

# MC3-Project-2 - ML Trading Strategy

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## Overview

We will evaluate the use of machine learning algorithms on creating trading strategies. Specifically, we will evaluate the use of KNN on forecasting future asset prices given a set of technical indicators.

## Regression Task

The following indicators were used as features in the regression task:

1. Bollinger Band Value w/ 20-day SMA/STDEV
2. 5 Day Price Momentum
3. 20 Day Rolling Standard Deviation

The regression task was set to predict the 5 day future asset price change. KNN was used with  $K=3$  and euclidean distance as the metric.

## Trading Strategy

The predicted future price change was used to create a trading strategy that would enter a long position whenever the predicted change went over 1%, entered a short position when predicted change dropped below -1%, and exited any long/short positions when predicted change fell between 1% and -1%.

## ML4T-399 Dataset

### 2008-2009 Time Period

**Regression Results** Figure 1 illustrates actual 5 day future price, predicted future price, and current price on the ML4T-399 dataset. We see that future prices, both actual and predicted, correctly lag 5 trading days behind current prices. We also see that predicted future prices and actual future prices visually match. This is validated by low cumulative error between predicted and actual Y values:

In sample results

RMSE: 0.000489350604935

corr: 0.999994374105

**Generated Trades** Figure 2 shows the entry and exits points period 2008-2009. Show long entries as green lines, short entries as red lines and exits as black lines. You may find it convenient to zoom in on a particular time period so this is evident.

