Stock Price Prediction

with TA-Lib : Technical Analysis Library

Bildquelle:
https://www.americanbanker.com/slideshow/early-returns-2018s-top-performing-bank-stocks

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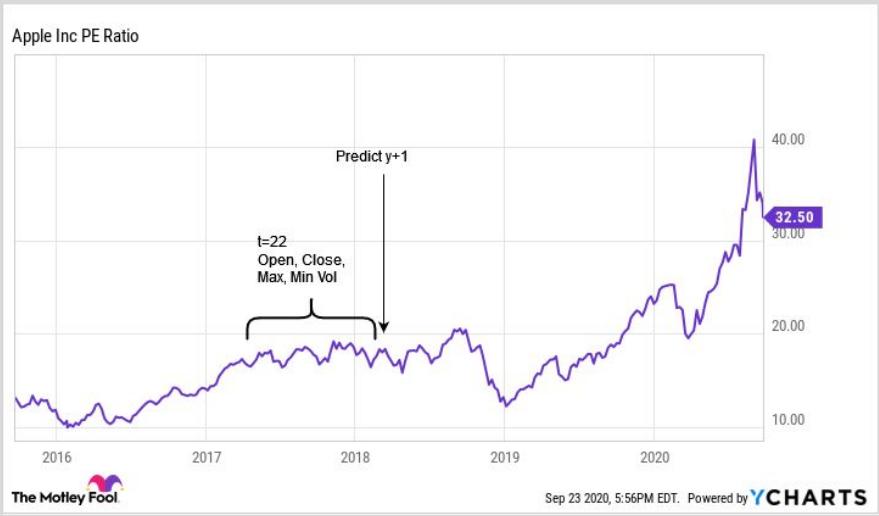
Structure

1. The paper
2. Stock prediction & TA-Lib
3. Our goal
4. The data
5. Preprocessing, validation, calculation
6. Network architecture
7. Results

The paper - Predicting Stock Prices Using LSTM



Stock example Apple Inc.

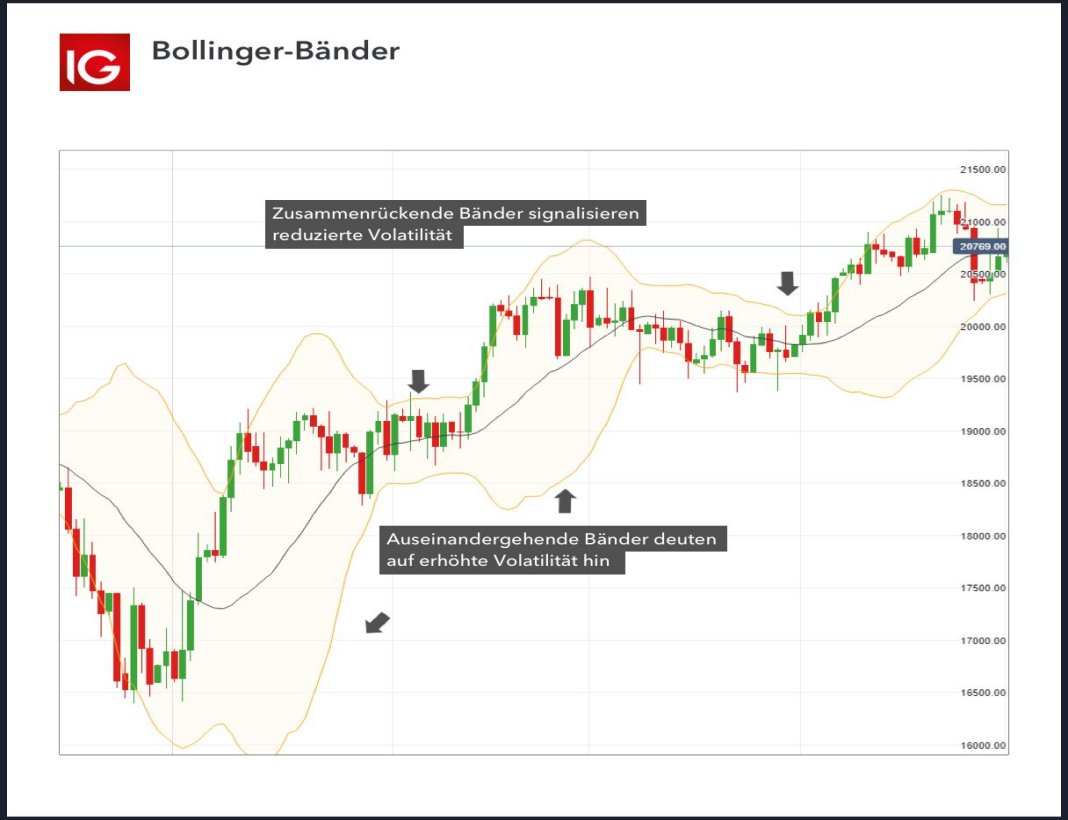
```
model = Sequential()

model.add(LSTM(128, input_shape=(layers[1],
layers[0]), return_sequences=True))

model.add(LSTM(64, input_shape=(layers[1],
layers[0]), return_sequences=False))

model.add(Dense(16,init='uniform',activation='relu'))

model.add(Dense(1,init='uniform',activation='linear'))
```

