Overview

Data Science projects since 2014: Pharma, Utility, Predictive Maintenance, Services
10 years US onsite: business process, ERP/BPM, management

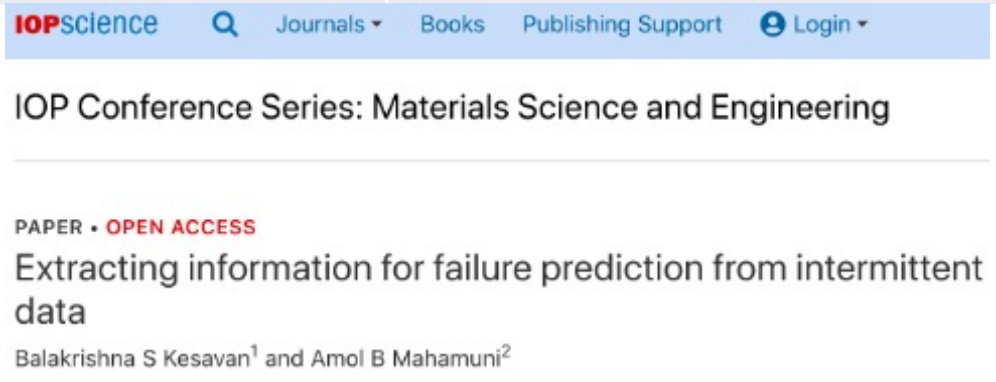
	Business impact & solution overview	Deep dive with code & proxy data
Cognizant	1. 20% improvement in FLR - helpdesk tickets 2. Asset reuse, ~300,000 users 3. Project health measure for $17Bn p.a. BPO projects 4. Azure helpdesk chatbot	1. Reducing call center load (ARIMA) 2. Revenue leakage prevention (LSTM & BERT)
IBM	1. Failure prediction 2. Project staffing optimization	1. Securing edge devices (T-CNN Auto Encoder)


https://www.cognizant.com/whitepapers/optimizing-it-operations-with-natural-language-processing-codex4914.pdf

Automatic Zoom

Digital Systems & Technology

Optimizing IT Operations with Natural Language Processing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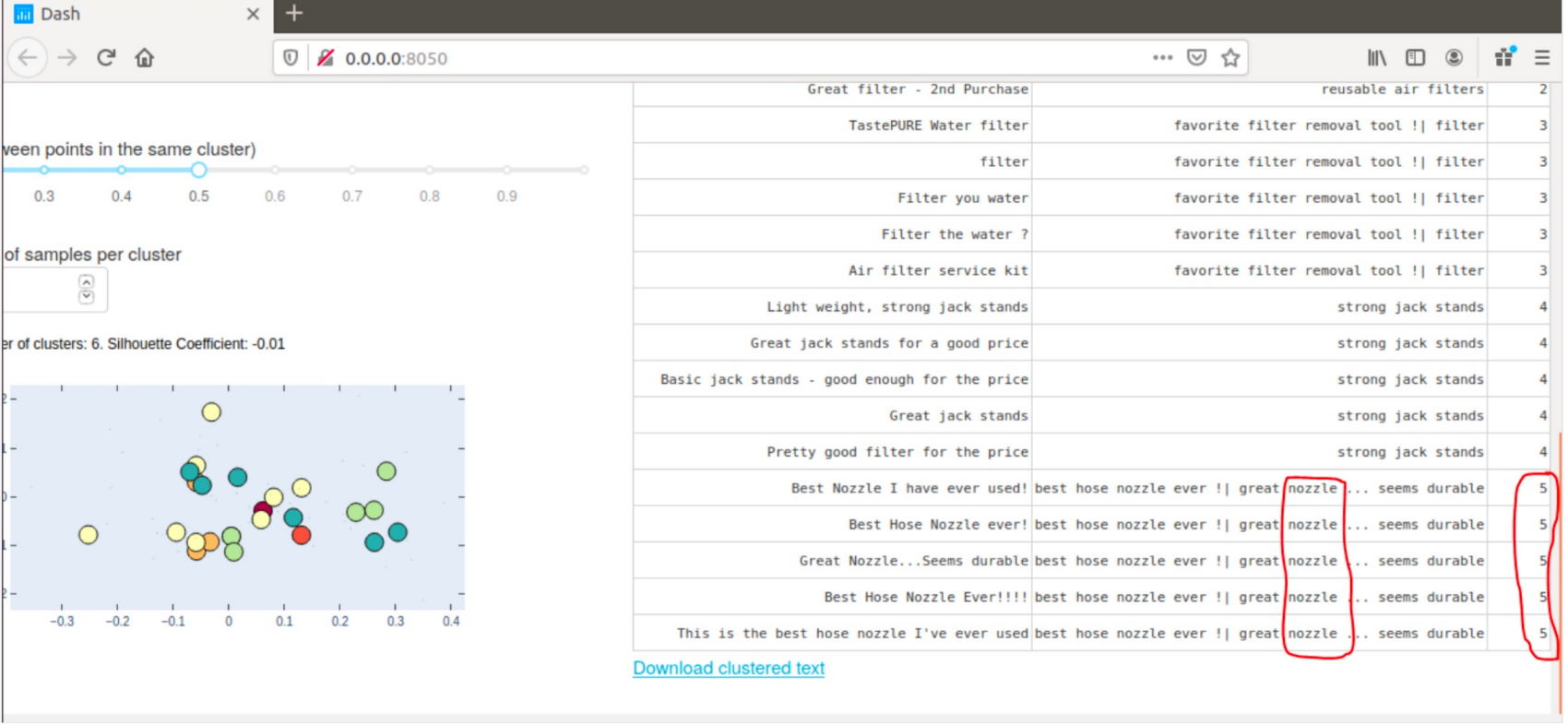
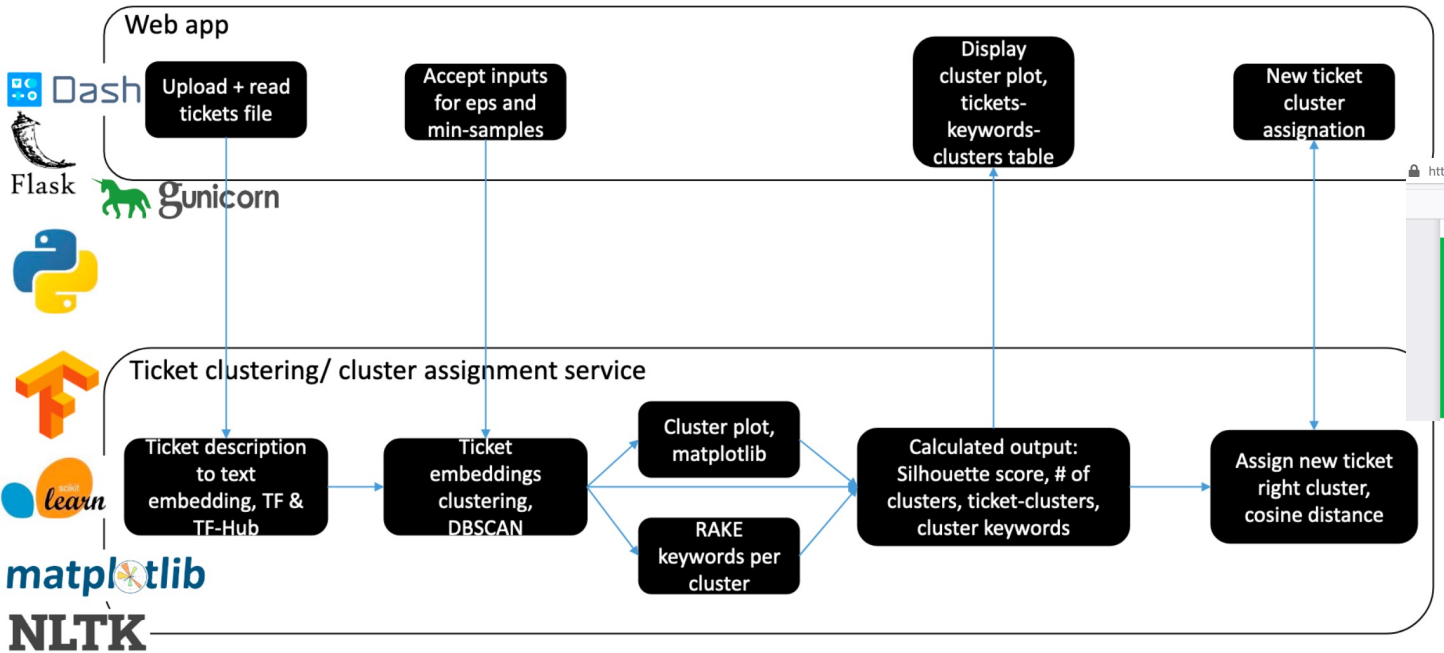
PAPER • OPEN ACCESS