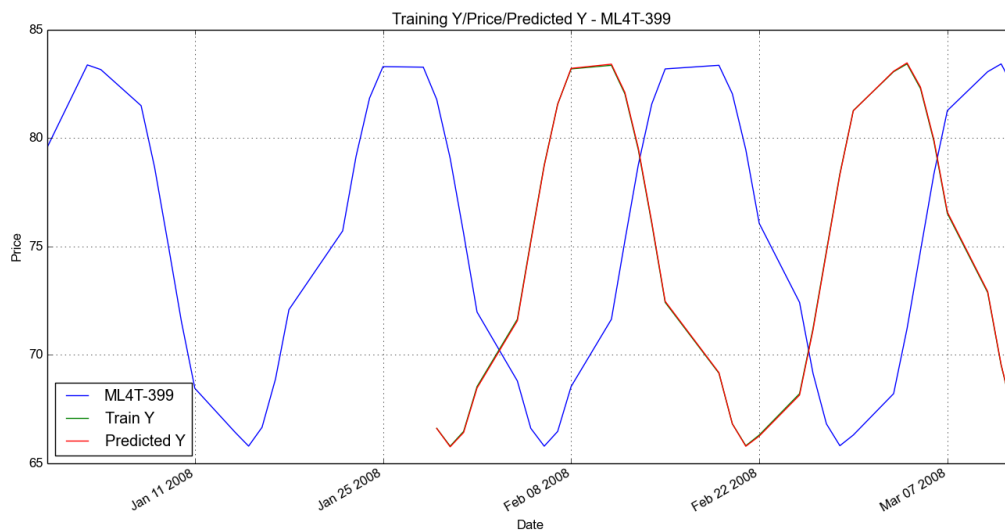


Figure 1: Training Y/Price/Predicted Y - ML4T-399 '08-'09

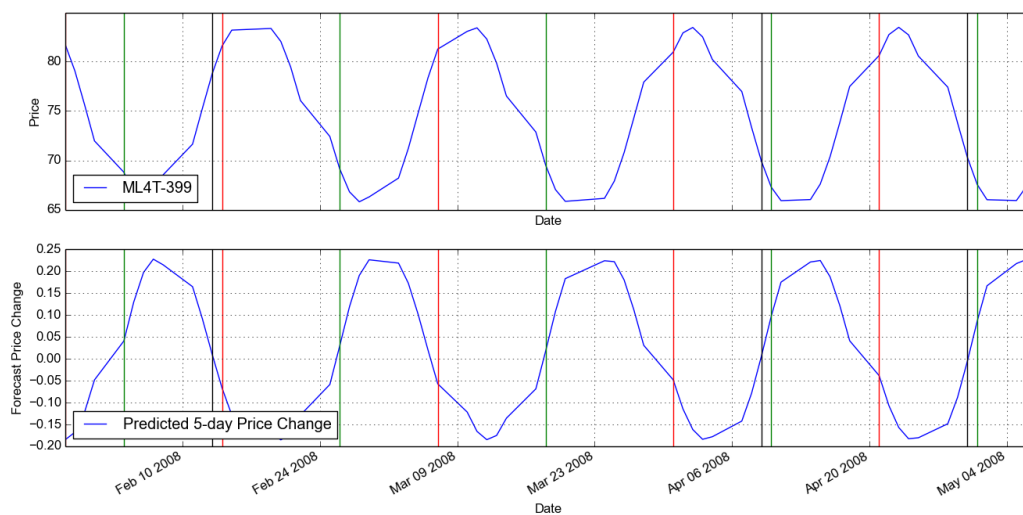


Figure 2: Entries/Exits - ML4T-399 '08-'09

## Trading Strategy Backtest Sine Data In Sample Backtest

Data Range: 2007-12-31 to 2009-12-31

Sharpe Ratio of Fund: 9.34910227904

Sharpe Ratio of \$SPX: -0.21996865409

Cumulative Return of Fund: 7.65646479

Cumulative Return of \$SPX: -0.240581328829

Standard Deviation of Fund: 0.00731742096044

Standard Deviation of \$SPX: 0.0219524869863

Average Daily Return of Fund: 0.00430950789491

Average Daily Return of \$SPX: -0.000304189525556

Final Portfolio Value: 86564.6479

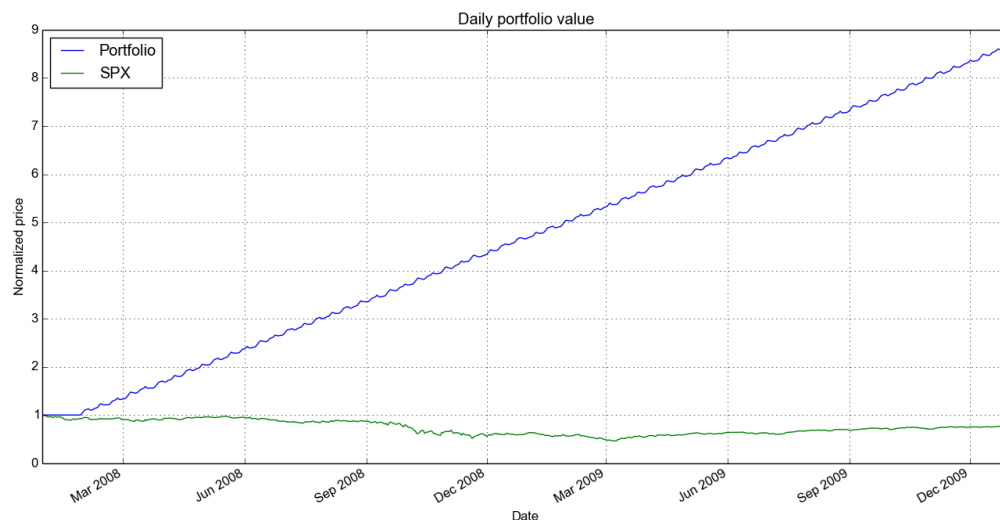


Figure 3: Backtest - ML4T-399 '08-'09

## 2010 Time Period

**Generated Trades** Sine Data Out of Sample Entries/Exits: Freeze your model based on the 2008-2009 data. Now test it for the year 2010 – Plot that illustrates entry & exits, generate trades,

