FINANCIAL TIME SERIES ANALYSIS WITH MACHINE LEARNING

SIT 724 Research Project B

Satvik Sharma (218595095)

ABOUT FINANCIAL TIME SERIES

Time Series can be defined as the study of dynamic consequences over a period of time. This presentation focuses on the financial time series, where the study is more concerned with the financial assets like stocks, shares, currency evaluation, et cetera. it is highly logical area, where the uncertainty is extremely high. Financial time series has always been of interest of business and financial analysts because of addition of uncertainty, statistical theory, methods and high volatile market makes financial time series analysis different from regular time series analysis.

OBJECTIVES OF THE PROJECT

FINDING PATTERNS

Finding different patterns in different algorithms and different stocks and finding out the similarities and differences in working of each algorithm

HYBRIDIZATION

Possibility of hybridizing the current algorithms to work optimally.

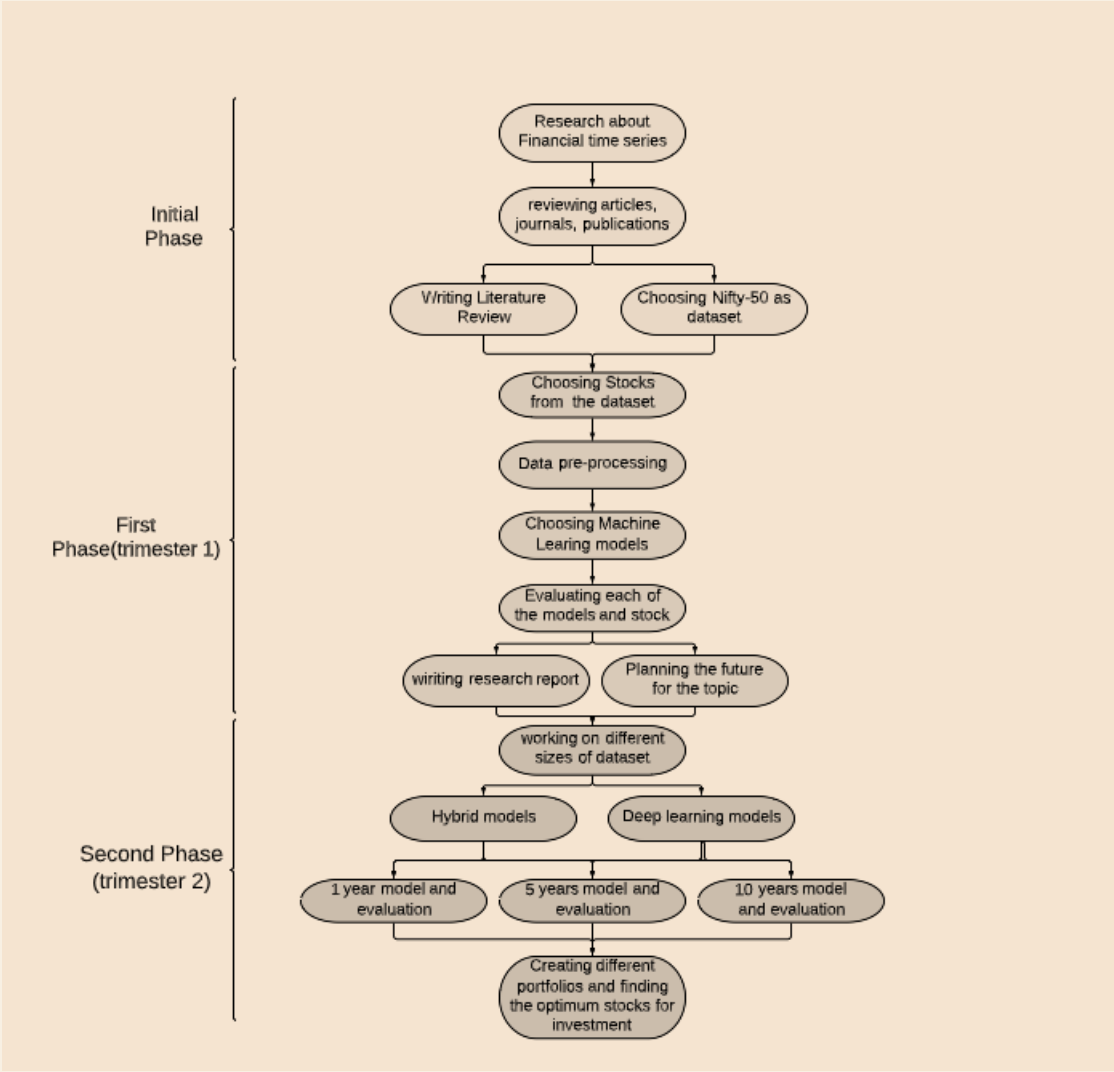
DIFFERENT DATASETS

Creating long term, mid term, and short term evaluation based on the current machine learning and choosing the algorithms that work the best

FUTURE WORK

Finding what can be done in the future in the field of financial time series.

