Predicting Stock Trends Using Technical Indicators And Machine Learning

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https://news.tradimo.com/an-introduction-to-technical-analysis/

Greed…. is good.
Greed is right.
Greed works.
…
Greed, in all of its forms, greed for life, for money, for love, for knowledge, has marked the upward surge of mankind.

BACKGROUND

Many traders use technical signals to trade based upon their own customization.

Our project is to combine technical indicators with machine learning to create a unified trading framework.

PROBLEM STATEMENT

Our tool could help small investors by

- Expand the efficient frontier beyond beyond domestic equities

- Enhancing the risk return profile

List of Assets Classes Analyzed

Domestic Equity	Foreign Equity	Bonds	Small Cap	Currency	Commodity
Apple	Baba	LQD	Russell 2000	EURUSD	Gold
Amazon	MSCI Europe	HYG		GPBUSD	Oil
EMR	Nikkei			Bitcoin	
EXC	Samsung				
F	Siemens				
GOOG					
JPM					
KO					
MMM					
PFE					
SPG					
TSLA					

Samples of:

- US equities from different sectors
- Foreign equities and indices
- Bond ETFs
- Small cap index
- Physical & Digital currencies
- Commodities

Collecting Data

Data Sources

- Yahoo Finance
- Capital IQ
- Coingecko

Libraries

- Pycoingecko
- TA-Lib

Brief introduction on technical analysis

Capital Markets are still Markets

A market is where people congregate (physical or digital) and exchange goods for a price.

Buyers think the asset value > the price.

Sellers think the asset value < the price.

Brief introduction on technical analysis

Capital Markets are still Markets

If there are more buyers in count and/or in confidence, then asset price ↑

If there are more sellers in count and/or in confidence, then asset price ↓

Brief introduction on technical analysis

Technical analysis is a quick statistical snapshot of which group is dominating – sellers or buyers.

If the price is moving down, the sellers are confident and the buyers are wavering.

If the price is moving up, the buyers are dominating and the sellers are wavering.

Brief introduction on technical analysis

Technical indicators are based upon **past** news and events.

It will not incorporate a new, material development.

TECHNICAL ANALYSIS INDICATORS

Momentum:

In the short term, within a news vacuum, one group will dominate.

The stock price will continue to follow its trajectory.

- Moving Average Convergence Divergence (MACD)
- Average Directional Index (ADX)

TECHNICAL ANALYSIS INDICATORS

Divergence:

technical signal indicates that either

- A subset of the sellers or buyers have changed their mind on the worth of the asset; OR
- New buyers or sellers have entered the market and expressed their opinion with actual transactions.
    - Relative Strength Index (RSI)

TECHNICAL ANALYSIS INDICATORS

Volume:

Put your money where your mouth is.

More volume = conviction.

Volume indicators express more confidence in the asset price’s direction.

- Force Index (FI) and Elder’s Force Index (EFI)

TECHNICAL ANALYSIS INDICATORS

Others:

