TIME SERIES ANALYSIS PROJECT

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BRANCH-MATHEMATICS AND COMPUTING

METHODOLOGY

- **Objective**: selecting a profitable and stable stock portfolio using time series forecasting and statistical analysis.
- **Data**: Data source is yfinance API, time span is 2020-01-01 to 2024-12-31, and the data is sampled daily.

Decomposition: We use seasonal_decomposition function for each stock to analyze trend, seasonality and residuals.

Forecasting Model:

- Models tried are ARIMA,SARIMA,FBProphet and Exponential Smoothening.
- The orders for models are selected based on the ACF and PACF plots of different stocks

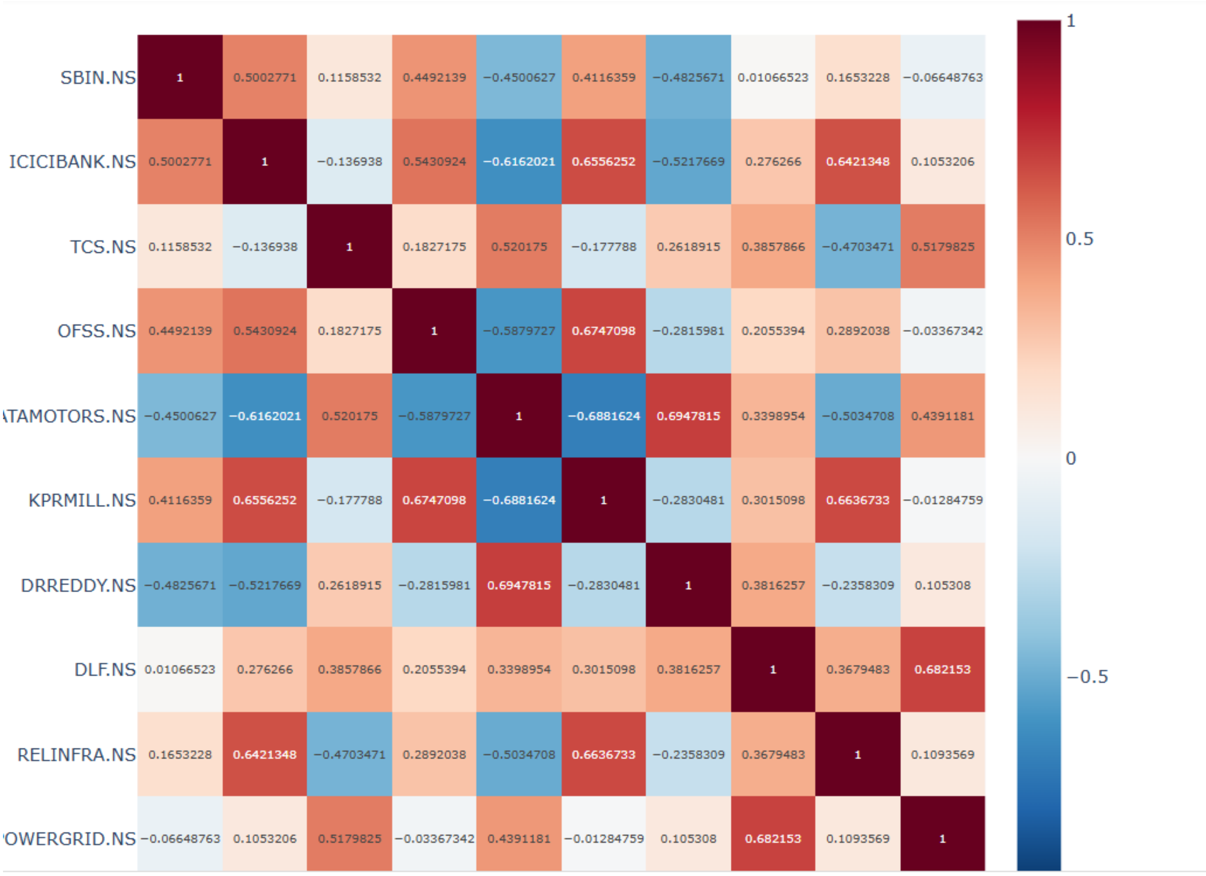
Metrics of Comparison: Analyze models based on the mean RMSE, MAPE and directional accuracy. We will select model with low RMSE and low MAPE and high directional accuracy.

```
results_df
```