RESEARCH DESIGN



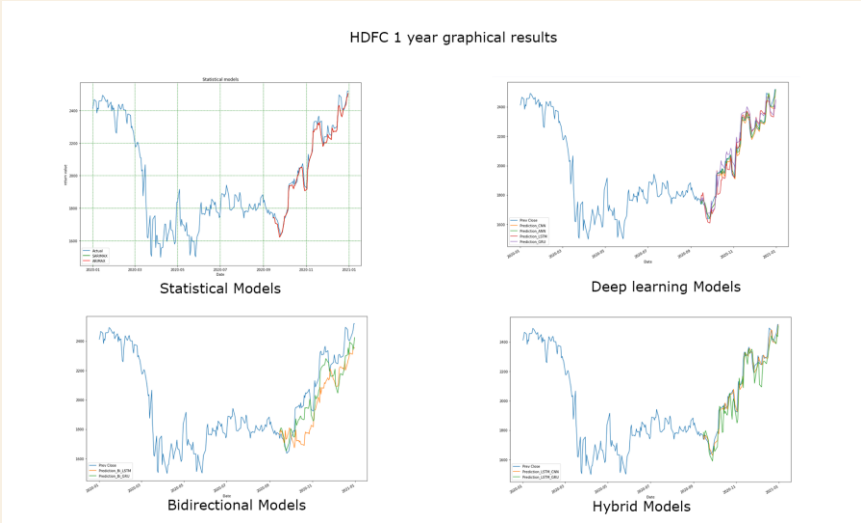
ML MODELS, STOCKS AND EVALUATION METHODS USED

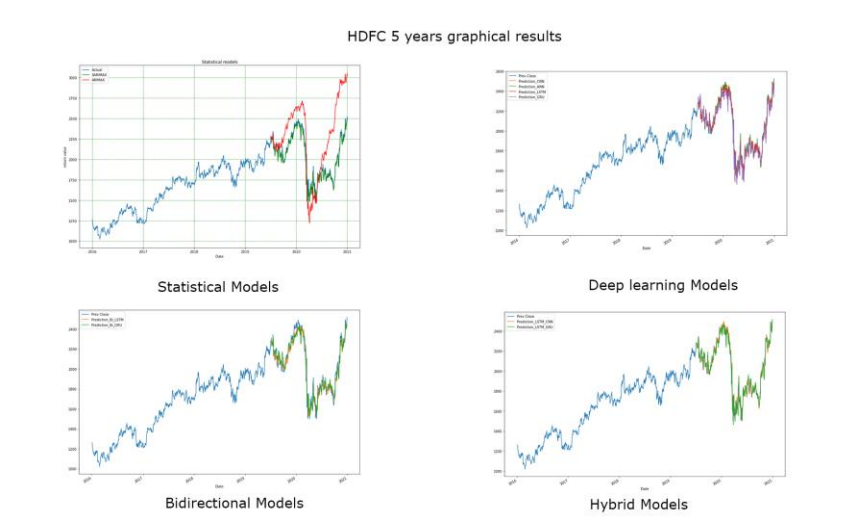
- ARIMAX
- SARIMAX
- ANN
- CNN
- LSTM
- GRU
- BI-LSTM
- BI-GRU
- LSTM-CNN
- LSTM-GRU

