Final Presentation

IEOR 4576: Data Driven Methods in Finance - Group LAMM

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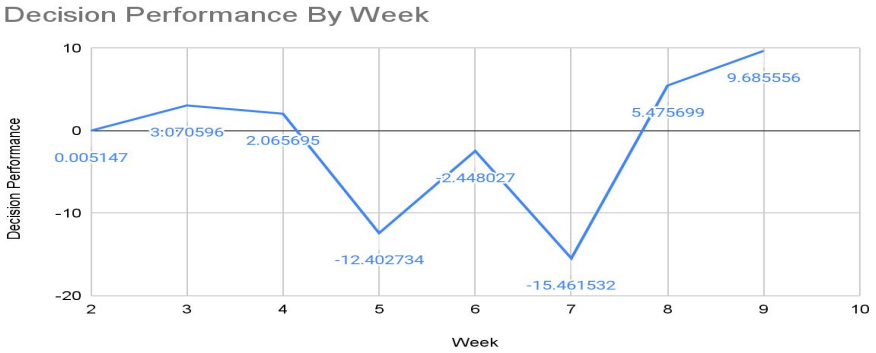
Outline

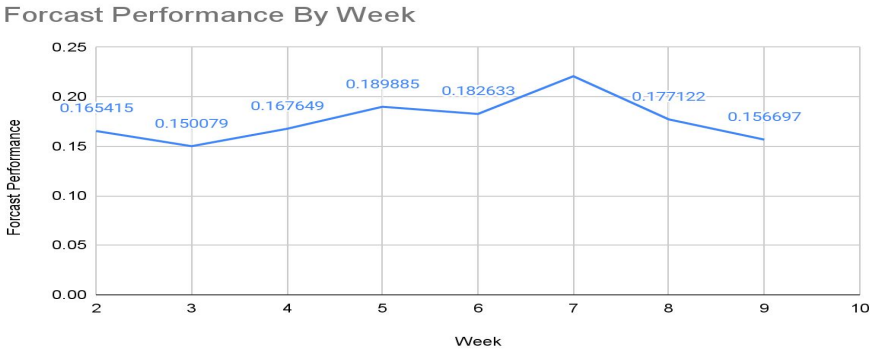
1. Introduction
2. Submissions 1-4
3. Submissions 5-7
4. Submissions 8-10
5. Decision Methodology

Introduction

Approach

- Three different approaches were used over the course of the semester
- Risks were taken in the second third that didn't pay off
- Backtesting was used to build all the models
- All input variables were normalized





Submissions 2-4

Data Used

- Company/ETF/Crypto Name Sentiment From Article Scraping
- Sector Sentiment
- 10 Day Momentum

Model

- Gradient Boosting Classifier to predict 5 bucket ranks

Sentiment

	Sector	Week	Sentiment
0	Financials Sector	2023-11-21	0.084365
1	Communication Services Sector	2023-11-21	0.121536
2	Consumer Discretionary Sector	2023-11-21	0.131643
3	Commodities Sector	2023-11-21	0.085087
4	Utilities Sector	2023-11-21	0.164545
5	Real Estate Sector	2023-11-21	0.090673
6	Fixed Income Sector	2023-11-21	0.193277
7	Volatility Sector	2023-11-21	0.173167
8	Health Care Sector	2023-11-21	0.193002
9	Crypto Sector	2023-11-21	0.079527
10	Information Technology Sector	2023-11-21	0.178198
11	Energy Sector	2023-11-21	0.282100
12	Equities Sector	2023-11-21	0.093444
13	Consumer Staples Sector	2023-11-21	0.132002
14	Industrials Sector	2023-11-21	0.134533
15	Materials Sector	2023-11-21	0.094670

Submissions 5-7

Additional Data Collected

- Crypto Specific Data:
  - Circulating Supply, Vol 24 hrs, Market Cap, Avg Vol
- ETF Specific Data:
  - Volume, Trailing PE, Avg daily volume 10 day, ETF Yield, Nav Price
- Company Specific Data:
  - Volume, Beta, Profit Margin, Revenue Per Share, Return on Assets, Dividend Yield, Price to Book,Forward P/E, Market Cap

Model

- Separated into 3 individual models
  - Crypto, ETF, Company

Results

- Performance affected by how weights were allocated for the 3 categories

Submissions 8-10

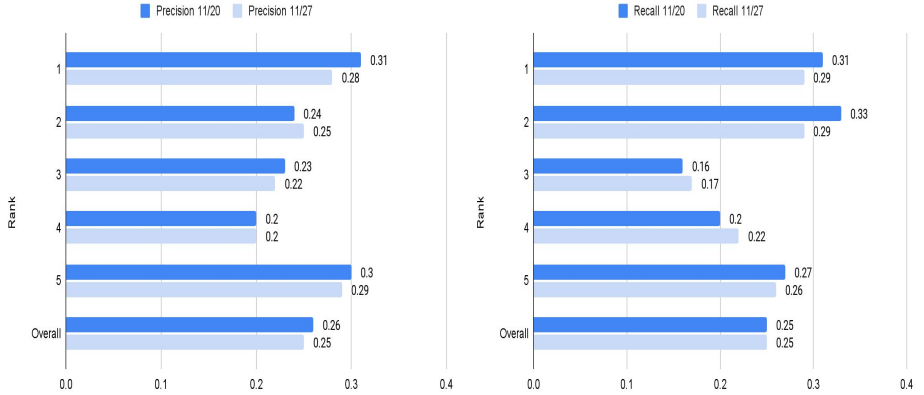
Data Used

- Company/ETF/Crypto Name Sentiment
- Sector Sentiment
- Additional Momentum Data
  - 3 Month Avg, 3 Month Momentum, 3 Month Percent Change, 6 Month Avg, 6 Month Momentum, 6 Month Percent Change, 10 Day Avg, 10 Day Momentum, 10 Day Percent Change