Extracting information for failure prediction from intermittent data

Balakrishna S Kesavan[1] and Amol B Mahamuni[2]





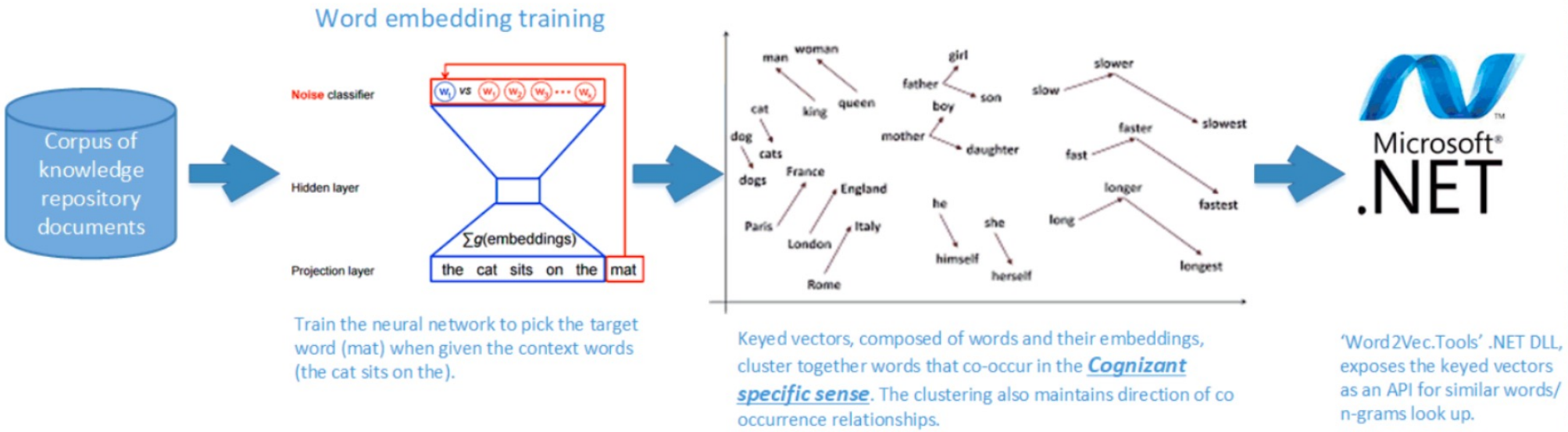
Pharma helpdesk left shift:

