

INTELLITRADER

An AI Leveraged Financial Trading System

FX-EURO/USD

Demo Day (07.10.2020)

Rana Bhattacharjee

Ajay Singh

Contents

Demo

Pipeline

Plan & Architecture

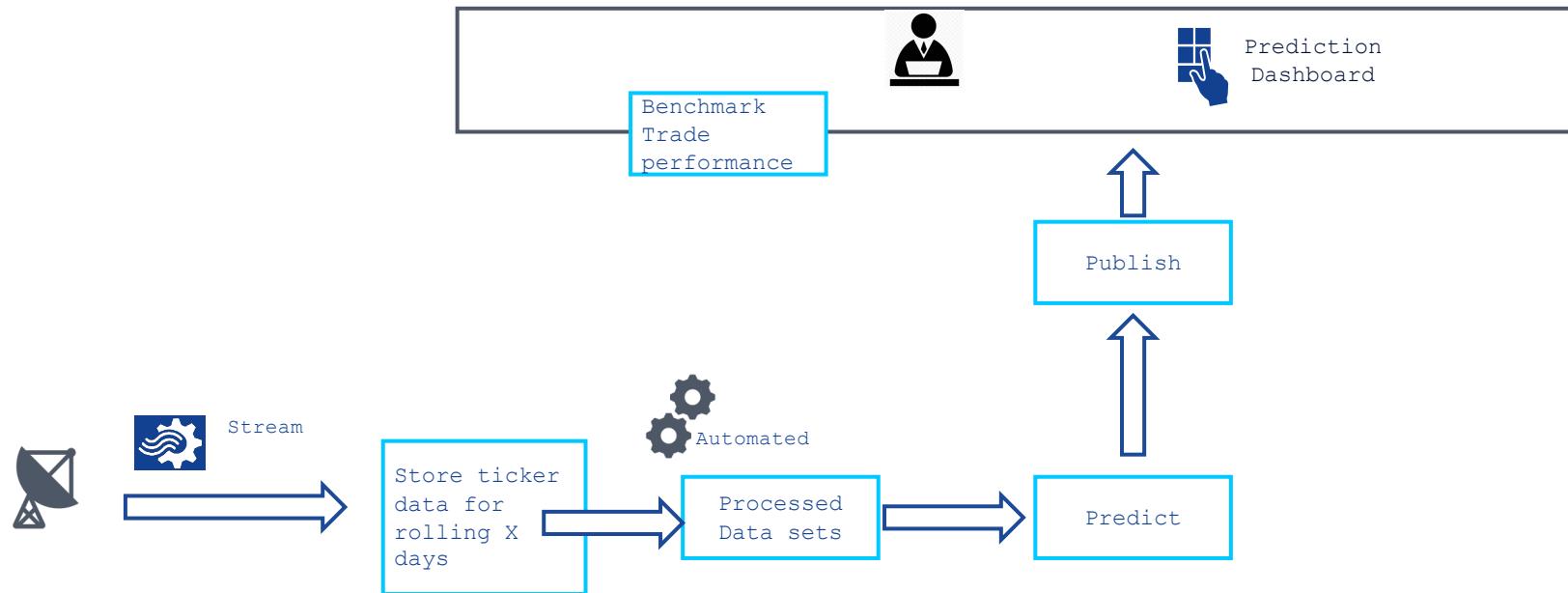
Scope Commentary

- Trading client demo
- Backend predictions commentary
- Other Backend results

- Data sources
- Data pre-processing
- Real time data ingestion

- Plan & Architecture Summary
- What's done, what's for future

- What we set out for, what we achieved

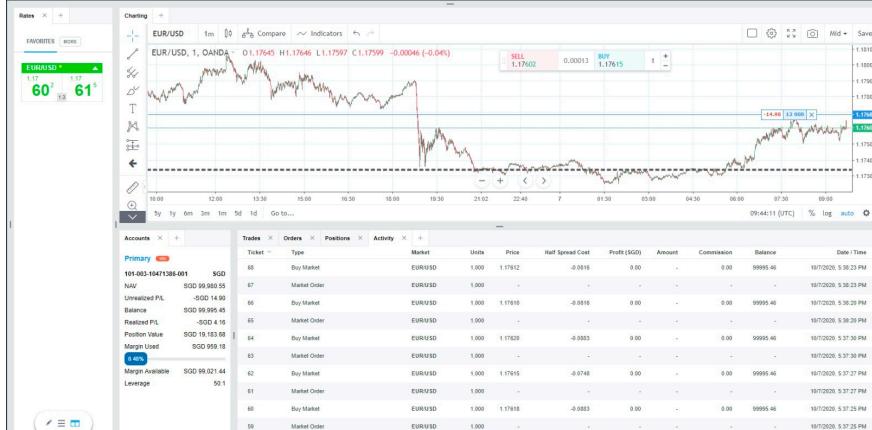


$$\begin{aligned} X = & (T_0 - 4) - T_0; (T_0 - 9) - T_0; \\ & (T_0 - 19) - T_0; (T_0 - 59) - T_0 \end{aligned}$$