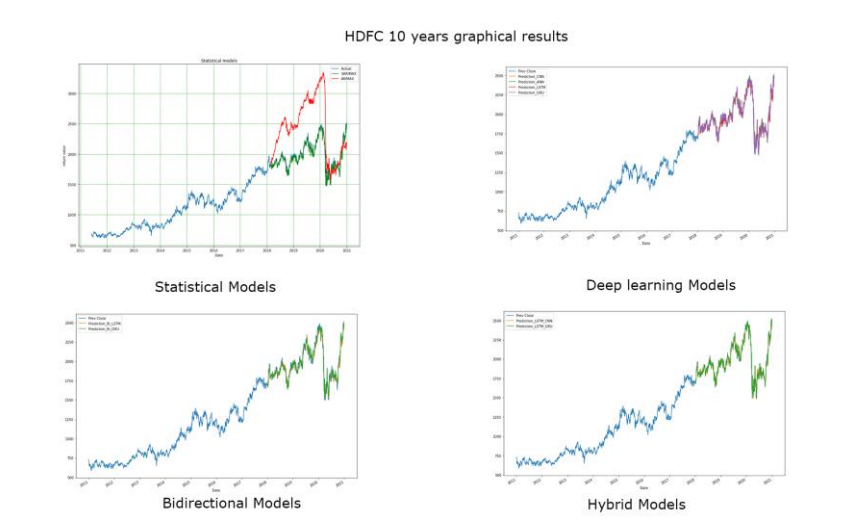
- HDFC
- INFOSYS
- HINDUSTAN UNILEVER

- MEAN ABSOLUTE ERROR
- ROOT MEAN SQUARED ERROR
- R^2 SCORE

RESULTS FOR HDFC STOCK







EVALUATION FOR HDFC STOCK

	Short term			Mid term			Long term		
	MAE	RMSE	R2 score	MAE	RMSE	R2 score	MAE	RMSE	R2 score
ARIMAX	26.420	34.473	98.158%	294.900	369.842	value out of bounds	484.01	568.858	value out of bounds
SARIMAX	25.441	34.497	98.157%	32.097	47.516	96.913%	25.972	38.676	96.900%
ANN	31.861	42.957	97.108%	37.443	53.540	96.074%	28.324	41.004	96.484%
CNN	35.110	47.171	96.513%	36.024	52.417	96.237%	29.758	42.552	96.214%
LSTM	48.970	61.953	93.986%	42.333	57.347	95.496%	95.132	48.253	95.132%
GRU	45.003	56.373	95.021%	47.831	63.014	94.562%	32.923	45.670	95.639%
Bi-LSTM	158.69	178.180	49.971%	50.874	64.82	94.288%	40.152	52.540	94.228%
Bi-GRU	91.400	105.813	82.458%	47.098	62.636	94.627%	36.645	49.006	94.979%
LSTM-CNN	32.584	44.175	96.942%	35.268	51.668	96.344%	29.692	42.192	96.278%
LSTM-GRU	54.121	44.175	91.632%	40.004	51.668	95.784%	30.356	42.192	96.050%
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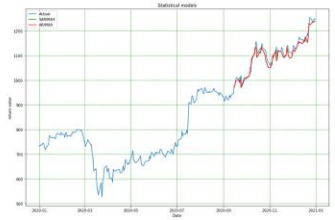
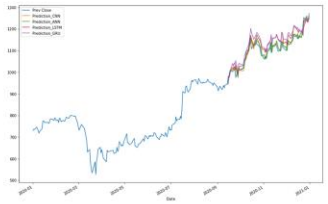
RESULTS FOR INFOSYS STOCK

