

Short Term Price Prediction in Financial Markets

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Objectives

- Apply Machine Learning techniques to predict short term price for a financial asset performing technical analysis.
- Perform long term price prediction with respect to direction of the prediction for different training set sizes.
- Short term price prediction accuracy for next ten days considering different financial assets data and technical indicators. Measure correlation between time sensitivity of training data and prediction accuracy.
- Come up with the confidence of price prediction within X% spread from actual based on cost function.

Dataset

- Using Bloomberg access, data is acquired for 10 years from 10/18/05 to 10/20/15.
- **Assets:** Assets considered are S&P Index, EURJPY (Foreign Exchange), HG1 (Commodity), TYA (Treasury).
- **Technical Indicators:** For each asset, acquired daily data for technical indicators (22) such as Moving Average, Momentum, Hurst etc.
- **Feature Engineering:** Feature vector contains data from assets such as previous close price, volume, technical indicators from previous day etc., to predict S&P close price for next day.

Methods

Long Term Price Prediction:

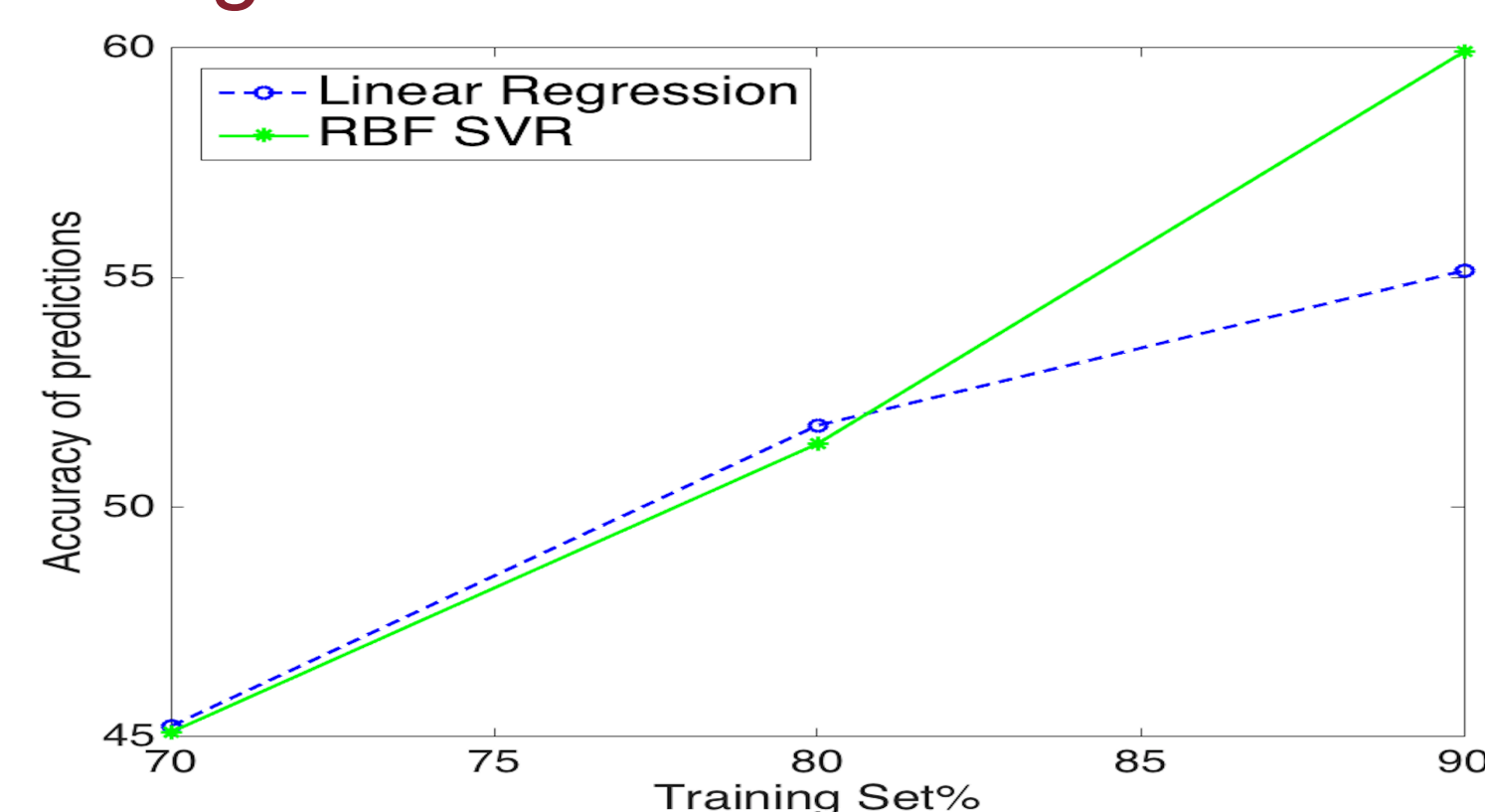
- Train with 70%, 80% and 90% training set size and measure the prediction accuracy (prediction is in same direction as actual) for the test set. Used Linear Regression and SMO Support Vector Regression with polynomial/RBF kernels.