Network architecture

Stock price prediction & TA-Lib

- Technical Performance Indicators: mathematical calculations performed on different stock parameters like Open, Close...
- Help us to make investment strategies
- TA-Lib - an open-source python library
- Examples: Bollinger Bands, Simple Moving Average (SMA), Average True Range
- Financial ratios are divided into different classes

TA-LIB Example - Bollinger Bands



Quelle:
https://a.c-dn.net/c/content/dam/publicsites/igcom/de/images/Bollinger%20bands%20DE.png

Our goal

Stock example Apple Inc.

Bollinger Bands

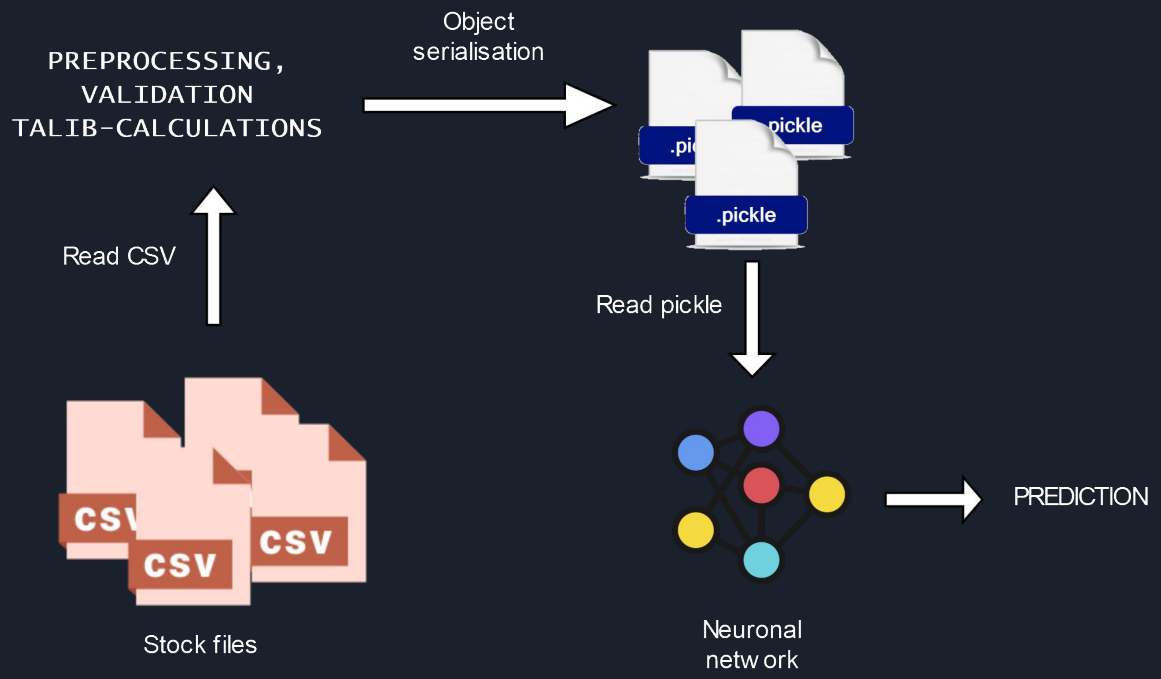
Weighted Moving Average (WMA)

Momentum

....