System Demo



Trade window

Benchmarking
trade
performanceSample I/P
datasets
Raw and
processed

RAW

Pre-processed

Processed

	Timestamp	Bid	Ask
0	20190401 000000462	1.12321	1.12322
1	20190401 000000564	1.12321	1.12323
2	20190401 000001036	1.12321	1.12323
3	20190401 000001134	1.12322	1.12324
4	20190401 000001614	1.12323	1.12324

	Timestamp	Bid	Ask
0	20170601 000000203	1.12467	1.12470
1	20170601 000004590	1.12466	1.12468
2	20170601 000004843	1.12464	1.12468
3	20170601 000005953	1.12463	1.12466
4	20170601 000008593	1.12462	1.12466

	Timestamp	open	high	low	close	Timestamp	open	high	low	close	Timestamp	open	high	low	close	avg_price	in_change	pct_change	in_open_close
2019-12-31 16:56:00	1.121205	1.121215	1.121170	1.121180	2019-12-31 16:56:00	1.121205	1.121215	1.121170	1.121180	2010-01-03	1.429825	0.000000	0.000000	0.000000					
2019-12-31 16:57:00	1.121215	1.121205	1.121085	1.121085	2019-12-31 16:57:00	1.121215	1.121205	1.121175	1.121180	2010-01-04	1.436350	0.004653	0.004563	-0.000070					
2019-12-31 16:58:00	1.121205	1.121210	1.121050	1.121050	2019-12-31 16:58:00	1.121205	1.121210	1.121100	1.121100	2010-01-05	1.440950	0.003197	0.003203	-0.000069					
2019-12-31 16:59:00	1.121207	1.121205	1.121150	1.121150	2019-12-31 16:59:00	1.121207	1.121205	1.121170	1.121150	2010-01-06	1.436600	-0.003023	-0.003019	0.000070					
2019-12-31 17:00:00	1.121202	1.121200	1.121130	1.121130	2019-12-31 17:00:00	1.121202	1.121200	1.121130	1.121130	2010-01-07	1.435250	-0.000940	-0.000940	-0.000069					

	Timestamp	Bid	Ask
0	20151101 170006490	1.10338	1.10377
1	20151101 170006740	1.10340	1.10376
2	20151101 170007998	1.10339	1.10375
3	20151101 170008990	1.10340	1.10375
4	20151101 170011490	1.10325	1.10375

	Timestamp	Bid	Ask	Mid
0	2010-01-03 17:00:12	1.43001	1.43044	1.43025
1	2010-01-03 17:00:21	1.43002	1.43035	1.43035
2	2010-01-03 17:00:22	1.43003	1.43036	1.43045
3	2010-01-03 17:00:33	1.43004	1.43037	1.43055
4	2010-01-03 17:00:53	1.43003	1.43036	1.43045

	Timestamp	open	high	low	close				
2019-12-31 13:00:00	1.12290	1.122900	1.122275	1.122335	2019-12-31 13:00:00	1.12290	1.122900	1.122275	1.122335
2019-12-31 14:00:00	1.12233	1.122330	1.121690	1.121715	2019-12-31 14:00:00	1.12233	1.122330	1.121690	1.121715
2019-12-31 15:00:00	1.12172	1.121845	1.121485	1.121760	2019-12-31 15:00:00	1.12172	1.121845	1.121485	1.121760
2019-12-31 16:00:00	1.12175	1.121750	1.121050	1.121150	2019-12-31 16:00:00	1.12175	1.121750	1.121050	1.121150
2019-12-31 17:00:00	1.12113	1.121130	1.121130	1.121130	2019-12-31 17:00:00	1.12113	1.121130	1.121130	1.121130

