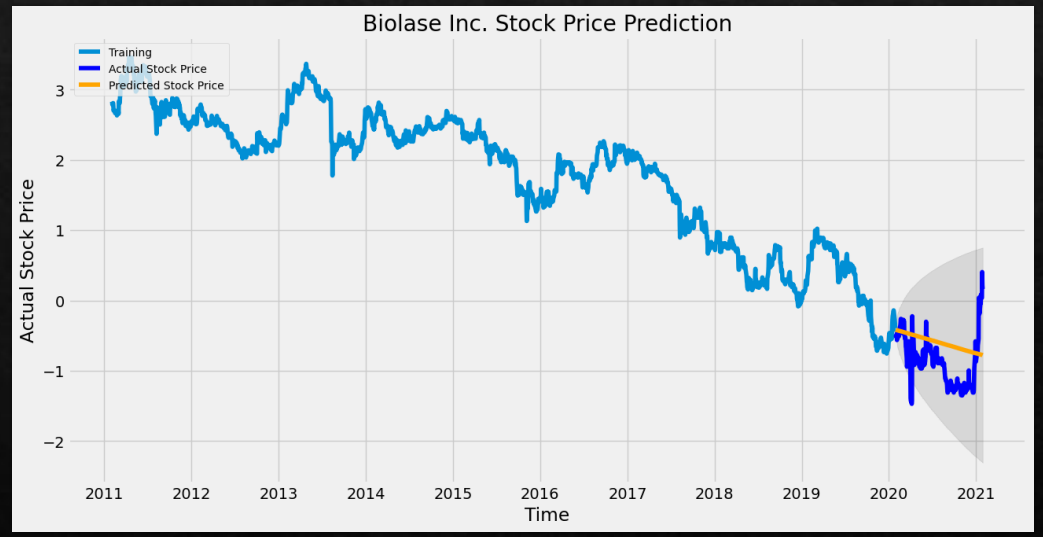


# Inuvo Stock Prediction

- Orange line is the price prediction.
- Shaded area is cone of uncertainty.
- Model is not effective at predicting.
  - MSE = 0.367
  - RMSE = 0.4911
  - Both fall outside of confidence interval.

# Biolase Stock Prediction

- Same prediction as Inuvo stock.
- Despite recent gains, falls within cone of uncertainty.
- Model is not effective; it falls outside of confidence interval.
  - MSE = 0.189
  - RMSE = 0.435



# Conclusions

- Despite low barrier of entry, not a good value for the short-term.
- Models predict downward trend for current year.
  - Outside forces will heavily impact this prediction.
- Nature of these stocks cause high error rate when evaluating models.
- Small variations in price will cause error rate to fluctuate wildly.
- Prediction models used should not be used as a tool for investing.

# Questions?