Calculated financial ratios from eight different classes

Basic procedure

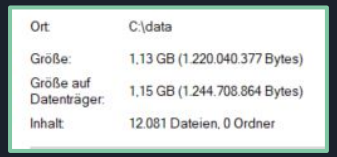


The data

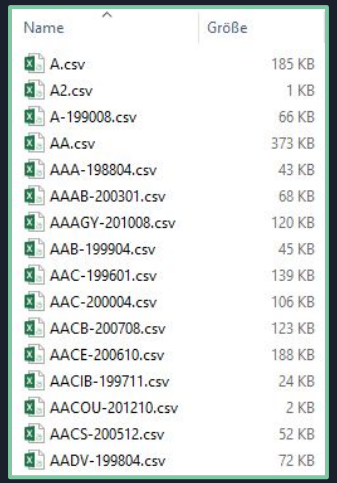
- More than 1 GB of stock data
- CSV format with ticker as filename
- Data structure:

Date	Open	High	Low	Close	Volume	Ticker
02.01.1985	10625	1125	10625	1125	7500	AAA-198804
03.01.1985	110	11125	110	11125	4800	AAA-198804
04.01.1985	1075	110	1075	110	700	AAA-198804
07.01.1985	11125	11125	10875	10875	4100	AAA-198804
08.01.1985	110	110	10875	10875	2600	AAA-198804
09.01.1985	110	110	1075	1075	1500	AAA-198804
10.01.1985	110	110	10875	10875	7400	AAA-198804
11.01.1985	10875	110	10875	110	6700	AAA-198804
14.01.1985	110	11375	110	11375	16900	AAA-198804
15.01.1985	120	12375	115	12125	47700	AAA-198804
16.01.1985	12375	12625	12125	125	32200	AAA-198804
17.01.1985	12375	125	1225	12375	7500	AAA-198804