	Ticker	Model	Mean_RMSE	Mean_MAPE	Directional_Accuracy
0	SBIN.NS	ARIMA	3.158690	0.003313	0.500000
1	SBIN.NS	SARIMAX	3.049909	0.003306	0.500000
2	SBIN.NS	Holt-Winters	3.011053	0.003288	0.833333
3	SBIN.NS	Prophet	44.905486	0.055027	0.666667
4	ICICIBANK.NS	ARIMA	12.371138	0.009120	0.333333
5	ICICIBANK.NS	SARIMAX	13.385632	0.009803	0.333333
6	ICICIBANK.NS	Holt-Winters	12.049705	0.009078	0.500000
7	ICICIBANK.NS	Prophet	44.681931	0.034252	0.500000
8	TCS.NS	ARIMA	43.428486	0.009435	0.333333
9	TCS.NS	SARIMAX	40.730554	0.008608	0.333333
10	TCS.NS	Holt-Winters	46.444977	0.010351	0.166667
11	TCS.NS	Prophet	160.957549	0.036500	0.166667
12	OFSS.NS	ARIMA	192.947160	0.018407	0.166667

STOCK SELECTION

- **Volatility-based sizing**: lower forecasted volatility = higher weight. It reduces the risk in our approach. The volatility is forecasted using GARCH(1,1).
- **Correlation filtering**: Explain your diversification approach using Pearson correlation threshold for selecting independent stocks.



FORECASTED RESULTS

The final model used for forecasting is SARIMA.

```
Forecast for SBIN.NS:
1325    780.559236
1326    781.259079
Name: predicted_mean, dtype: float64

Forecast for ICICIBANK.NS:
1325    1392.108574
1326    1393.943498
Name: predicted_mean, dtype: float64

Forecast for TCS.NS:
1325    3451.408531
1326    3446.186132
Name: predicted_mean, dtype: float64

Forecast for OFSS.NS:
1325    8037.646067
1326    8054.376826
Name: predicted_mean, dtype: float64

Forecast for TATAMOTORS.NS:
1325    709.066254
1326    706.990447
Name: predicted_mean, dtype: float64

Forecast for KPRMILL.NS:
1325    1312.619058
1326    1308.681601
Name: predicted_mean, dtype: float64

Forecast for DLF.NS:
1325    635.959507
1326    637.196154
Name: predicted_mean, dtype: float64

Forecast for RELINFRA.NS:
1325    237.567627
1326    238.020213
Name: predicted_mean, dtype: float64
```

PORTFOLIO COMPOSITION

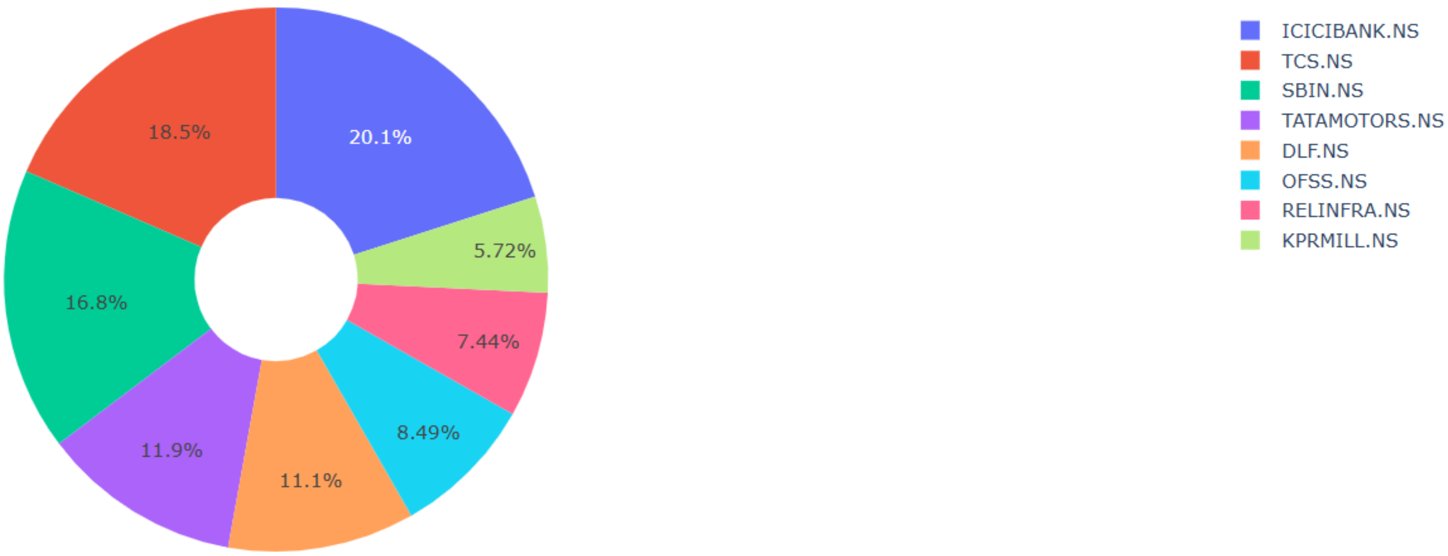
The final selected tickers are ICICIBANK.NS, TCS.NS, SBIN.NS, TATAMOTORS.NS, DLF.NS, OFSS.NS, RELINFRA.NS, KPRMILL.NS.