Model

- Training model using entire universe again

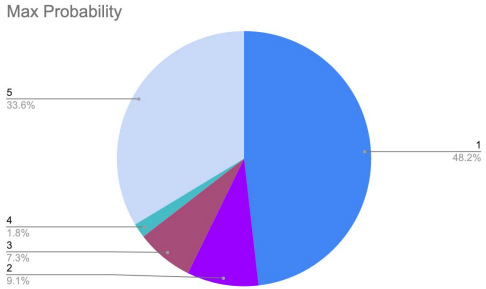
Results



Model & Data Problems

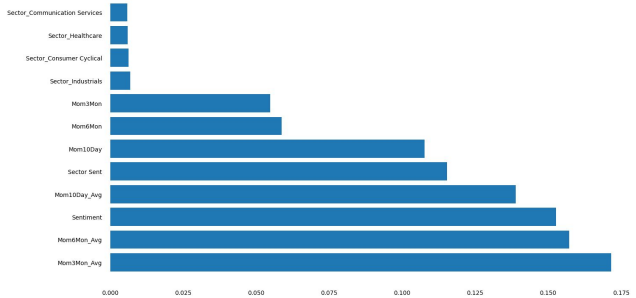
Issues with Probability Predictions

- Model discerns volatile stocks well
  - Unable to predict direction of volatility
- Frequently has highest probabilities in both bucket 1 and bucket 5



Data Collected, Not Used

- Unemployment Data
- Search Interest by Ticker by Week
- Liquidity Information: current Ratio, Quick Ratio, Cash Ratio, Days of Sales Outstanding, Days of Inventory Outstanding, Operating Cycle, Days of Payables Outstanding, Cash Conversion Cycle



Optimization

Why Optimization - because we are Operations Research, that's all we know

Objective functions

- Maximize return for a level of risk
- Minimize risk (volatility) for a given level of return
- Maximize Information Ratio

$$\text{Maximize} \quad \left(\sum_{i=1}^{n} w_i \cdot R_i\right)$$

Subject to the constraint:

$$\text{Maximize} \quad \frac{\sum_{i=1}^{n} w_i \cdot (R_i - R_b)}{\sqrt{\sum_{i=1}^{n}\sum_{j=1}^{n} w_i \cdot w_j \cdot \text{Cov}(R_i, R_j)}}$$

$$\text{Minimize} \quad -\left(\sum_{i=1}^{n} w_i \cdot R_i\right)$$

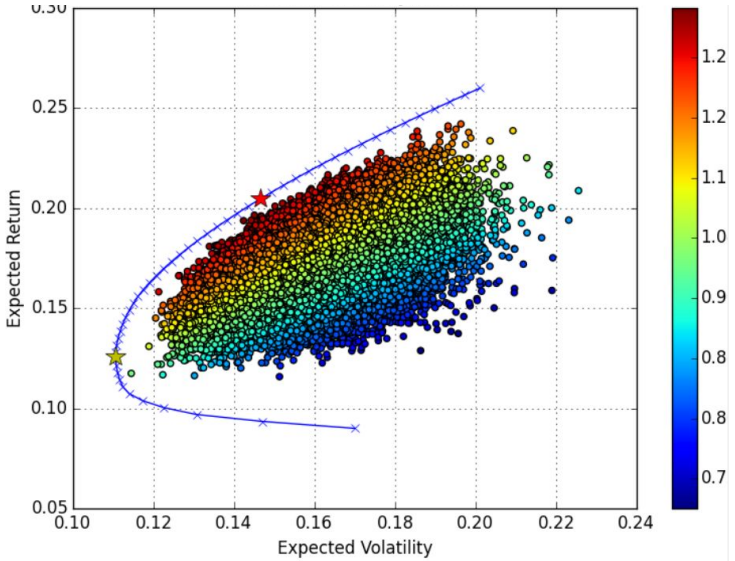
Subject to constraints such as:

$$\sigma_p \leq \text{Threshold}$$

Optimization

Objective functions

- Maximize Sharpe Ratio
  - Only Long
  - Short based on Probability
  - Combine averages of weights
  - Stricter bounds for diversification
  - Adjustments - International Affairs, Season




```
def sharpe_ratio(weights, log_returns, cov_matrix, risk_free_rate):
    return (expected_return(weights, log_returns) - risk_free_rate) / standard_deviation(weights, cov_matrix)
```

```
constraints = {'type': 'eq', 'fun': lambda weights: np.sum(abs(weights)) - 1}
bounds = [(-0.2, 0.2) for _ in range(len(tickers))]
initial_weights = np.array([1/len(tickers)]*len(tickers))
```

THANK YOU! QUESTIONS?