50% SME effort reduction

20 % improvement in FLR

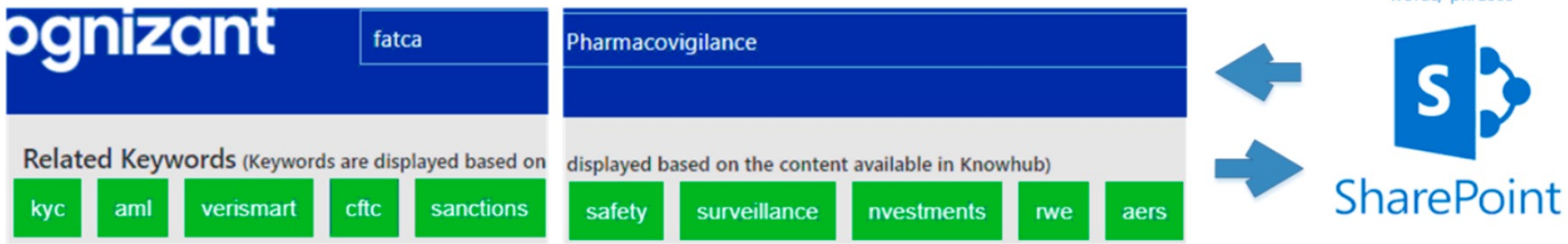
Whitepaper

One time+ periodic update

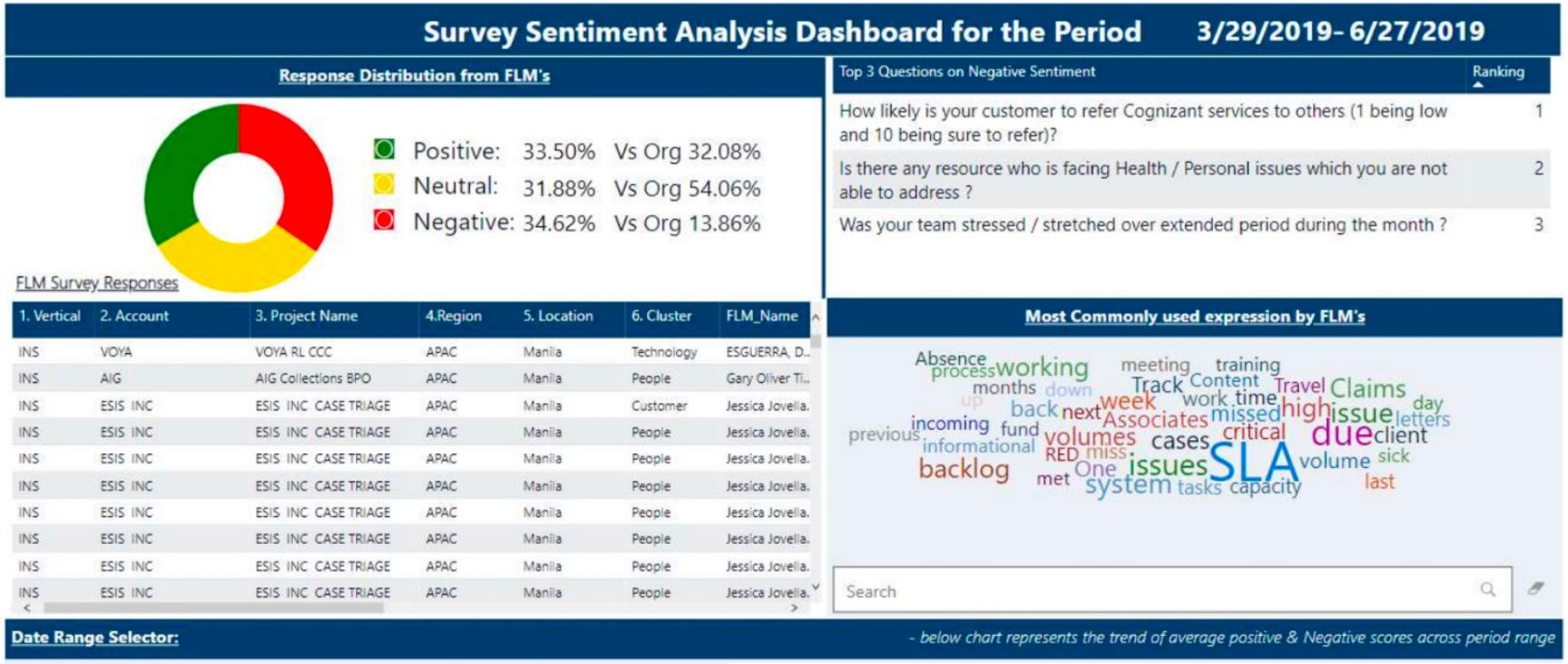


API call for similar words/ phrases

User query phrase mapped to similar words/ phrases to help users find documents covering similar subjects (2 examples)