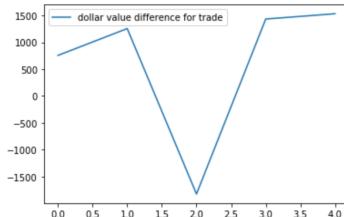
Model Architecture	Historical binding	Prediction Structure	O	L	H	C	Avg = (H+L)/2	Log (Avg t/Avg t-1)	% (Avgt-Avg t-1)/Avg t-1	log (Open T/Close T-1)
MLP	weekly history	Rolling 5 days, predict 6th day	5.21E-05	8.17E-05	1.87E-05	2.83E-05	6.57E-05	7.52E-06	7.07E-06	1.70E-07
	fortnight history	Rolling 10 days, predict 11th day	2.40E-05	2.53E-05	4.91E-05	4.53E-05	1.66E-05	8.33E-06	7.21E-06	1.18E-07
	monthly history	Rolling 20 days, predict 21 st day	7.39E-05	2.62E-05	1.90E-05	3.05E-05	4.67E-05	7.89E-06	8.99E-06	2.83E-07
	quarterly history	Rolling 60 days, predict 61st day	9.00E-05	8.32E-05	9.30E-05	2.44E-05	3.78E-05	8.71E-06	8.54E-06	5.83E-07
Model Architecture	Historical binding	Prediction Structure	O	L	H	C	Avg = (H+L)/2	Log (Avg t/Avg t-1)	% (Avgt-Avg t-1)/Avg t-1	log (Open T/Close T-1)
Basic LSTM	weekly history	Rolling 5 days, predict 6th day	4.74E-05	7.35E-05	0.000190192	0.000545594	8.70E-05	6.31E-06	6.44E-06	1.48E-07
	fortnight history	Rolling 10 days, predict 11th day	0.000434509	6.05E-05	0.000134756	0.000258425	5.42E-05	6.27E-06	6.77E-06	1.18E-07
	monthly history	Rolling 20 days, predict 21 st day	4.73E-05	0.00052808	0.00033091	0.000138907	0.000240363	6.33E-06	6.27E-06	1.44E-07
	quarterly history	Rolling 60 days, predict 61st day	7.63E-05	0.00015406	4.42E-05	4.75E-05	5.03E-05	5.87E-06	6.26E-06	3.13E-07
Model Architecture	Historical binding	Prediction Structure	O	L	H	C	Avg = (H+L)/2	Log (Avg t/Avg t-1)	% (Avgt-Avg t-1)/Avg t-1	log (Open T/Close T-1)
Vanilla Encoder	weekly history	Rolling 5 days, predict 6th day	0.026326132	0.025684406	0.026985978	0.026339711	0.02926946	1.69E-05	1.69E-05	9.94E-07
	fortnight history	Rolling 10 days, predict 11th day	0.030169326	0.029438923	0.030987456	0.03014728	0.030235418	1.72E-05	1.72E-05	1.05E-06
	monthly history	Rolling 20 days, predict 21 st day	0.016089937	0.015826169	0.016322725	0.016070185	0.018642766	1.69E-05	1.69E-05	9.50E-07
	quarterly history	Rolling 60 days, predict 61st day	0.013033613	0.012858878	0.013171817	0.013013151	0.014389659	1.68E-05	1.68E-05	9.23E-07
Model Architecture	Historical binding	Prediction Structure	O	L	H	C	Avg = (H+L)/2	Log (Avg t/Avg t-1)	% (Avgt-Avg t-1)/Avg t-1	log (Open T/Close T-1)
Attention Only	weekly history	Rolling 5 days, predict 6th day	4.05E-05	4.42E-05	3.89E-05	3.84E-05	7.10E-05	4.54E-06	4.54E-06	2.62E-08
	fortnight history	Rolling 10 days, predict 11th day	4.37E-05	4.28E-05	4.89E-05	4.03E-05	9.29E-05	4.60E-06	4.67E-06	6.72E-08
	monthly history	Rolling 20 days, predict 21 st day	4.59E-05	5.35E-05	5.12E-05	5.04E-05	6.78E-05	4.11E-06	4.22E-06	4.79E-08
	quarterly history	Rolling 60 days, predict 61st day	2.29E-05	2.59E-05	1.82E-05	1.76E-05	0.000165832	4.47E-06	4.25E-06	5.26E-07
Model Architecture	Historical binding	Prediction Structure	O	L	H	C	Avg = (H+L)/2	Log (Avg t/Avg t-1)	% (Avgt-Avg t-1)/Avg t-1	log (Open T/Close T-1)
GRU	weekly history	Rolling 5 days, predict 6th day	0.000691137	0.000636682	0.000679951	0.000672595	0.002480801	3.80E-05	3.78E-05	1.12E-05
	fortnight history	Rolling 10 days, predict 11th day	0.000740155	0.000666208	0.000666384	0.000578271	0.00107039	7.17E-06	7.17E-06	7.75E-08
	monthly history	Rolling 20 days, predict 21 st day	0.039409402	0.040959624	0.041048716	0.042278141	0.000296937	3.56E-06	3.56E-06	7.23E-08
	quarterly history	Rolling 60 days, predict 61st day	0.010739709	0.009002187	0.010408199	0.01371527	0.049763267	4.08E-05	2.71E-05	6.89E-06
Model Architecture	Historical binding	Prediction Structure	O	L	H	C	Avg = (H+L)/2	Log (Avg t/Avg t-1)	% (Avgt-Avg t-1)/Avg t-1	log (Open T/Close T-1)
Multihead attention	weekly history	Rolling 5 days, predict 6th day	0.000199587	0.000214429	0.0001956	0.000191448	0.000145672	1.13E-05	1.12E-05	4.34E-06
	fortnight history	Rolling 10 days, predict 11th day	0.000147357	0.000153291	0.000154146	0.000138056	0.000174132	1.19E-05	1.12E-05	4.40E-06
	monthly history	Rolling 20 days, predict 21 st day	0.001678234	0.001559112	0.001794763	0.001660155	0.000236368	1.12E-05	1.10E-05	4.43E-06
	quarterly history	Rolling 60 days, predict 61st day	0.001071243	0.001431132	0.001293113	0.001399098	0.003921759	1.12E-05	1.15E-05	5.19E-06
Model Architecture	Historical binding	Prediction Structure	O	L	H	C	Avg = (H+L)/2	Log (Avg t/Avg t-1)	% (Avgt-Avg t-1)/Avg t-1	log (Open T/Close T-1)
LSTM-Attention	weekly history	Rolling 5 days, predict 6th day	1011.743013	12.19428764	12.17228818	0.017428734	6.77E-05	3.25E-06	3.25E-06	5.08E-08
	fortnight history	Rolling 10 days, predict 11th day	8.56E-05	4.76E-06	4.75E-06	3.39E-08	0.179209878	0.000484145	0.00046226	1.15E-05
	monthly history	Rolling 20 days, predict 21 st day	0.050973917	2.13E-05	2.13E-05	2.42E-07	7.63E-05	3.57E-06	3.58E-06	3.07E-08
	quarterly history	Rolling 60 days, predict 61st day	0.000237528	3.49E-06	3.52E-06	3.31E-08	0.001147298	3.47E-06	3.46E-06	4.82E-08
Model Architecture	Historical binding	Prediction Structure	O	L	H	C	Avg = (H+L)/2	Log (Avg t/Avg t-1)	% (Avgt-Avg t-1)/Avg t-1	log (Open T/Close T-1)
SeriesNet	weekly history	Rolling 5 days, predict 6th day	0.000886937	0.000777911	0.0007986	0.000750802	0.00071109	7.86E-06	7.89E-06	1.54E-08
	fortnight history	Rolling 10 days, predict 11th day	0.00178351	0.001642802	0.001818069	0.00169125	0.001737036	4.96E-06	4.97E-06	1.58E-08
	monthly history	Rolling 20 days, predict 21 st day	0.002750359	0.002615764	0.002815297	0.002675225	0.002711615	4.23E-06	4.24E-06	3.78E-08
	quarterly history	Rolling 60 days, predict 81st day	0.00852576	0.008185849	0.008873621	0.00847593	0.008458718	3.33E-06	4.48E-06	2.35E-08
	consolidated output series of 50 future periods		0.007541682	0.008191677	0.008630198	0.0083457	0.008220323	3.42E-06	3.43E-06	2.60E-08