Inside AA-198804.CSV



Properties of the folder



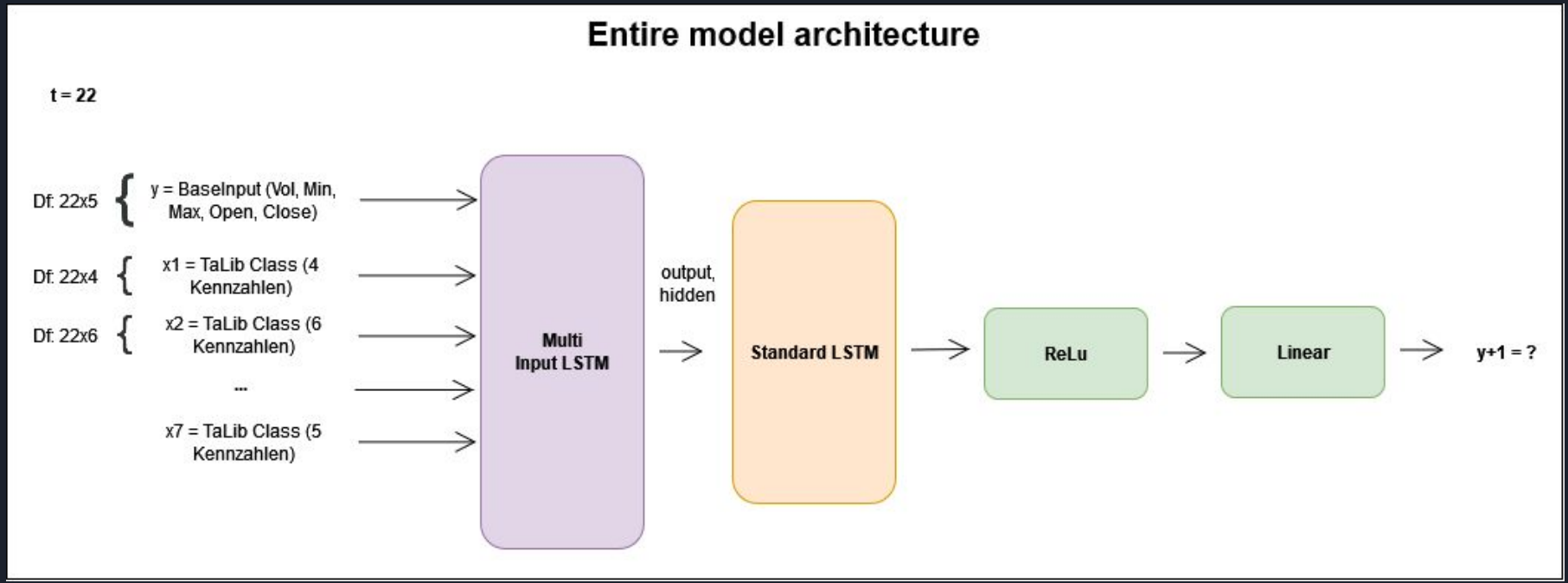
The folder in editor view

Preprocessing, Validation, Calculation

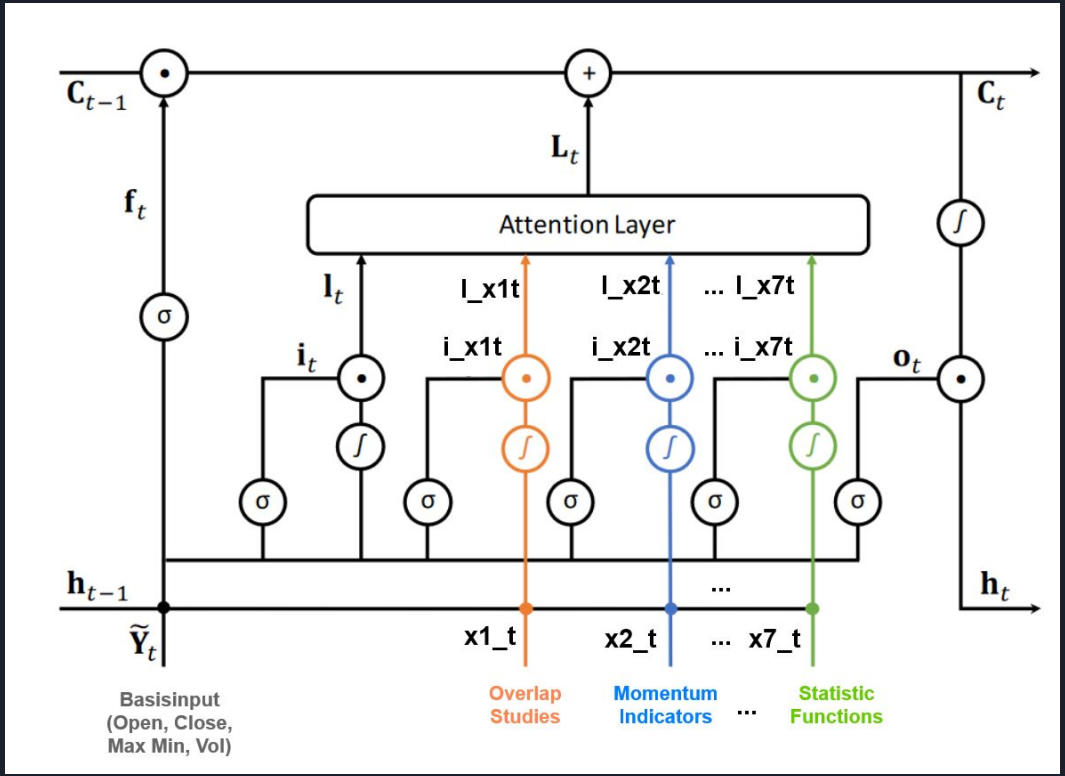
Date	Open	High	Low	Close	Volume	Ticker	upperBB	middleBB	lowerBB	midpoint	wma	mom	mfi	bop	adline	adosc	obv	atr	natr	tr	avgprice	typprice	wclprice	whiteso...	starsins...	twocro...	linearreg	stddev	tsf
1996-08-05	0.00000	0.13043	0.00000	0.00000	0.15251	AACB-200708	0.00943	0.01897	0.44547	0.00000	0.04225	0.50000	0.32454	0.50000	0.00133	0.65721	0.00744	0.08618	0.08618	0.27778	0.00000	0.01449	0.00000	0.00000	0.00000	0.00000	0.13603	0.01854	0.14677
1996-08-06	0.00000	0.13043	0.00000	0.16667	0.11783	AACB-200708	0.01402	0.02710	0.46284	0.00000	0.04968	0.81250	0.07796	1.00000	0.00678	0.69412	0.01352	0.10386	0.10386	0.22222	0.04348	0.07246	0.08696	0.00000	0.00000	0.00000	0.14148	0.01823	0.15209
1996-08-07	0.00000	0.13043	0.00000	0.12500	0.12813	AACB-200708	0.01526	0.03523	0.49219	0.00000	0.05180	0.75000	0.05514	0.87500	0.00974	0.74499	0.00692	0.12115	0.12115	0.22222	0.03261	0.05797	0.06522	0.00000	0.00000	0.00000	0.13454	0.01013	0.14475
1996-08-08	0.33333	0.30435	0.08333	0.08333	0.13421	AACB-200708	0.01482	0.04065	0.51631	0.00000	0.04861	0.43750	0.06191	0.00000	0.00353	0.73075	0.00000	0.18203	0.18203	0.33333	0.17391	0.13043	0.10870	0.00000	0.00000	0.00000	0.11918	0.00175	0.12889
1996-08-09	0.83333	0.82609	0.83333	0.83333	0.00218	AACB-200708	0.01092	0.03523	0.50773	0.00000	0.04522	0.50000	0.07583	0.00000	0.00129	0.71621	0.00000	0.19762	0.19762	0.22222	0.13043	0.10145	0.08696	0.00000	0.00000	0.00000	0.11918	0.00000	0.12906
1996-08-12	0.66667	0.65217	0.66667	0.66667	0.00000	AACB-200708	0.01344	0.03794	0.51000	0.00000	0.05201	0.68750	0.00000	0.70000	0.00537	0.75057	0.00757	0.23485	0.23485	0.27778	0.07609	0.08696	0.09783	0.00000	0.00000	0.00000	0.13107	0.00219	0.14112
1996-08-13	0.50000	0.73913	0.50000	0.70833	0.00788	AACB-200708	0.01383	0.03252	0.48607	0.00000	0.03874	0.43750	0.00099	0.50000	0.00336	0.76068	0.00533	0.24930	0.24930	0.22222	0.00000	0.01449	0.00000	0.00000	0.00000	0.00000	0.10803	0.01044	0.11776