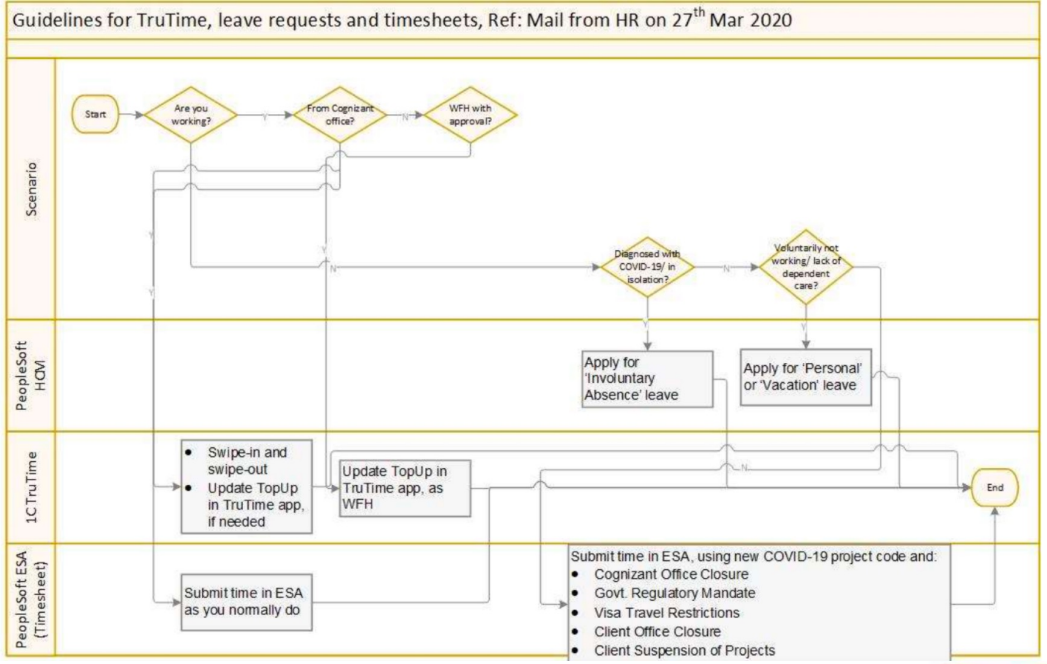
KnowHub: asset reuse, ~300,000 users

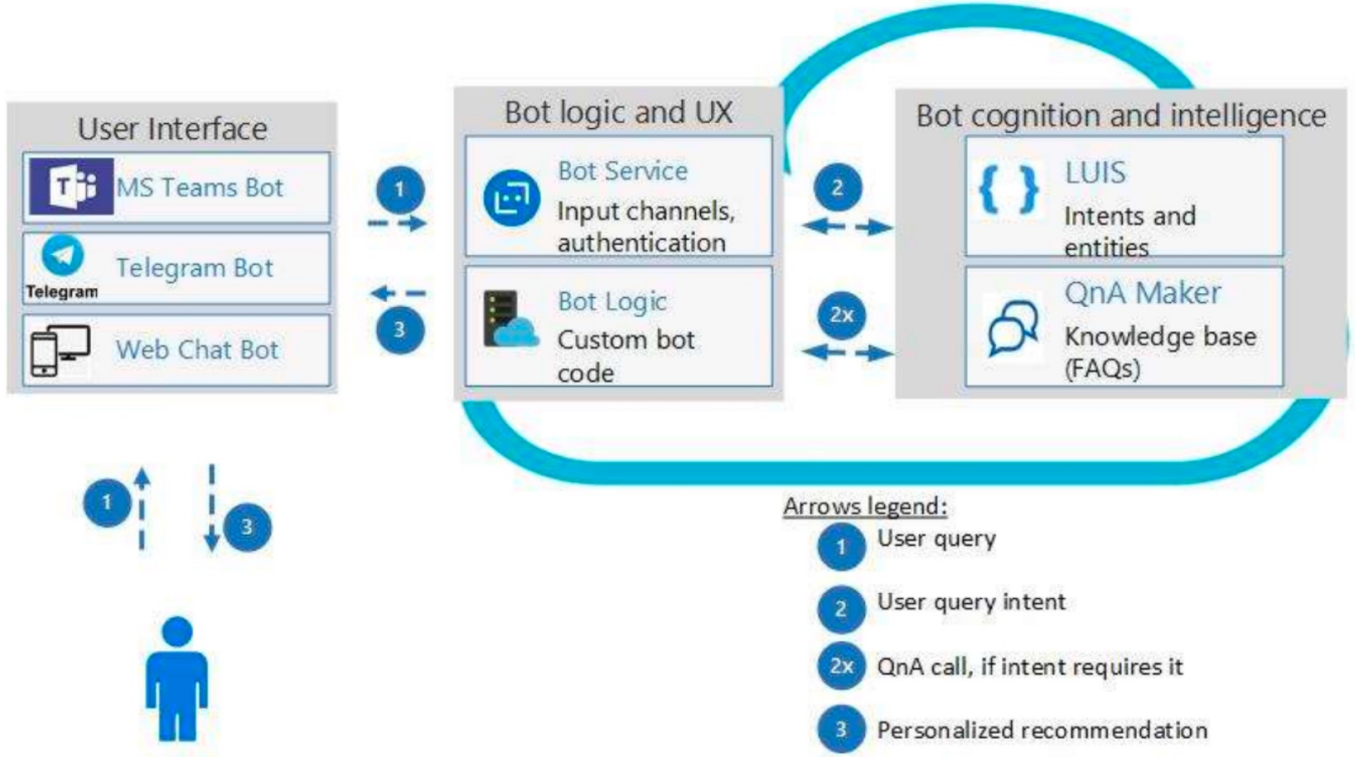


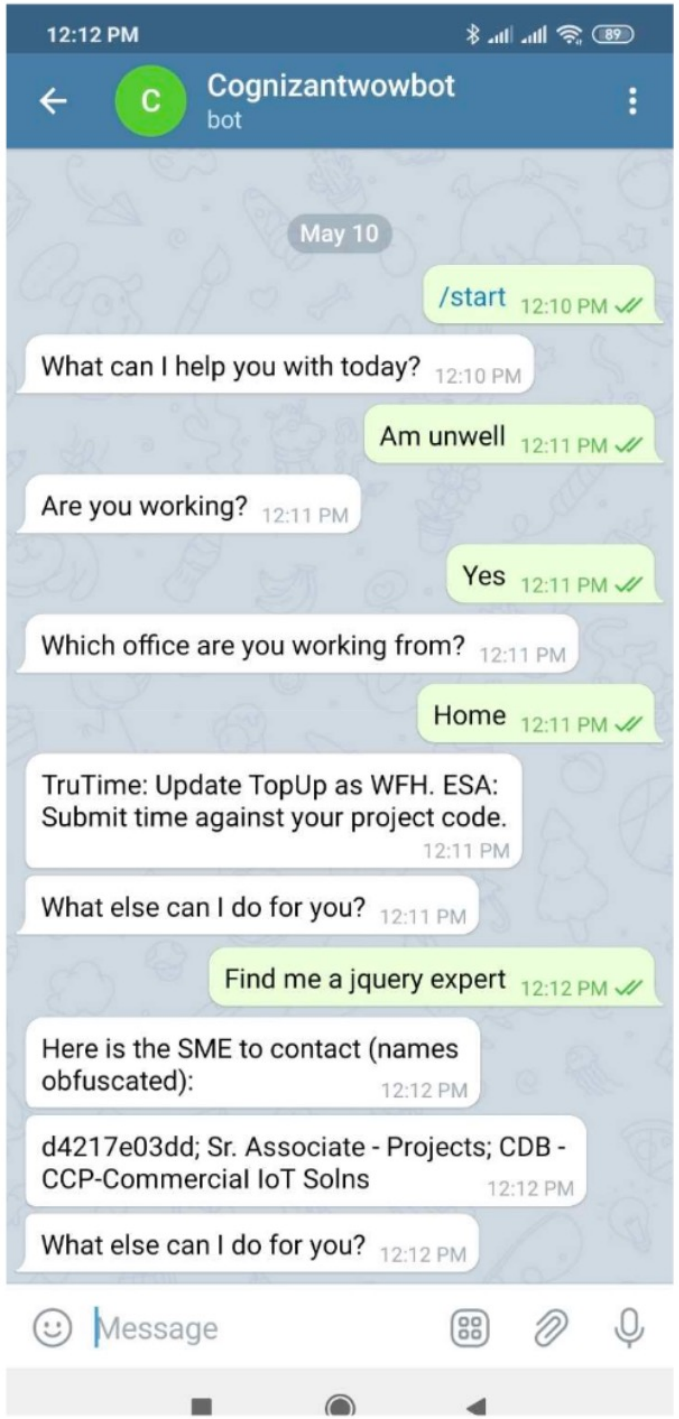

```
> sentiment_by("reverse transition")
   element_id word_count sd ave_sentiment
1:          1          2 NA             0
> customSentimentBy("reverse transition")
   element_id word_count sd ave_sentiment
1:          1          2 NA    -0.7071068
```

```
> sentiment_by("no developmental feedback")
   element_id word_count sd ave_sentiment
1:          1          3 NA             0
> customSentimentBy("no developmental feedback")
   element_id word_count sd ave_sentiment
1:          1          3 NA     0.5773503
```