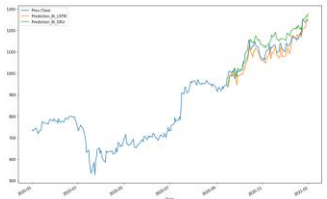
Infosys 1 year graphical results



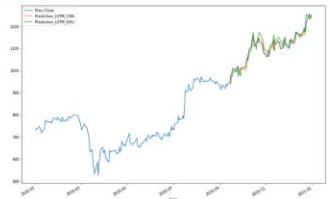
Statistical Models



Deep learning Models

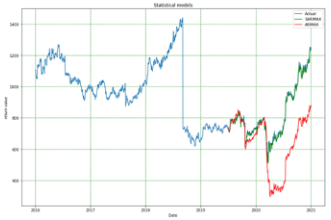


Bidirectional Models

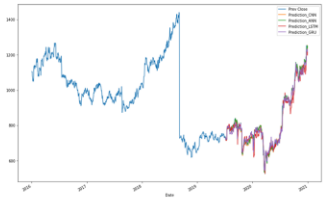


Hybrid Models

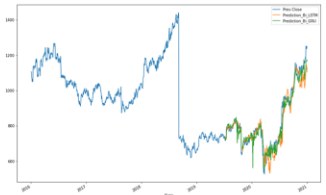
Infosys 5 years graphical results



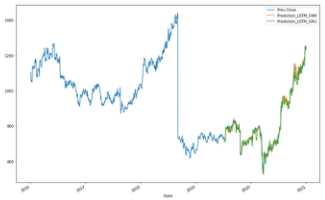
Statistical Models



Deep learning Models

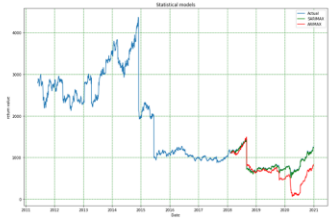


Bidirectional Models

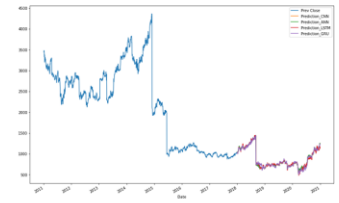


Hybrid Models

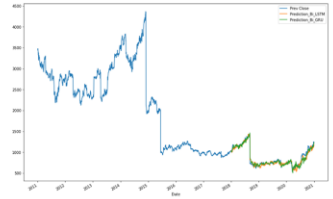
Infosys 10 years graphical results



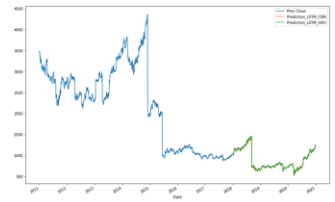
Statistical Models



Deep learning Models



Bidirectional Models



Hybrid Models

EVALUATION FOR INFOSYS STOCK

	Short term			Mid term			Long term		
	MAE	RMSE	R2 score	MAE	RMSE	R2 score	MAE	RMSE	R2 score
ARIMAX	20.478	26.223	93.254%	1110.37	1464.35	Value out of bounds	721.407	935.055	Value out of bounds
SARIMAX	20.474	26.219	93.256%	25.916	37.243	94.853%	25.916	30.536	94.853%
ANN	23.549	30.025	90.922%	28.091	42.726	92.992%	22.030	33.732	98.548%
CNN	21.085	27.232	92.532%	26.676	41.309	93.449%	20.973	32.628	98.642%
LSTM	30.958	38.342	85.197%	31.077	44.317	92.461%	25.182	36.854	98.333%
GRU	31.957	39.747	84.093%	29.636	43.805	92.634%	23.260	33.854	98.538%
Bi-LSTM	56.504	68.780	52.367%	37.821	54.203	88.723%	28.299	39.289	98.021%
Bi-GRU	38.789	49.238	75.588%	33.509	51.154	89.956%	28.787	40.709	97.886%
LSTM-CNN	21.737	27.970	92.122%	27.590	41.883	93.266%	21.216	32.304	98.668%
LSTM-GRU	27.648	27.970	88.542%	26.534	41.883	93.691%	23.005	32.304	98.546%
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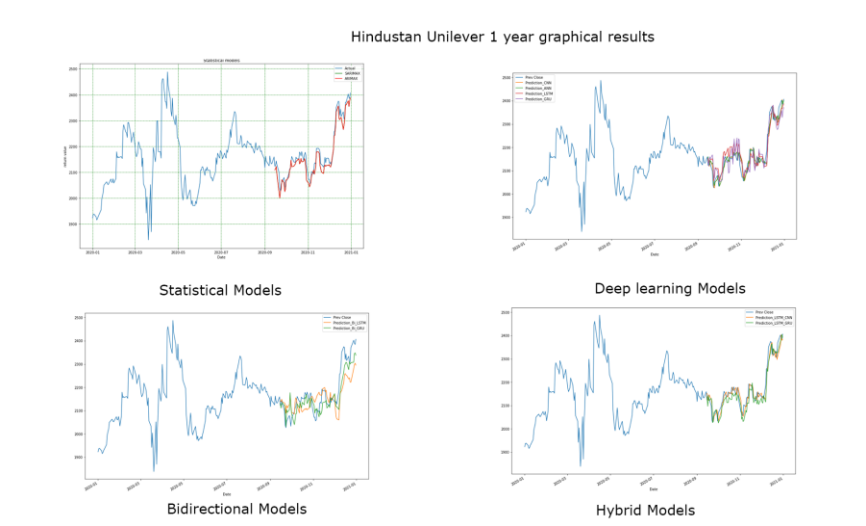
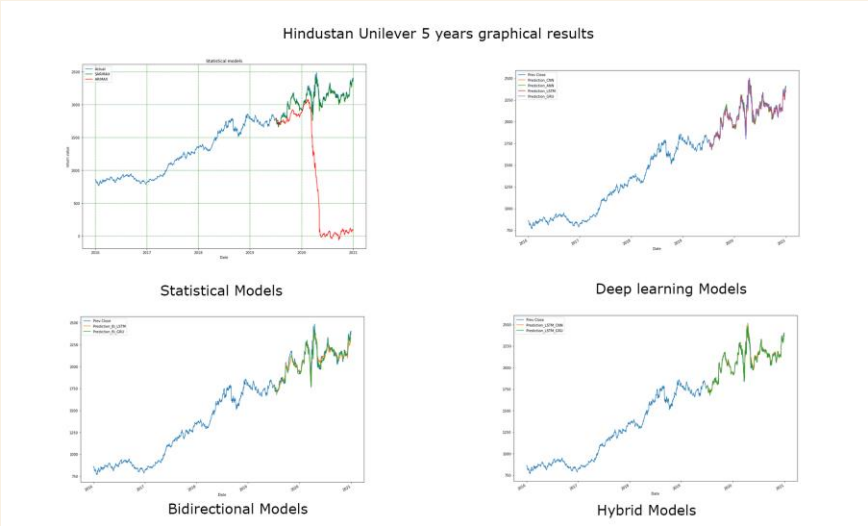
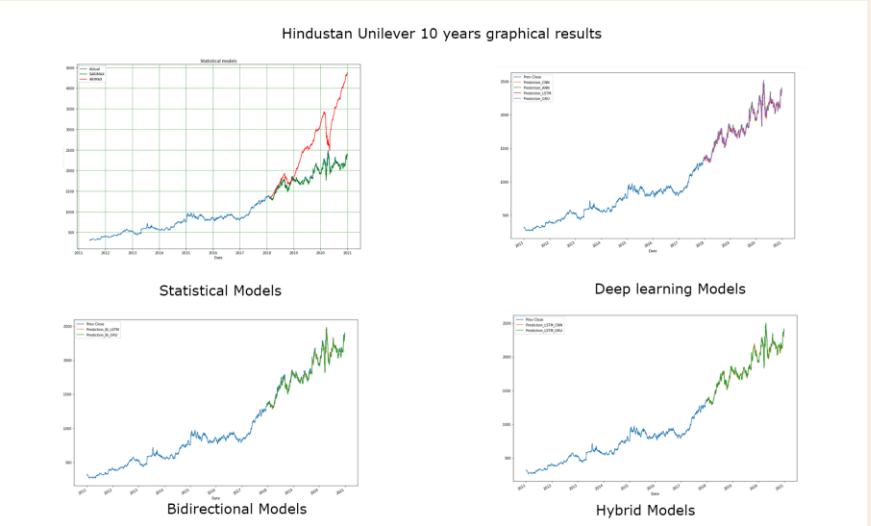
RESULTS FOR HINDUSTAN UNILEVER STOCK