Trade performance
- 10 Mil USD trade

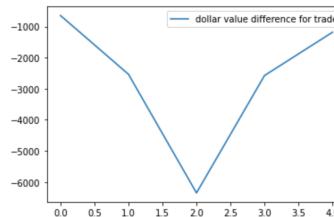
1

Attention
only



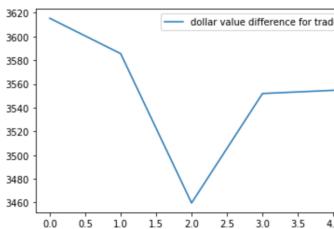
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LSTM
Attention

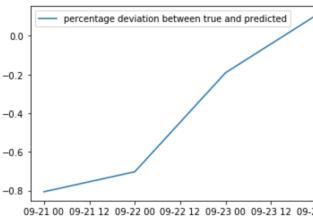
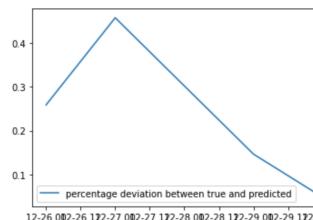
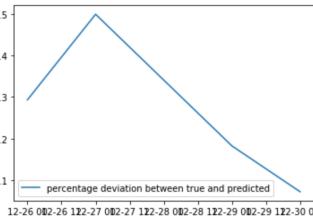


3

Multi-headed
Attention

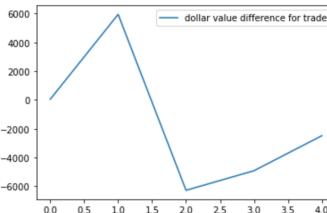


Prediction comparison





Trade performance
– 10 Mil USD trade



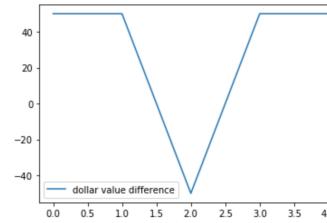
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Encoder
Vanilla



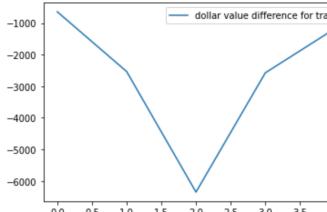
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SeriesNet

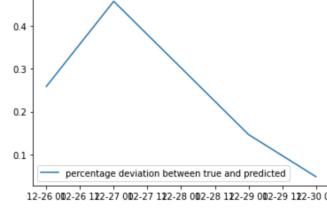
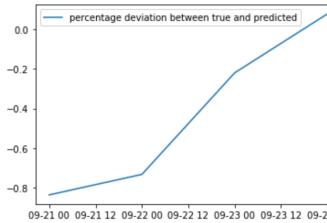
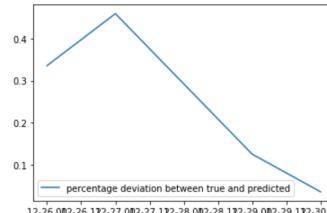