Short Term Price Prediction:

- This is the primary focus of this project. Predict prices for next 1, 5 and 10 day horizons. Following methodologies are used. SMO SVR with polynomial and RBF kernels is used.
- **Fixed Window:** Considered training set sizes say 70%, 71%..99% and measured the prediction accuracy for next 1, 5 and 10 days using Support Vector Regression.
- **Rolling Window:** To determine the time sensitivity of data, performance is measured for last 36, 24, 12, 6, 3 months of training set. In both the cases, ablative analysis is done considering data from different assets to determine it's effectiveness.
- **Technical Indicators:** Analysis with different technical indicators to determine the high performing indicators.
- **Confidence of prediction:** Determine the confidence of price prediction within X% from actual.

Results

Long Term Price Prediction:



Short Term Price Prediction:

Fixed Window: Best performance is obtained with SPX asset data alone and degrades with additional asset data.

Assets/Horizon	1	5	10
SPX	72.41	64.13	46.89
SPX_EU	41.37	49.65	38.27
SPX_HG1	41.37	35.86	33.44
SPX_EU_HG1	55.17	44.13	34.48
SPX_EU_HG1_TYA	41.37	35.86	25.51

Rolling Window: Performance is optimal considering last 6 months of training data. This shows correlation between time sensitivity of train data and prediction accuracy. Accuracy is improved with other assets data as opposed to fixed window.

Assets/Horizon	X% (10%=1 year)	1	5	10
SPX	30%	86.20	75.17	65.51
	10%	79.31	83.44	73.10
	5%	82.75	83.44	77.58
	2%	75.86	77.93	72.75
SPX_EU_HG1	30%	86.20	88.27	85.17
	10%	86.2	88.96	84.13
	5%	82.75	91.03	84.82
	2%	82.75	89.65	84.82

Results

Technical Indicators:

- Ablative analysis to determine the technical indicators that perform well.
- The table below shows the Polynomial Support Vector Regression with C=1 on SPX Index data with three technical indicators to predict accuracy for next 1, 5 and 10 day horizon for fixed window.

EA - Exponential Moving Average
Mom- Momentum
H - Hurst Exponent

Tech. Ind/Horizon	1	5	10
SPX	72.41	64.13	46.89
SPX, EA, Mom, H	72.41	67.58	60.00
SPX EA, H	72.41	67.58	64.13
SPX using E	58.62	59.31	54.48
SPX using H	72.41	67.58	62.75

- As observed, prediction accuracy is better for 5 and 10 day horizon when EM and Hurst technical indicators are considered.

Future Work

Add results for below tasks in final report:

- Locally weighted linear regression as data is time sensitive.
- Ablative analysis considering additional technical indicators.
- Confidence of prediction within X% from actual.
- Report for different values of C and Y for Support Vector Regression.