EVALUATION FOR HINDUSTAN UNILEVER STOCK

	Short term			Mid term			Long term		
	MAE	RMSE	R2 score	MAE	RMSE	R2 score	MAE	RMSE	R2 score
ARIMAX	13.240	17.687	93.285%	188.739	246.314	Value out of bounds	206.347	287.515	Value out of bounds
SARIMAX	13.196	17.630	93.332%	11.432	17.563	98.876%	11.608	30.631	98.161%
ANN	15.882	19.478	91.447%	12.276	18.213	98.791%	12.278	30.220	98.216%
CNN	14.925	18.944	91.909%	12.908	18.832	98.707%	12.460	30.195	98.219%
LSTM	24.989	30.494	79.037%	23.817	32.072	96.252%	24.886	40.817	96.745%
GRU	31.811	37.104	68.964%	17.845	24.236	97.859%	26.357	43.356	96.328%
Bi-LSTM	25.552	30.478	79.059%	35.637	51.031	90.512%	43.473	60.166	92.929%
Bi-GRU	34.929	40.054	63.834%	28.126	37.992	94.741%	35.332	54.532	94.191%
LSTM-CNN	15.217	19.491	91.435%	12.553	18.441	98.761%	12.442	30.244	98.213%
LSTM-GRU	17.718	19.491	88.490%	17.274	18.441	97.885%	15.108	30.244	97.901%
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CONCLUSION

- Overall the most reliable models were SARIMAX and CNN
- The best results were seen with Deep learning models.
- The statistical models showed great results with short term predictions, but with mid term and long term predictions, it showed poor results
- Vice versa can be said for the Bidirectional and Hybrid models

FUTURE WORK

- Working with different algorithms and hybridizing deep learning and statistical models.
- Using different optimizers for deep learning analysis.
- Creating an application based portfolios for ease of client usage

THANK YOU

https://www.youtube.com/watch?v=8DcWgua7Bu4