1996-08-14	0.66667	0.65217	0.66667	0.66667	0.00016	AACB-200708	0.01342	0.02981	0.47625	0.00000	0.03068	0.37500	0.02805	0.50000	0.00304	0.77198	0.00569	0.24144	0.24144	0.16667	0.02174	0.02899	0.02174	0.00000	0.00000	0.00000	0.09316	0.01317	0.10266
1996-08-15	0.66667	0.65217	0.66667	0.66667	0.00023	AACB-200708	0.00938	0.02439	0.46819	0.00000	0.02770	0.68750	0.05656	0.25000	0.00054	0.76685	0.00847	0.23376	0.23376	0.16667	0.07609	0.07246	0.06522	0.00000	0.00000	0.00000	0.09415	0.01108	0.10384
1996-08-16	0.66667	0.73913	0.66667	0.75000	0.00281	AACB-200708	0.00913	0.02981	0.49160	0.00000	0.02494	0.62500	0.05393	0.00000	0.00000	0.76903	0.00847	0.20425	0.20425	0.11111	0.08696	0.07246	0.06522	0.00000	0.00000	0.00000	0.07978	0.00317	0.08899
1996-08-19	0.75000	0.73913	0.50000	0.50000	0.00694	AACB-200708	0.01344	0.03794	0.51000	0.00000	0.03195	0.68750	0.04716	1.00000	0.00168	0.79176	0.01033	0.19738	0.19738	0.16667	0.06522	0.08696	0.09783	0.00000	0.00000	0.00000	0.08424	0.00219	0.09329
1996-08-20	0.58333	0.56522	0.58333	0.58333	0.00055	AACB-200708	0.01728	0.04336	0.51877	0.00000	0.03864	0.68750	0.04716	1.00000	0.00381	0.82737	0.01033	0.19065	0.19065	0.16667	0.06522	0.08696	0.09783	0.00000	0.00000	0.00000	0.09192	0.00382	0.10097
1996-08-21	0.75000	0.78261	0.75000	0.79167	0.00218	AACB-200708	0.01728	0.04336	0.51877	0.00000	0.03513	0.43750	0.03194	0.50000	0.00381	0.85194	0.01007	0.16209	0.16209	0.11111	0.04348	0.04348	0.04348	0.00000	0.00000	0.00000	0.08375	0.00382	0.09262
1996-08-22	0.75000	0.73913	0.75000	0.75000	0.00016	AACB-200708	0.01728	0.04336	0.51877	0.00000	0.04161	0.56250	0.04226	0.50000	0.00501	0.87994	0.01141	0.13415	0.13415	0.11111	0.10870	0.10145	0.10870	0.00000	0.00000	0.00000	0.09886	0.00382	0.10806
1996-08-23	0.58333	0.56522	0.58333	0.58333	0.00062	AACB-200708	0.01344	0.03794	0.51000	0.00000	0.03811	0.56250	0.04316	0.00000	0.00446	0.89552	0.01080	0.15078	0.15078	0.22222	0.13043	0.10145	0.08696	0.00000	0.00000	0.00000	0.09861	0.00219	0.10797
1996-08-26	0.50000	0.47826	0.50000	0.50000	0.00023	AACB-200708	0.02079	0.04607	0.51749	0.00000	0.04978	0.62500	0.05203	1.00000	0.00669	0.92620	0.01327	0.14506	0.14506	0.16667	0.10870	0.13043	0.14130	0.00000	0.00000	0.00000	0.11397	0.00833	0.12341