The following are the volatility weights based on forecasted volatilities. KPRMILL has very high volatility hence very low weight is assigned to it.

Selected uncorrelated stocks with volatility-based weights:

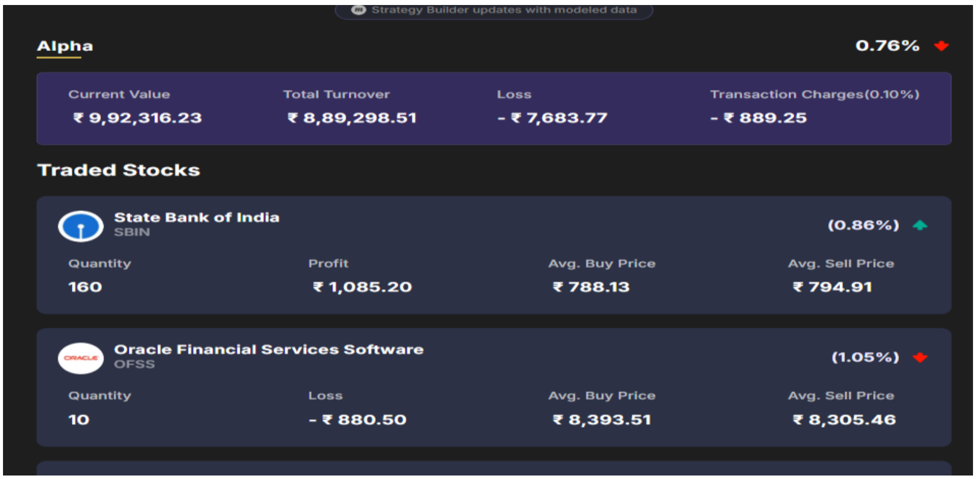
	Ticker	VolatilityWeight
0	ICICIBANK.NS	0.200593
1	TCS.NS	0.184835
2	SBIN.NS	0.168302
3	TATAMOTORS.NS	0.118579
4	DLF.NS	0.111170
5	OFSS.NS	0.084853
6	RELINFRA.NS	0.074424
7	KPRMILL.NS	0.057245

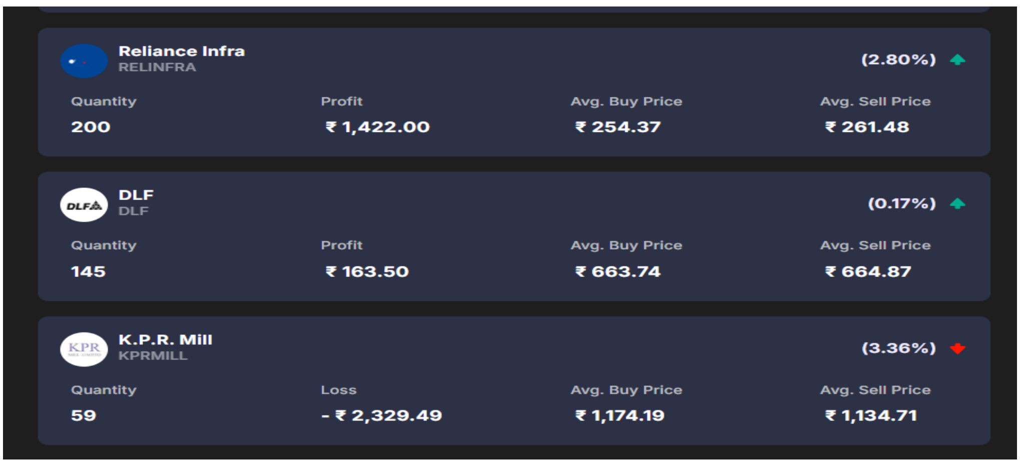
The given below pie chart shows the composition of my portfolio.