## Trading Strategy Backtest Sine Data Out of Sample Backtest

Data Range: 2009-12-31 to 2010-12-31

Sharpe Ratio of Fund: 10.4088491304

Sharpe Ratio of \$SPX: 0.756512754402

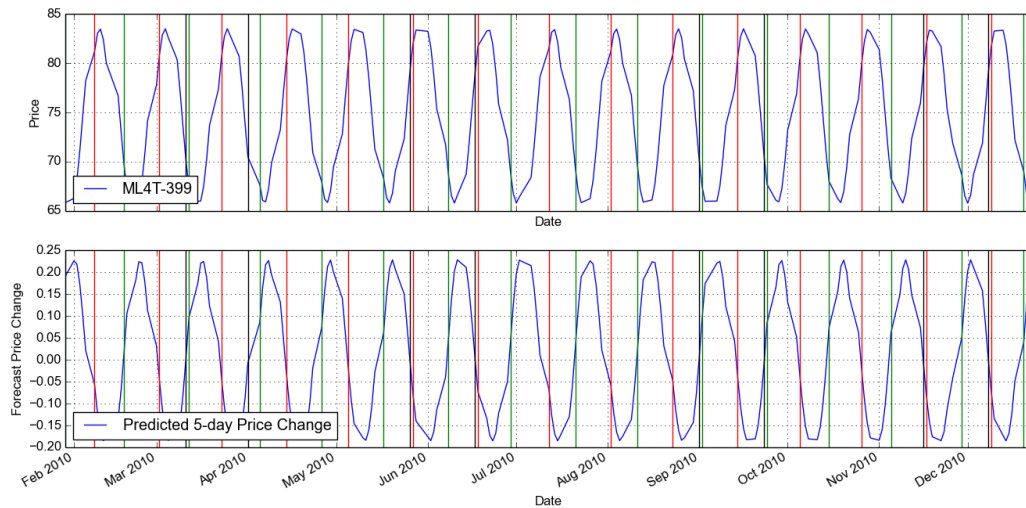


Figure 4: Entries/Exits - ML4T-399 '10

Cumulative Return of Fund: 3.67897198

Cumulative Return of \$SPX: 0.127827100708

Standard Deviation of Fund: 0.00943439017466

Standard Deviation of \$SPX: 0.0113715303326

Average Daily Return of Fund: 0.00618609060464

Average Daily Return of \$SPX: 0.000541919649169

Final Portfolio Value: 46789.7198

Learning results

In sample results

RMSE: 0.00182176340524

corr: 0.999922732335

## ML4T-399 Dataset

### 2008-2009 Time Period

### Regression Results

**Generated Trades** IBM Data In Sample Entries/Exits: Create a plot that illustrates entry and exits as vertical lines on a price chart for the in sample period 2008-2009. Show long entries as green lines, short entries as red lines and exits as black lines. You may find it convenient to zoom in on a particular time period so this is evident.