BPO: project health measure for $17Bn p.a. projects





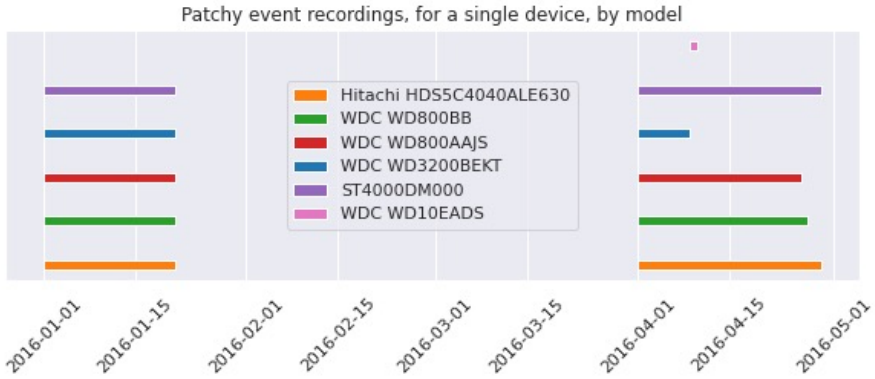


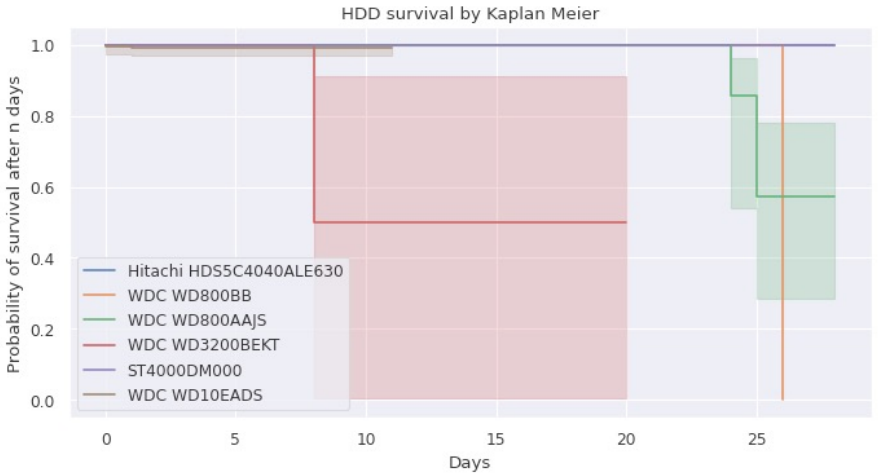
Azure helpdesk chatbot:

Employee experience

Time to roll out

IBM: Edge device failure prediction





These are the failures for model WDC WD3200BEKT:

event_at	removed	observed	censored	entrance	at_risk
0.0	0	0	0	2	2
8.0	1	1	0	0	2
20.0	1	0	1	0	1

$$\hat{S} = \prod_{t_i<t} \frac{n_i - d_i}{n_i}$$

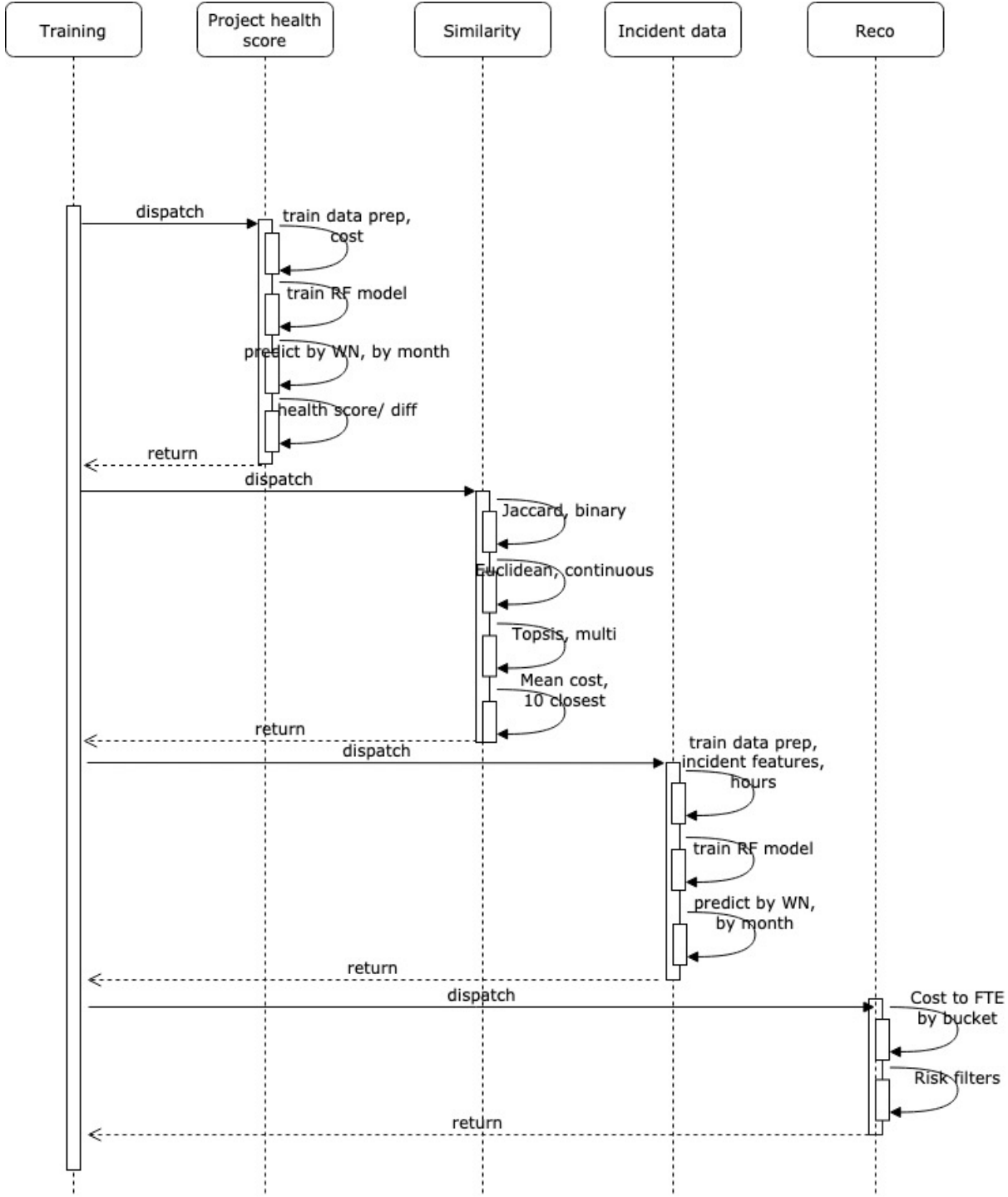
Day	Number of devices at risk	Number of devices that failed	Survival probability (product of terms)
0	2	0	(2-0)/2 = 1
8	2	1	{(2-0)/2}x{(2-1)/2} = 0.5
20	1	0	{(2-0)/2}x{(2-1)/2}x{(1-0)/1} = 0.5