Overlap

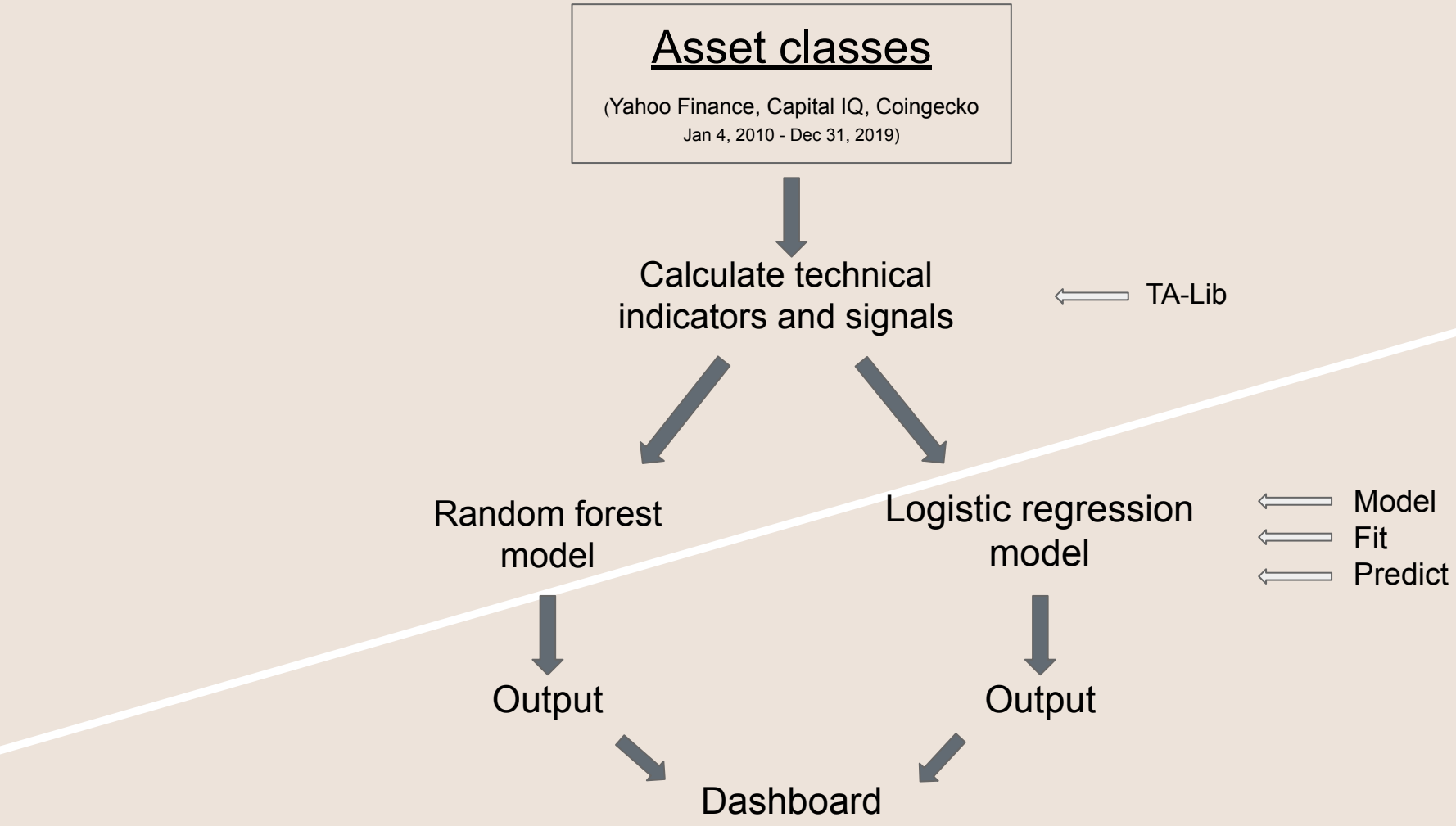
- Moving Averages - Simple and Exponential

Volatility

- Bollinger Bands (BB)

Utilizing Machine Learning Models

Determine importance of specific technical indicators for each asset class using machine learning models to predict price movement.


Asset classes
(Yahoo Finance, Capital IQ, Coingecko
Jan 4, 2010 - Dec 31, 2019)
Calculate technical indicators and signals
TA-Lib
Random forest model
Logistic regression model
Model
Fit
Predict
Output
Output
Dashboard

Results:

Random forest model using indicators vs. signals

“AAPL”

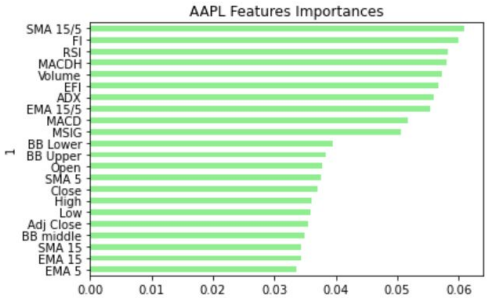
AAPL: Confusion Matrix (Indicators Only, No Signals)