6

LSTM



Prediction comparison

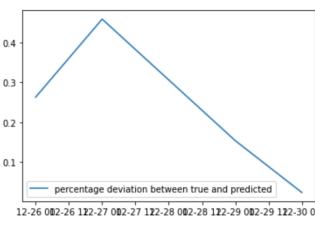
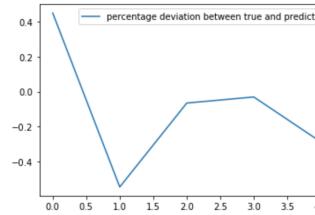
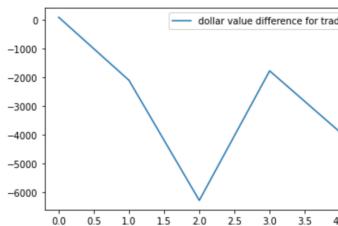
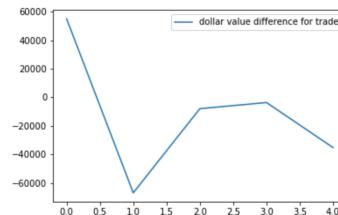




Trade performance
- 10 Mil USD trade



Prediction comparison

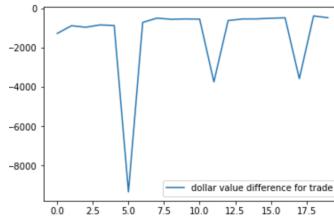




Trade performance
- 10 Mil USD trade

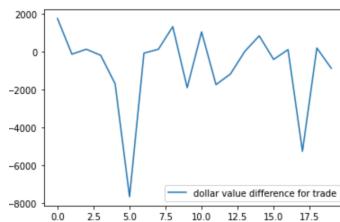
1

Attention
only



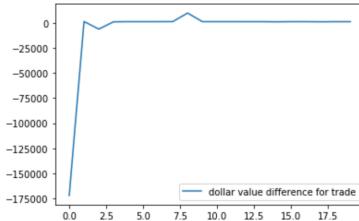
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LSTM
Attention

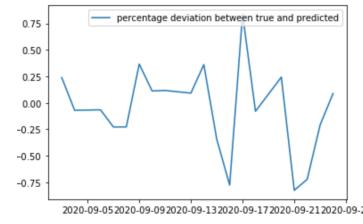
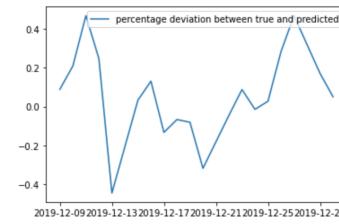
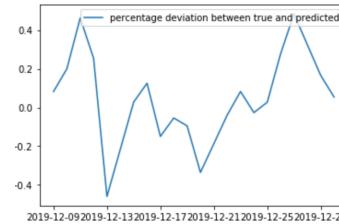


3

Mult-headed
Attention



Prediction comparison





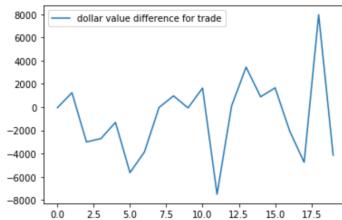
Trade performance
- 10 Mil USD trade



Prediction comparison

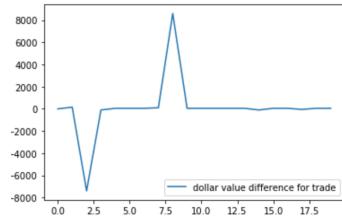
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Encoder
Vanilla



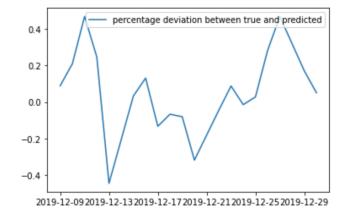
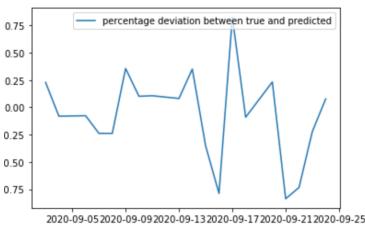
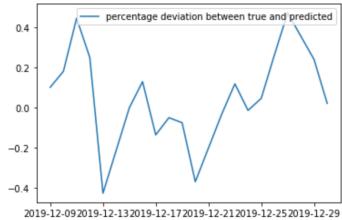
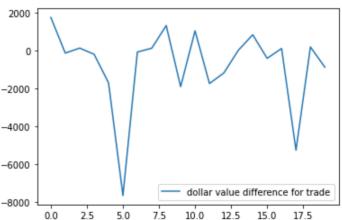
5

SeriesNet



6

LSTM

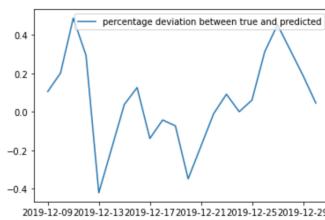
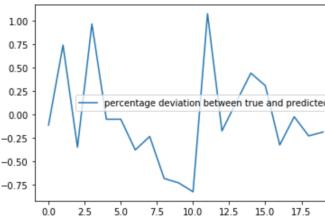
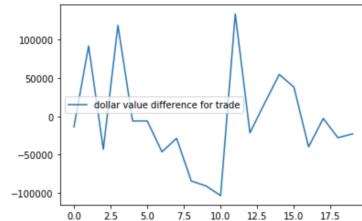