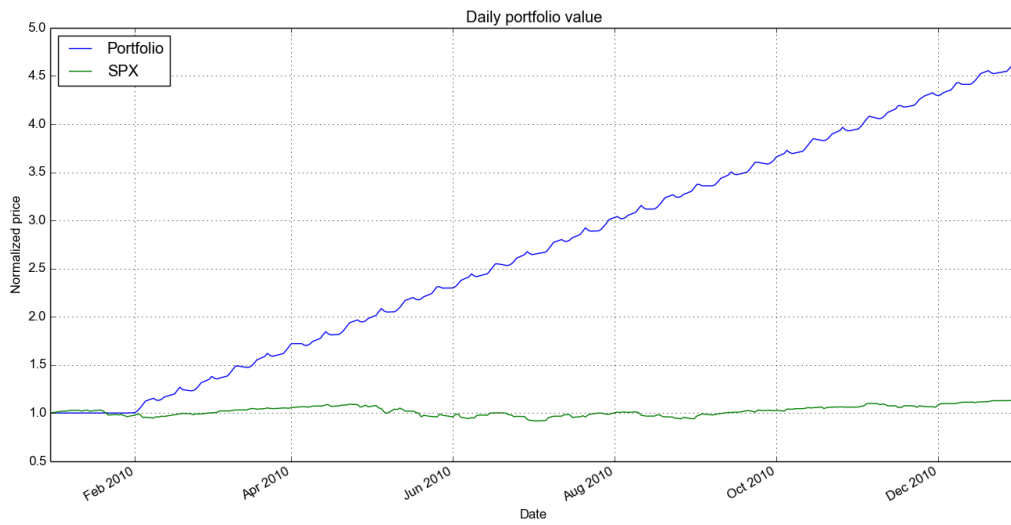


Figure 5: Backtest - ML4T-399 '10

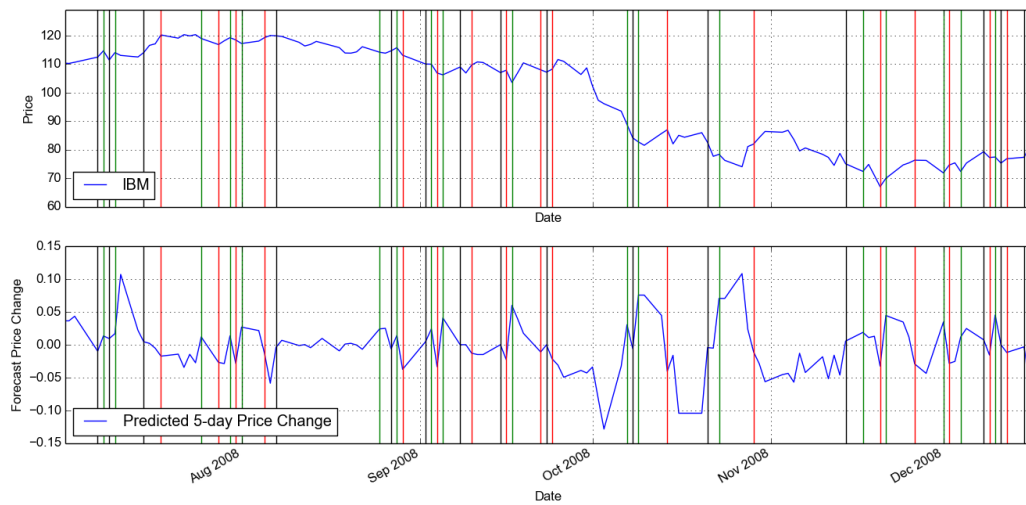


Figure 6: Training Y/Price/Predicted Y - IBM '08-'09

In sample results  
RMSE: 0.0310958524397  
corr: 0.697132609597

### Trading Strategy Backtest IBM Data In Sample Backtest

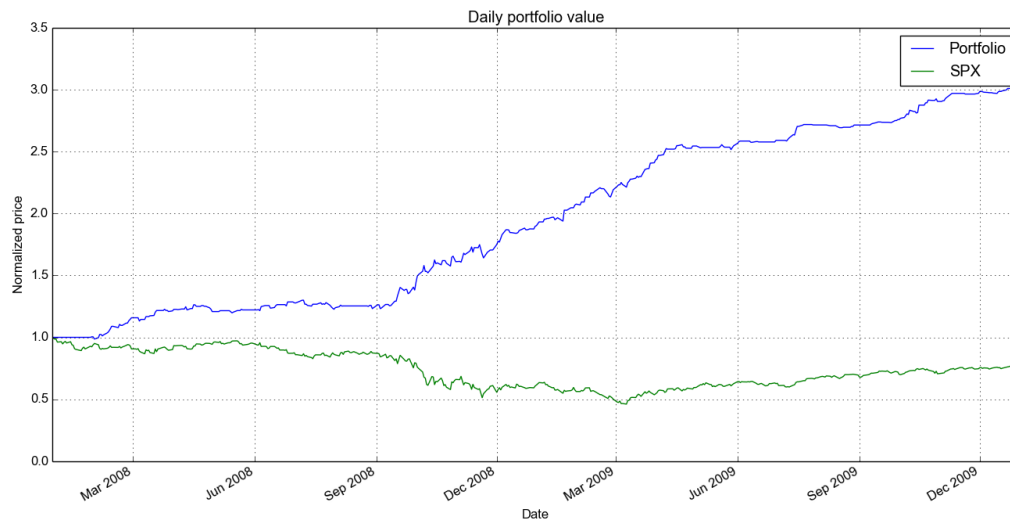


Figure 7: Backtest - IBM '08-'09

Data Range: 2007-12-31 to 2009-12-31

Sharpe Ratio of Fund: 3.70915105837  
Sharpe Ratio of \$SPX: -0.21996865409

Cumulative Return of Fund: 2.0096  
Cumulative Return of \$SPX: -0.240581328829

Standard Deviation of Fund: 0.00954080200275  
Standard Deviation of \$SPX: 0.0219524869863

Average Daily Return of Fund: 0.00222925183849  
Average Daily Return of \$SPX: -0.000304189525556

Final Portfolio Value: 30096.0

### 2010 Time Period

**Generated Trades** IBM Data Out of Sample Entries/Exits: Freeze your model based on the 2008-2009 data. Now test it for the year 2010 – Plot that illustrates entry & exits, generate trades,