t_0	-1
null_distribution	chi squared
degrees_of_freedom	1
test_name	logrank_test

		test_statistic	p	-log2(p)
Hitachi HDS5C4040ALE630	ST4000DM000	5.41	0.02	5.64
	WDC WD10EADS	18.72	<0.005	16.01
	WDC WD3200BEKT	751.37	<0.005	547.10
	WDC WD800AAJS	799.60	<0.005	581.94
	WDC WD800BB	262.02	<0.005	193.36
ST4000DM000	WDC WD10EADS	24.96	<0.005	20.70
	WDC WD3200BEKT	389.80	<0.005	285.82
	WDC WD800AAJS	621.79	<0.005	453.49
	WDC WD800BB	90.00	<0.005	68.51
WDC WD10EADS	WDC WD3200BEKT	13.30	<0.005	11.88
	WDC WD800AAJS	0.22	0.64	0.65
	WDC WD800BB	0.05	0.83	0.27
WDC WD3200BEKT	WDC WD800AAJS	14.00	<0.005	12.42
	WDC WD800BB	3.00	0.08	3.59
WDC WD800AAJS	WDC WD800BB	0.47	0.49	1.02

Statistical methods for automated generation of service engagement staffing plans

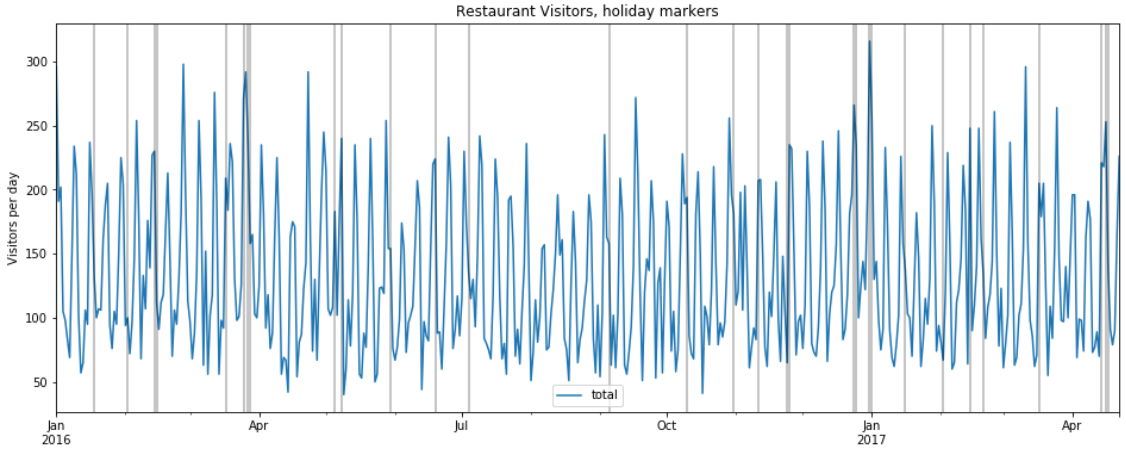
J. Hu
B. K. Ray
M. Singh



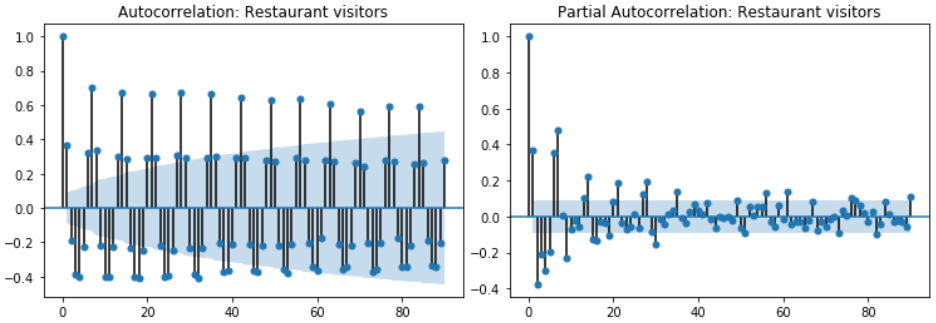
IBM, project staffing optimization:

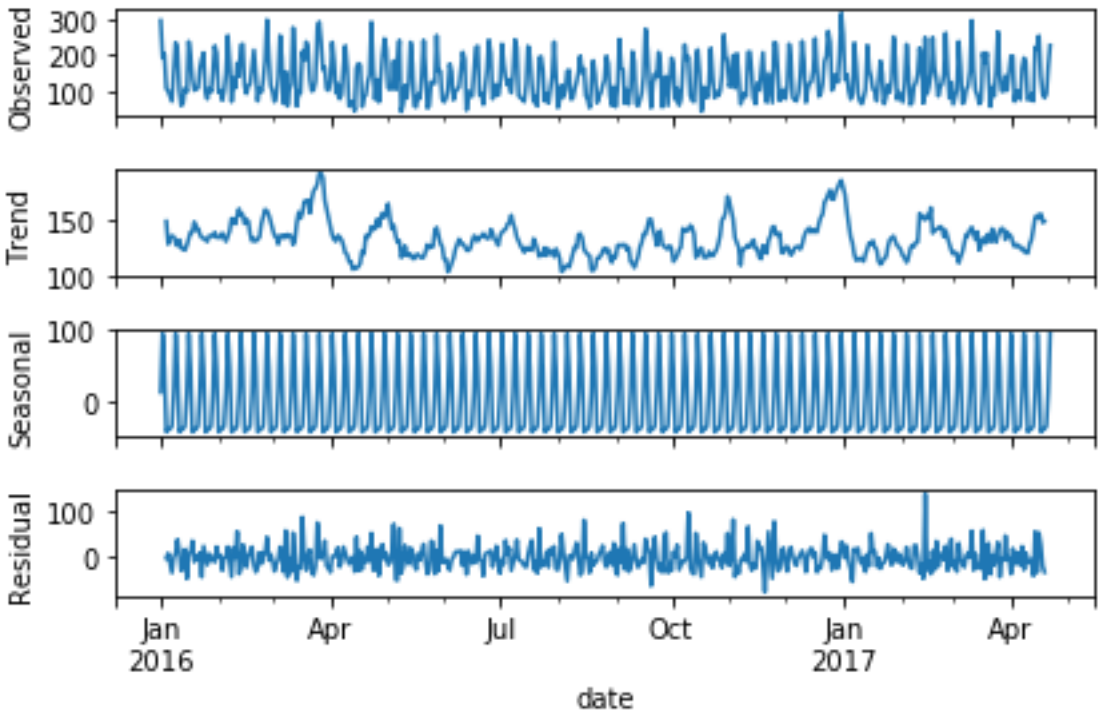
Benchmark similar + well run projects

ARIMA time series analysis, restaurant employees data

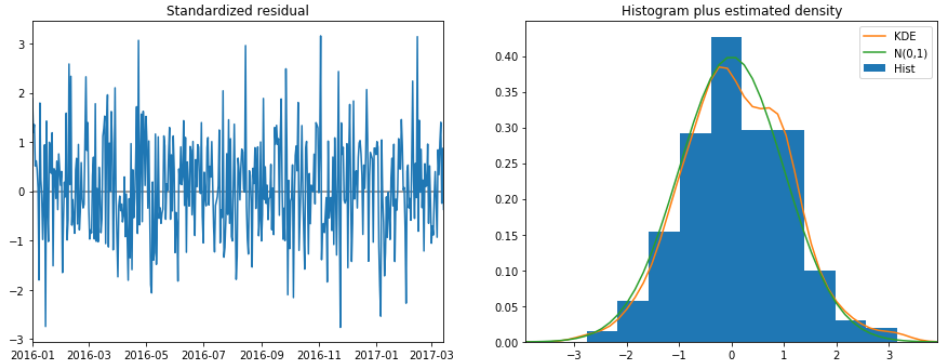


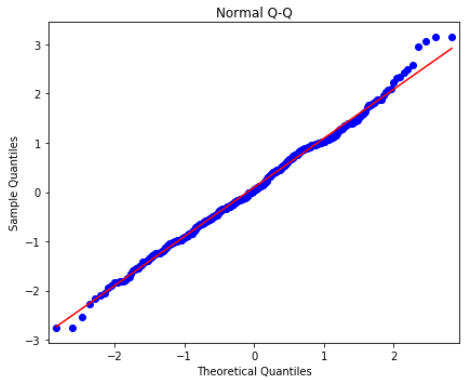
Dickey Fuller test for stationarity
(-5.592496972543475, 1.3193770946941 42e-06)

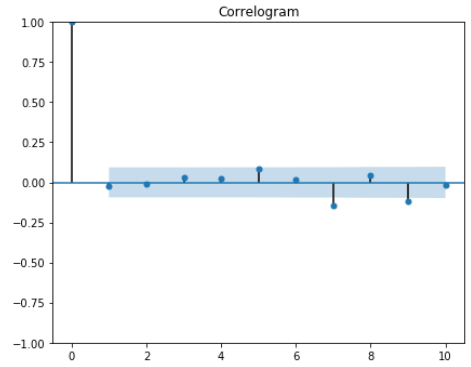


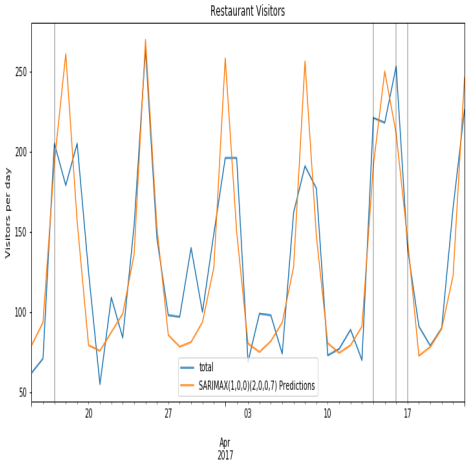


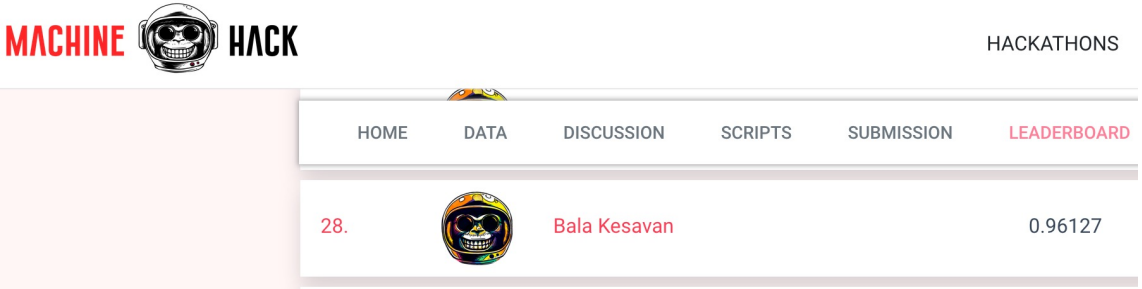
Auto_arima recco: SARIMAX(1, 0, 0)x(2, 0, 0, 7)












```
#definining a bi-directional LSTM
inp = Input(shape=(maxlen,))
x = Embedding(max_features, embed_size, weights=[embedding_matrix])(inp)
x = Bidirectional(LSTM(50, return_sequences=True, dropout=0.05, recurrent_dropout=0.05))(x)
x = Bidirectional(LSTM(50, return_sequences=True, dropout=0.05, recurrent_dropout=0.05))(x)
x = GlobalMaxPool1D()(x)
x = Dense(50, activation="relu")(x)
x = Dropout(0.1)(x)
x = Dense(10, activation="sigmoid")(x)
model = Model(inputs=inp, outputs=x)
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
```

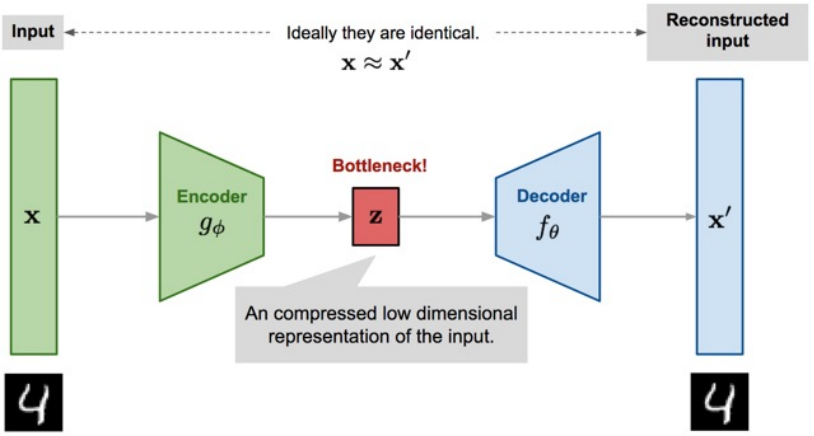
label	precision	recall	fscore	support
0	0.94	0.91	0.93	598
1	0.78	0.80	0.79	99
2	0.93	0.93	0.93	395
3	0.96	0.96	0.96	196
4	0.92	0.93	0.92	492
5	0.83	0.89	0.86	482
6	0.87	0.86	0.87	118
7	0.78	0.73	0.75	162
8	0.92	0.73	0.81	151
9	0.75	0.86	0.80	154