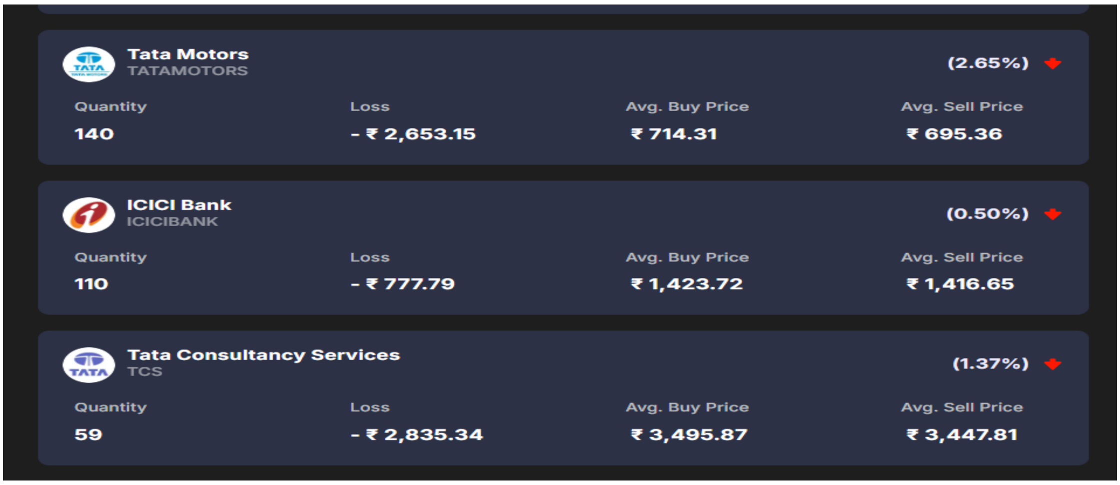


PERFORMANCE ON STOCKGRO

The following is the performance of my stocks on stockgro.







Major losses: My major losses is due to KPRMILL and Tata Mototrs stocks which perform very in comparison to my prediction.

Best Stocks: Reliance infra and SBI were the best performing stocks.

MODEL ACCURACY

The following are the metrics for comparison of stock price for 2 days. We can conclude that OFSS and KPRMILL did not perform according to my model.

```
Forecast Accuracy (per ticker):
                     RMSE         MAE
SBIN.NS          20.792635   20.790471
ICICIBANK.NS     47.559098   46.524178
TCS.NS          128.979408  118.850616
OFSS.NS         562.386683  548.937497
TATAMOTORS.NS     8.312160    6.221649
KPRMILL.NS      147.783504  146.971512
DLF.NS           42.641461   42.597155
RELINFRA.NS      22.878175   22.406077
```

I used MAPE and RMSE as metrics of comparison.

The below shown data that there is sudden movement in stock price of KPRMILL.

```
📈 Forecast for KPRMILL.NS:
1325    1313.250935
1326    1309.592113
Name: predicted_mean, dtype: float64
📌 Actual values:
Date
2025-05-12    1181.750000
2025-05-13    1147.150024
Name: KPRMILL.NS, dtype: float64
```

REFLECTIONS

WHAT WENT WRONG: Taking stocks which performed well in previous week was a blunder by me.

The sudden shift in stock price of KPRMILL work against my model.

IMPROVEMENTS:

- I should use ensemble of models for prediction that may have worked better.
- I should have tune the orders of SARIMA model little bit more.