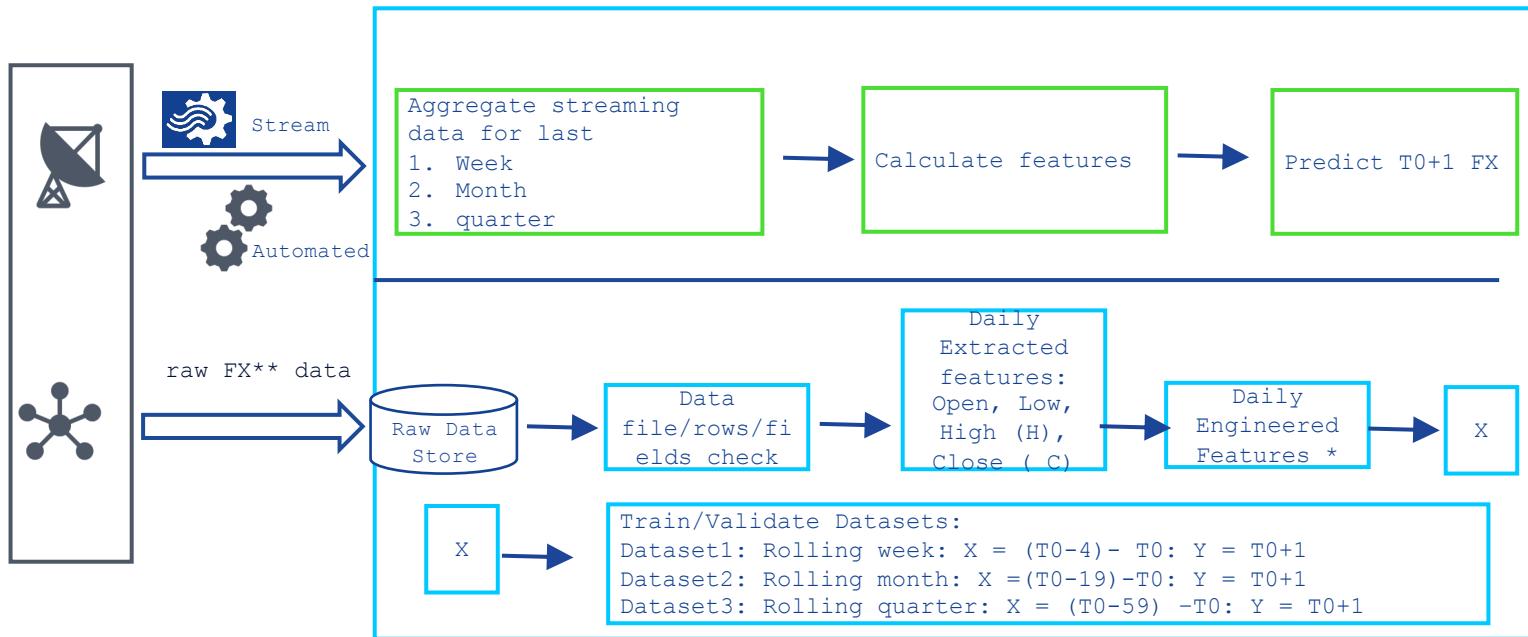


Trade performance
- 10 Mil USD trade



Prediction comparison





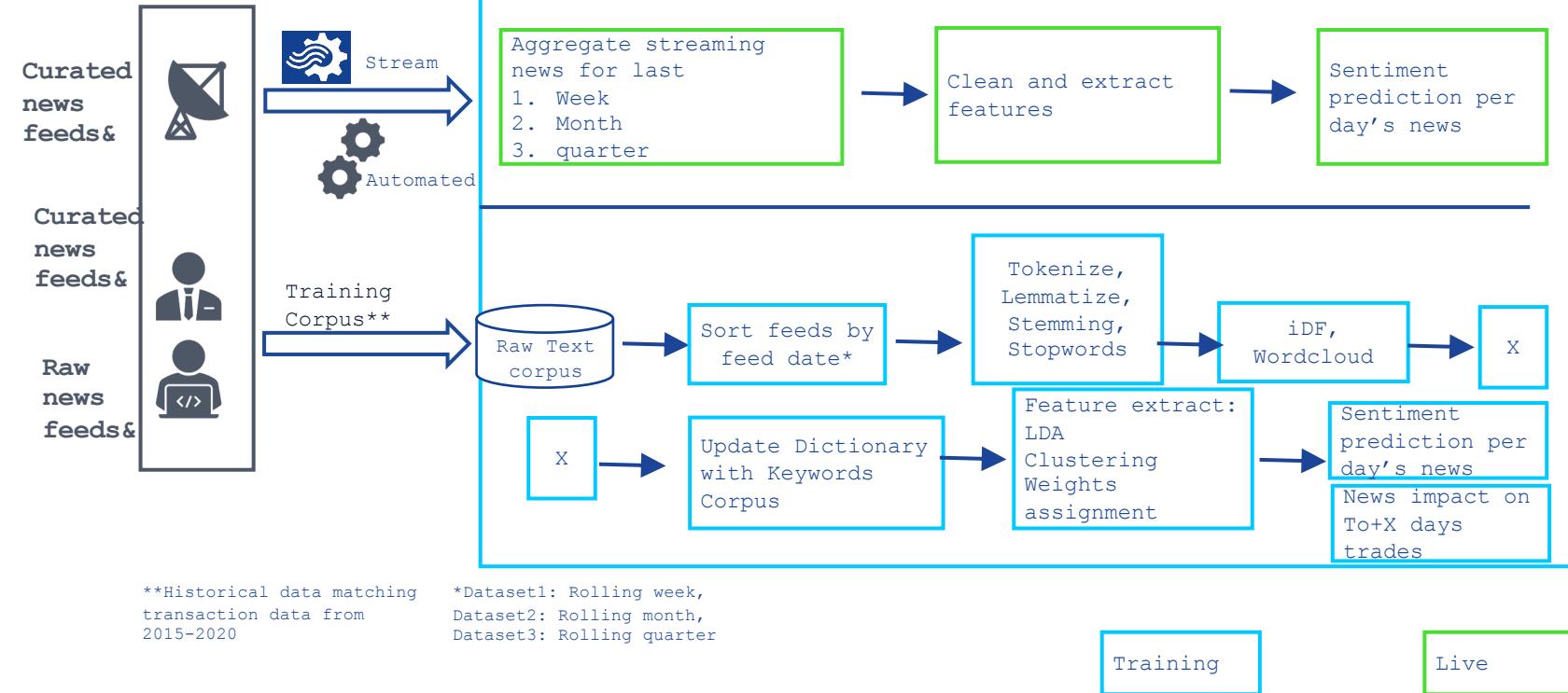
**FX = USD/EUR transaction data

**Historical data from 2015-2020

*e.g. $\ln(H(t)/H(t-1))$

Training

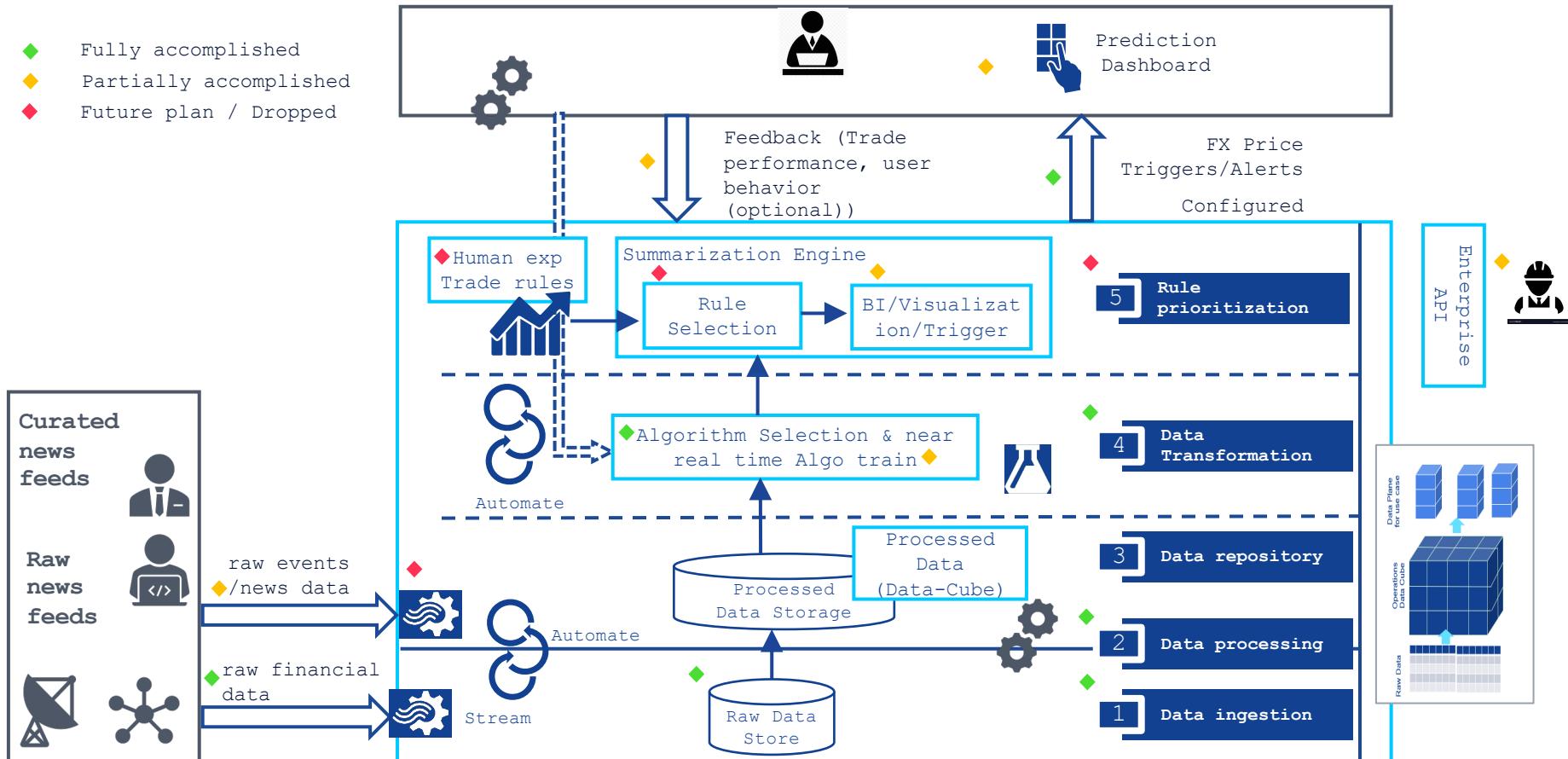
Live

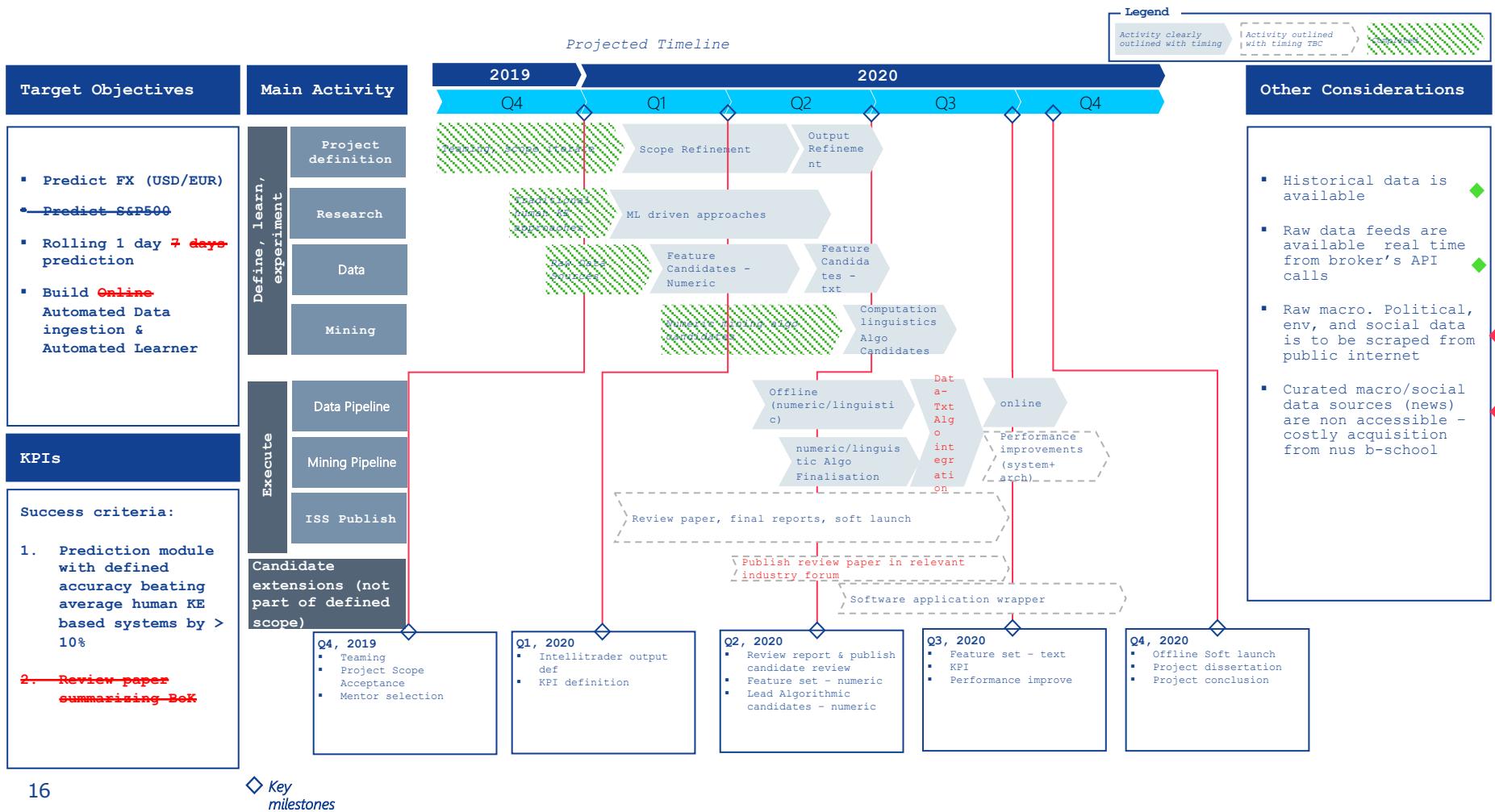


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 Market news:<https://www.spglobal.com/spdji/en/rss/>
 Regulator news: US Fed:<https://www.federalreserve.gov/feeds/feeds.htm>
 European Union feeds: <https://www.bankingsupervision.europa.eu/home/rss/html/index.en.html>
 Curated data source: <https://www.ravenpack.com/finance>

Lack of co-operation from NUS B-School for Text Corpus and feed

- ◆ Fully accomplished
- ◆ Partially accomplished
- ◆ Future plan / Dropped





Project Goal

Goals

- Build an Intelligent, Automated, near real time Data ingestion & Learner (ML based) based price predictor & trade recommender system
- Recommender system scope:
 - FX (USD/EUR)
 - S&P500
- Rolling X days prediction and recommendation
(Rolling 1 day ahead), and futures trading (Extended above original scope)
- Beat, on an average, defined portfolio performance metrics

Lack of co-operation from NUS B-School for Text Corpus and feed