### Trading Strategy Backtest IBM Data Out of Sample Backtest

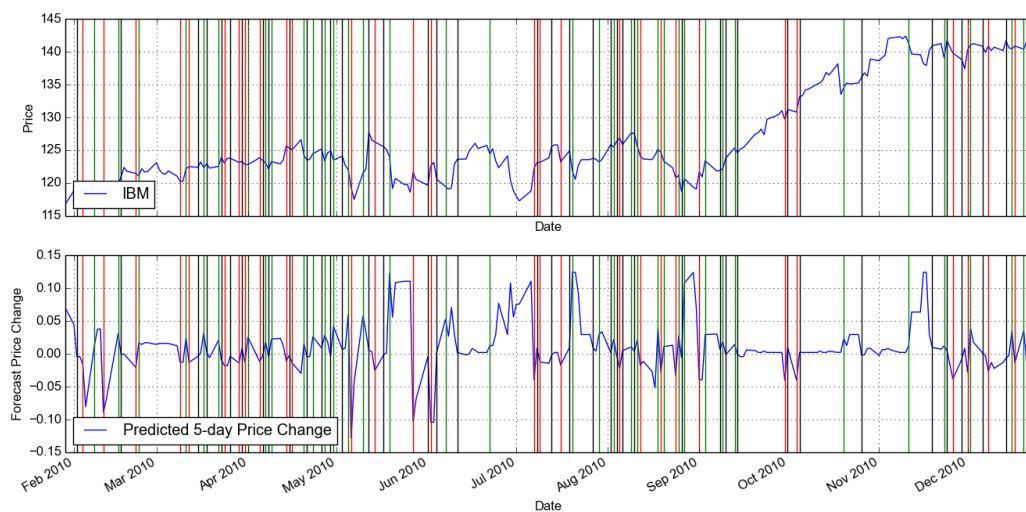


Figure 8: Entries/Exits - IBM '10

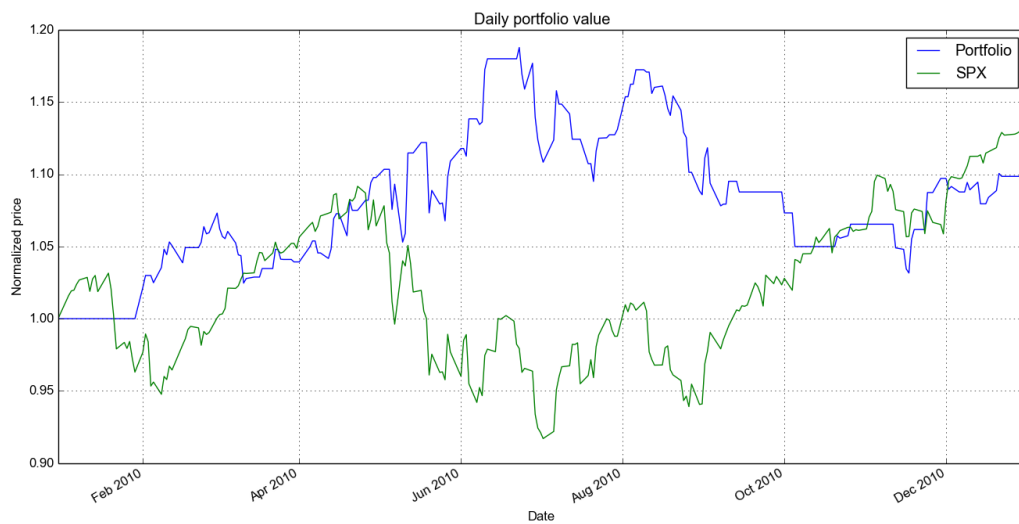


Figure 9: Backtest - IBM '10

Data Range: 2009-12-31 to 2010-12-31

Sharpe Ratio of Fund: 0.679632745049

Sharpe Ratio of \$SPX: 0.756512754402

Cumulative Return of Fund: 0.0985

Cumulative Return of \$SPX: 0.127827100708

Standard Deviation of Fund: 0.00983141011967

Standard Deviation of \$SPX: 0.0113715303326

Average Daily Return of Fund: 0.000420910575847

Average Daily Return of \$SPX: 0.000541919649169

Final Portfolio Value: 10985.0

Learning results

In sample results

RMSE: 0.04283663904

corr: 0.140995673532