	Predicted 0	Predicted 1
Actual 0	165	178
Actual 1	179	223

Accuracy Score : 0.5208053691275167

Classification Report

	precision	recall	f1-score	support
-1.0	0.48	0.48	0.48	343
1.0	0.56	0.55	0.56	402
accuracy			0.52	745
macro avg	0.52	0.52	0.52	745
weighted avg	0.52	0.52	0.52	745



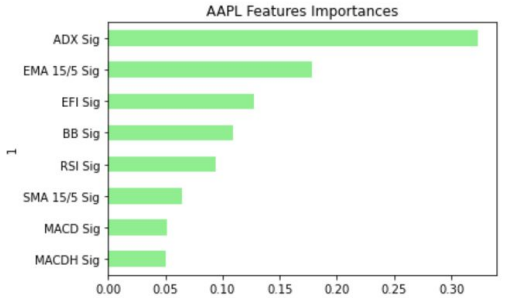
AAPL: Confusion Matrix (Signals Only, No Indicators)

	Predicted 0	Predicted 1
Actual 0	149	194
Actual 1	170	232

Accuracy Score : 0.5114093959731544

Classification Report

	precision	recall	f1-score	support
-1.0	0.47	0.43	0.45	343
1.0	0.54	0.58	0.56	402
accuracy			0.51	745
macro avg	0.51	0.51	0.51	745
weighted avg	0.51	0.51	0.51	745



Results:

Logistic regression model using indicators vs. signals

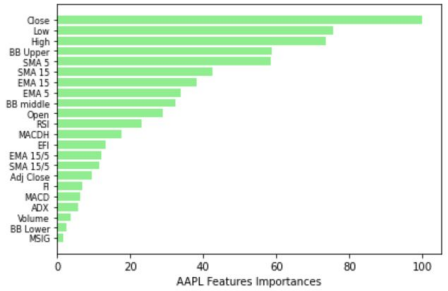
“AAPL”

AAPL: Confusion Matrix (Indicators Only, No Signals)

	Predicted 0	Predicted 1
Actual 0	105	238
Actual 1	119	283

Accuracy Score : 0.5208053691275167
Classification Report

	precision	recall	f1-score	support
-1.0	0.47	0.31	0.37	343
1.0	0.54	0.70	0.61	402
accuracy			0.52	745
macro avg	0.51	0.51	0.49	745
weighted avg	0.51	0.52	0.50	745

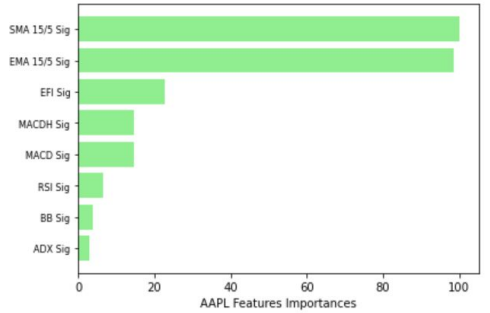


AAPL: Confusion Matrix (Signals Only, No Indicators)

	Predicted 0	Predicted 1
Actual 0	124	219
Actual 1	153	249

Accuracy Score : 0.5006711409395973
Classification Report

	precision	recall	f1-score	support
-1.0	0.45	0.36	0.40	343
1.0	0.53	0.62	0.57	402
accuracy			0.50	745
macro avg	0.49	0.49	0.49	745
weighted avg	0.49	0.50	0.49	745



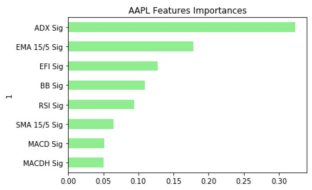
Comparisons - Part I:

Random forest and Logistic regression models using signals

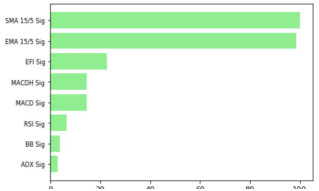
Asset classes

AAPL

Random Forest

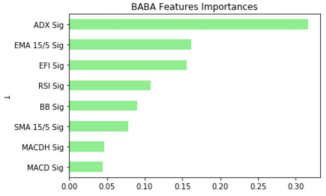


Logistic Regression

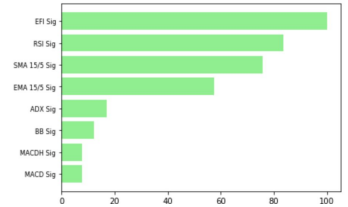


BABA

Random Forest

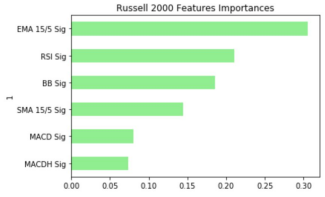


Logistic Regression

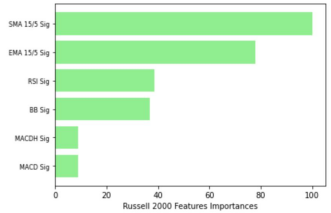


Russell 2000

Random Forest



Logistic Regression



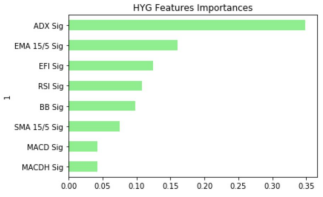
Comparisons - Part I:

Random forest and Logistic regression models using signals

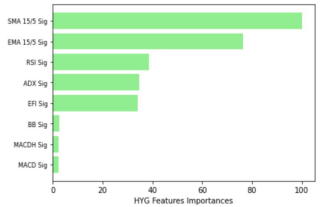
Asset classes

HYG

Random Forest

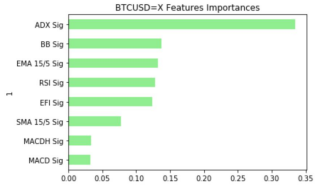


Logistic Regression

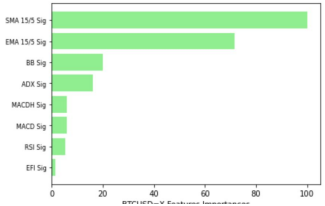


BTC

Random Forest

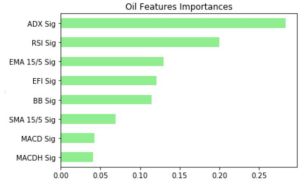


Logistic Regression

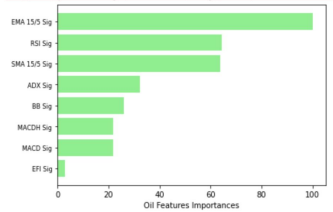


Oil

Random Forest



Logistic Regression



Comparisons - Part II:

Average accuracy scores

		Accuracy Average Score				
		Random Forest		Logistic Regression		
		Indicators Only	Signals Only	Indicators Only	Signals Only	
4	**Domestic Equity (12)**	52.05%	51.24%	51.61%	51.47%	**51.59%**
5	**Foreign Equity (5)**	61.39%	60.18%	61.48%	60.72%	**60.94%**
6	**Bonds (2)**	54.77%	51.01%	53.69%	54.23%	**53.42%**
7	**Small Cap (1)**	52.48%	55.97%	52.89%	54.90%	**54.06%**
8	**Currency (3)**	55.29%	50.78%	66.49%	50.01%	**55.64%**
9	**Commodity (2)**	58.05%	59.40%	59.23%	58.39%	**58.77%**
10		**55.67%**	**54.76%**	**57.56%**	**54.95%**	

Comparisons - Part II:

Average accuracy scores

		Accuracy Average Score				
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		Indicators Only	Signals Only	Indicators Only	Signals Only	
4	**Domestic Equity (12)**	52.05%	51.24%	51.61%	51.47%	**51.59%**
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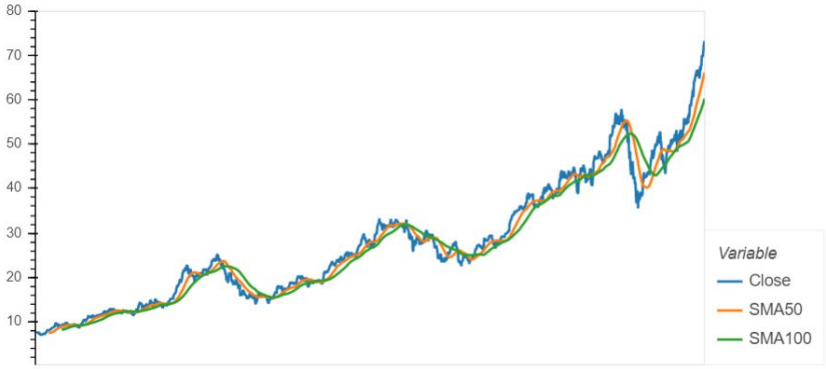
6	**Bonds (2)**	54.77%	51.01%	53.69%	54.23%	**53.42%**
7	**Small Cap (1)**	52.48%	55.97%	52.89%	54.90%	**54.06%**
8	**Currency (3)**	55.29%	50.78%	66.49%	50.01%	**55.64%**
9	**Commodity (2)**	58.05%	59.40%	59.23%	58.39%	**58.77%**
10		**55.67%**	**54.76%**	**57.56%**	**54.95%**	

Dashboard: AAPL

Trading Dashboard



[14]:

#	index	Backtest
0	Annual Return	0.02424849830819394
1	Cumulative Returns	0.2682357215881306
2	Annual Volatility	0.029258159701038802
3	Sharpe Ratio	0.8287772900266521
4	Sortino Ratio	1.2019654081993933

#	Stock	Entry Date	Exit Date	Shares	Entry Share F	Exit Share Pr	Entry Portfolic	Exit Portfolio	Profit/Loss
1	AAPL	2010-09-21	2011-05-18	500.0	10.134643	12.138214	5,067.321301	6,069.107056	-1,001.78575
2	AAPL	2011-07-26	2012-07-06	500.0	14.4075	21.638571	7,203.750134	10,819.28538	-3,615.53525
3	AAPL	2012-08-07	2012-11-21	500.0	22.175358	20.060715	11,087.67890	10,030.35736	1,057.321548
4	AAPL	2013-07-10	2013-07-16	500.0	15.026071	15.364286	7,513.035297	7,682.143211	-169.107914
5	AAPL	2013-08-15	2014-03-10	500.0	17.782499	18.96143	8,891.249657	9,480.714798	-589.465141
6	AAPL	2014-05-06	2015-08-03	500.0	21.22893	29.610001	10,614.46476	14,805.00030	-4,190.53554
7	AAPL	2015-12-09	2016-01-13	500.0	28.905001	24.3475	14,452.50034	12,173.74992	2,278.75042
8	AAPL	2016-04-25	2016-06-14	500.0	26.27	24.365	13,135.00022	12,182.49988	952.500343
9	AAPL	2016-08-22	2018-03-26	500.0	27.127501	43.192501	13,563.75026	21,596.25053	-8,032.50026
10	AAPL	2018-04-19	2018-11-30	500.0	43.200001	44.645	21,600.00038	22,322.50022	-722.499847
11	AAPL	2019-03-28	2019-07-22	500.0	47.18	51.805	23,590.00015	25,902.50015	-2,312.5

Conclusion

Implementing common technical analysis indicators in machine learning models such as Random Forest or Logistic Regression can predict market trend with modest accuracy.

Future directions

1. Improve current analysis:
    a. Fine-tune parameters
    b. Cluster indicators/signals
    c. Include more data
    d. Include other technical analysis indicators
2. Clustering stocks/asset classes based on feature importances
3. Testing monetary performance of our analysis
4. Comparison between technical analysis vs. fundamental analysis; blended analysis + sentimental analysis?
5. Apply different machine learning models

Questions?