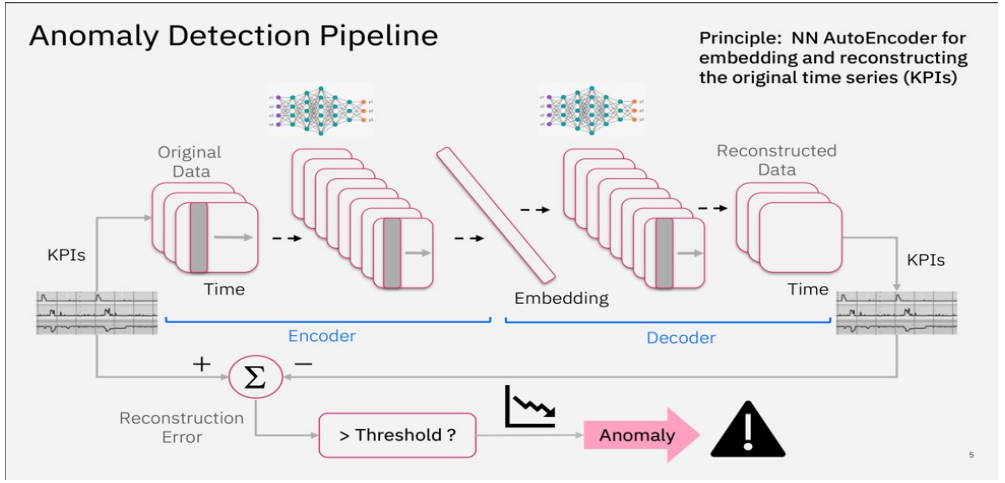
Obligations extraction from contracts:

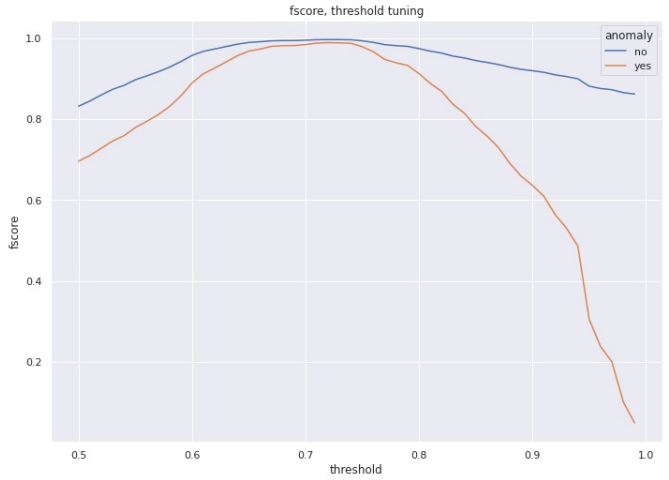
Prevent revenue leakage

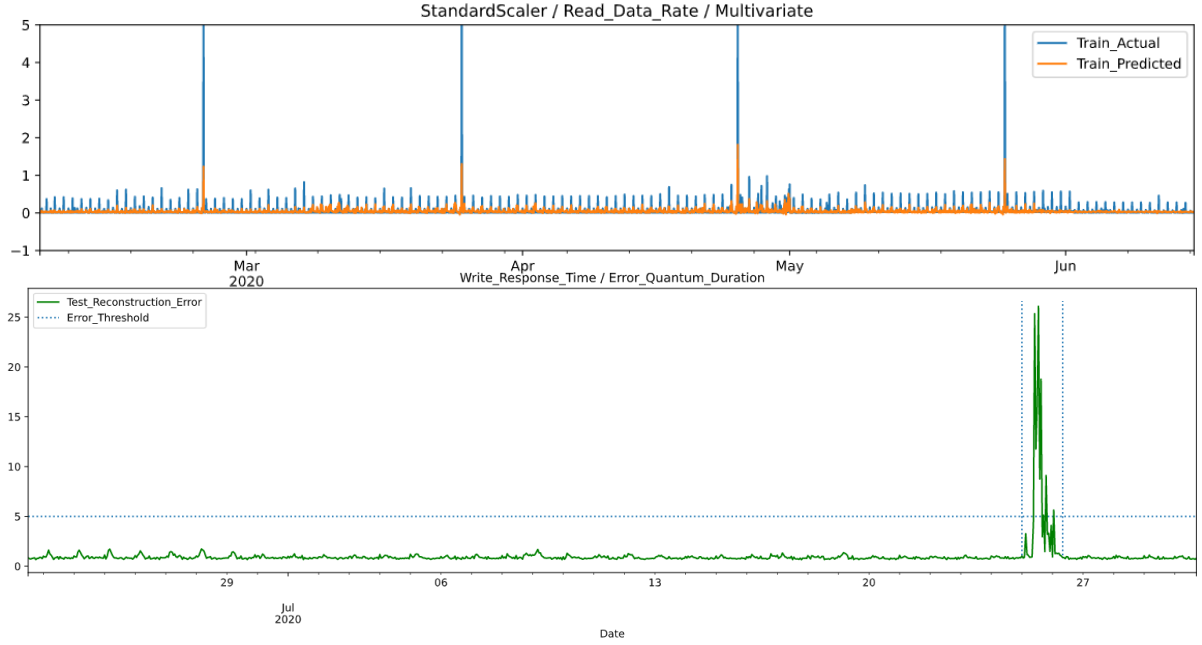
Proxy data, hackathon entry

Text classifier: BERT + TF2.0, LSTM + Keras









Layer (type)	Output Shape	Param #
conv1d_3 (Conv1D)	(None, 24, 64)	30784
dropout_4 (Dropout)	(None, 24, 64)	0
conv1d_4 (Conv1D)	(None, 12, 32)	12320
dropout_5 (Dropout)	(None, 12, 32)	0
conv1d_5 (Conv1D)	(None, 6, 16)	3088
conv1d_transpose_4 (Conv1DTr	(None, 12, 16)	1552
dropout_6 (Dropout)	(None, 12, 16)	0
conv1d_transpose_5 (Conv1DTr	(None, 24, 32)	3104
dropout_7 (Dropout)	(None, 24, 32)	0
conv1d_transpose_6 (Conv1DTr	(None, 48, 64)	12352
conv1d_transpose_7 (Conv1DTr	(None, 48, 80)	30800

Total params: 94,000
Trainable params: 94,000
Non-trainable params: 0

IBM edge device, anomaly detection:

Impending failure

Device security