# Combining Technical Indicators with Black-Litterman for Advanced Portfolio Management

## Introduction

The tool developed in our work are for those users who want to explore and strhgthen their portfolio. It is a combination of long term, mid term and short term analysis. The user can use the tool by exploring on different timeframes for lookup period and holding period and create a portfolio.We have put up more weight on the technicals of a stock and on those findings we have further filtered on long term market returns and short term performance metrices. The results shows it worked better than the benchmark results for a window of 20, 60 periods.

## Architecture Overview
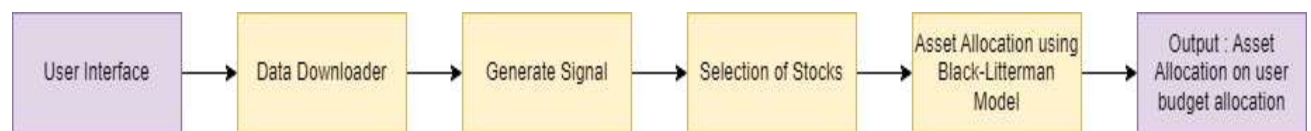


**User Interface:** It is the entry point of tool, where user will give inputs like, window size, holding period, start date, end date. Asset is allocated only using window size and stock data. Holding period, start date and end date are used for back testing of the tool on those parameters.

**Data Downloader:** This is the data engineering phase, where data is downloaded and cleaned for the tool. We have only used S&P100 stocks, S&P100 index and treasury bond data. This could be replaced with any other group of stocks of user choice.

**Generate Signals:** This is the signal generating phase where profiling of stocks is done. This is the most compute intensive phase of the tool. We generate technical and other indicator values to generate signals. It starts with evaluating RSI, Stochastic and Bollinger values. It evaluates Sharpe ratio, Performance rank and slope of the stocks.

**Selection of Stocks:** This is the selection phase of the stocks, the sets created after profiling the stocks are selected using set operations. At the end of this phase on each timestamp we have a buy recommendation list and one sell recommendation list. But our focus is only on the buying side.

**Asset Allocation Using BL Model:** The buy recommendations are passed through our BL model with a budget of $20000. The BL model need a view and interval vector, which are the confidence vector. We evaluate these vectors during our `generate signal` phase.

**Output:** User gets an allocation of each stock in number. Ex. {'AMZN': 35, 'BAC': 68, 'COST': 2, 'DIS': 13, 'DPZ': 12, 'MCD': 8, 'MSFT': 9, 'NAT': 1062, 'SBUX': 22}

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Flowchart



**Start**

**User Input**
sharpe_window(period for cal sharpe ratio)
window_size(period for calculating technicals)
rsi_slow(SMA of %K in stochastic indicator)
per_rank_day(period of evaluating performance rank)
holding_period(period for testing allocation)
n(size of portfolio)

**Data Collection of S&P100 Stocks, S&P Index and Treasury bond**

**Generate technical and other indicator values on each time index.**

1. Evaluate mean of each stock or a rolling window of window size.
2. RSI Evaluation on predefined window size.
3. Stochastic Evaluation on predefined window size.
4. Bollinger Evaluation on predefined window size.
5. Mean score of all the technical z-score
6. Find normalized Sharpe Ratio to get z-score
7. Find normalized Performance metrics to get z-score
8. Find slope for a week
9. Find view and interval values, to be used in BL
10. Generate buy and sell recommendation

**Selection of Stocks**

1. S1 - Top quartile stocks based on z-score of technical indicators
2. S2 - Top quartile stocks based on z-score of Sharpe ratio
3. S3 - Top quartile stocks based on z-score of performance metrics
4. Get best recommendation stock from intersection of S1, S2, S3 based on a hierarchy. The stocks under intersection of all the sets are the best recommendation.

**Black-Litterman Model**

On predefined budget of $20000 the tool allocates assets.

**Stop**

**Internal Storage Dataframe**