IOWA STATE UNIVERSITY
Department of Industrial and Manufacturing Systems Engineering

Multi-Asset Signal Generation

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Project Overview

Problem Statement

Principal's on-going investing process recommends investment options restricted to a certain asset class. This can result in exposure to macroeconomic risks that are asset class specific

Project Scope

The project focused on building a model that recommends specific asset classes and risk exposures given the current market conditions

Goal and Objectives

Goal

Develop machine learning models that generate signals based on predicting the directions of asset class returns

Objectives

1. Analyze statistical relationships among macroeconomic variables, factors and asset class rates of return (RoRs)
2. Select features and identify models that accurately classify the direction of return movements or predict numerical values

Methodology Overview

1. Estimate correlation among features and asset class returns
2. Tune and train K-nearest Neighbors (KNN) and Random Forest (RF) algorithms to predict numerical and binary values for signals
3. Compare performance between predicting binary values versus predicting numerical values for signals

Feature Engineering and Selection Process

Feature Construction

Monthly Future Rate of Return , Momentum, Volatility

Pearson Correlation

1. Select assets as features based on low cross-correlation
2. Group macroeconomic variables (MEVs) statistically related to asset classes

Build Model Architectures

Construct combination of input variables:

1. Highly correlated MEVs
2. Factors & MEVs as features
3. Assets & MEVs as features
4. Factors, MEVs & Assets as features

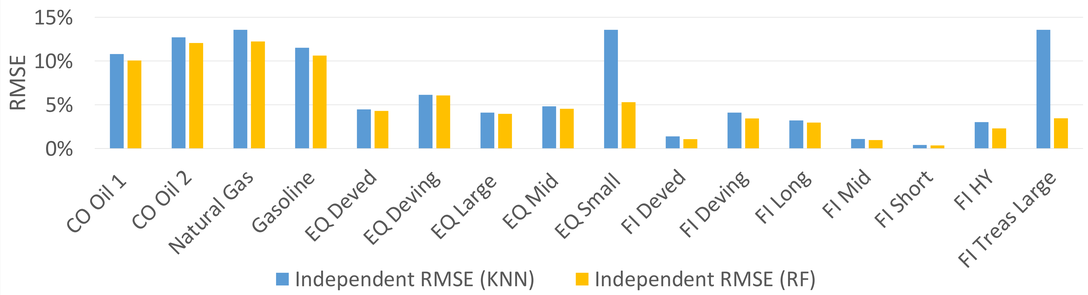
Implement Multiple Linear Regression Model

Select optimal input variables based on RMSE values

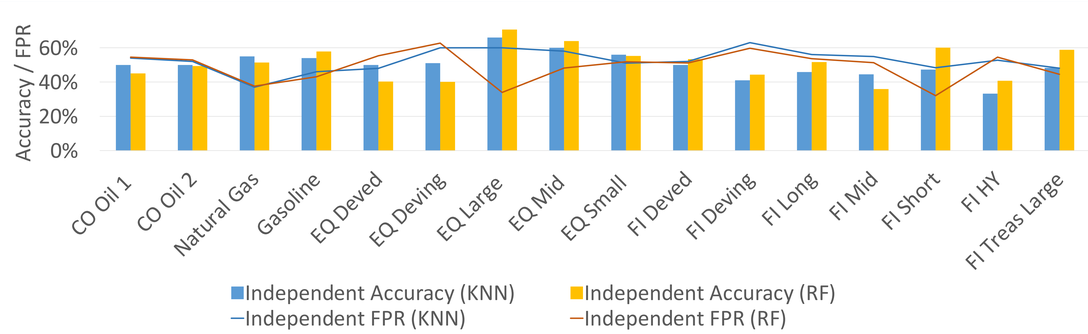
The resulting optimal input variables were:

Factors & MEVs as Features

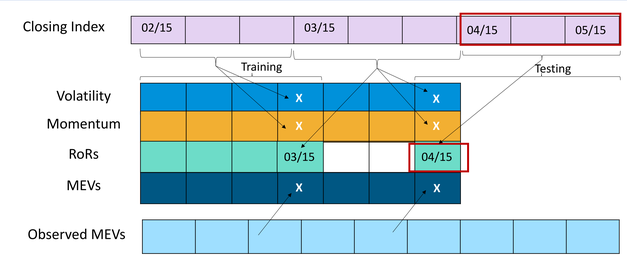
KNN vs RF Numerical Prediction



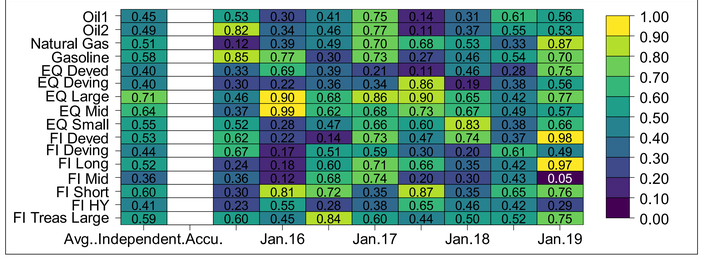
KNN vs RF Classification Prediction



Forward Looking Monthly RoR Prediction



RF Classification Predictions



Conclusions

1. Directions of the rate of return movements are predicted more accurately than the predictions of numerical values
2. RF produces more accurate predictions than KNN
3. Accuracy of the predictions strongly depends on calculation of the Momentum values

Recommendations

1. Future experimentations should be conducted on appropriate Momentum usage for predictive modeling
2. Models should further be analyzed by constructing portfolio of asset classes that generate upward signals and by evaluating this portfolio against a benchmark