1996-08-27	0.33333	0.30435	0.20833	0.20833	0.00273	AACB-200708	0.01837	0.04336	0.51489	0.00000	0.05116	0.62500	0.04703	0.16667	0.00626	0.94304	0.01186	0.13947	0.13947	0.16667	0.11957	0.10145	0.09783	0.00000	0.00000	0.00000	0.12116	0.00635	0.13083
1996-08-28	0.25000	0.21739	0.25000	0.25000	0.00000	AACB-200708	0.02554	0.05149	0.52300	0.00000	0.06263	0.56250	0.02892	1.00000	0.00637	0.95702	0.01199	0.11202	0.11202	0.11111	0.13043	0.14493	0.15217	0.00000	0.00000	0.00000	0.13603	0.01207	0.14576
1996-08-29	0.16667	0.17391	0.16667	0.16667	0.02013	AACB-200708	0.01971	0.04607	0.52134	0.00000	0.06379	0.56250	0.03193	0.50000	0.00589	0.96472	0.01144	0.08517	0.08517	0.11111	0.09783	0.10145	0.09783	0.00000	0.00000	0.00000	0.14668	0.00581	0.15681
1996-08-30	0.08333	0.08696	0.08333	0.08333	0.01716	AACB-200708	0.01837	0.04336	0.51489	0.00000	0.06018	0.37500	0.02867	0.33333	0.00529	0.96842	0.01078	0.08088	0.08088	0.16667	0.08696	0.08696	0.07609	0.00000	0.00000	0.00000	0.14222	0.00635	0.15234
1996-09-03	0.04167	0.00000	0.04167	0.04167	0.00374	AACB-200708	0.01092	0.03523	0.50773	0.00000	0.05668	0.50000	0.02862	0.00000	0.00479	0.97082	0.01078	0.03272	0.03272	0.05556	0.06522	0.05797	0.05435	0.00000	0.00000	0.00000	0.14594	0.00000	0.15639
1996-09-04	0.00000	0.13043	0.00000	0.00000	1.00000	AACB-200708	0.01700	0.04065	0.50851	0.00000	0.06846	0.75000	0.04491	0.50000	0.00511	0.97891	0.01257	0.07354	0.07354	0.27778	0.16304	0.15942	0.16304	0.00000	0.00000	0.00000	0.16551	0.00683	0.17621
1996-09-05	0.00000	0.13043	0.00000	0.00000	0.15251	AACB-200708	0.02424	0.04878	0.51641	0.00000	0.08003	0.75000	0.04687	1.00000	0.00679	1.00000	0.01257	0.02554	0.02554	0.05556	0.15217	0.15942	0.16304	0.00000	0.00000	0.00000	0.18062	0.01270	0.19140

- split data into chunks of size 23 (t=22 and y+1)
- create pickle files as final input data for our neural network

Network architecture



Custom Multi Input LSTM cell



Basic config

Number of layers	4 (lstm / lstm / relu / linear)
Number of hidden nodes per layer	32
Optimization algorithm	SGD
Loss function	L1Loss (MAE)
Epochs	10
Learning rate	0.001 / 0.01

Four configs

Config 1

Without Ta-Lib

Config 2

With 7 Ta-Lib classes

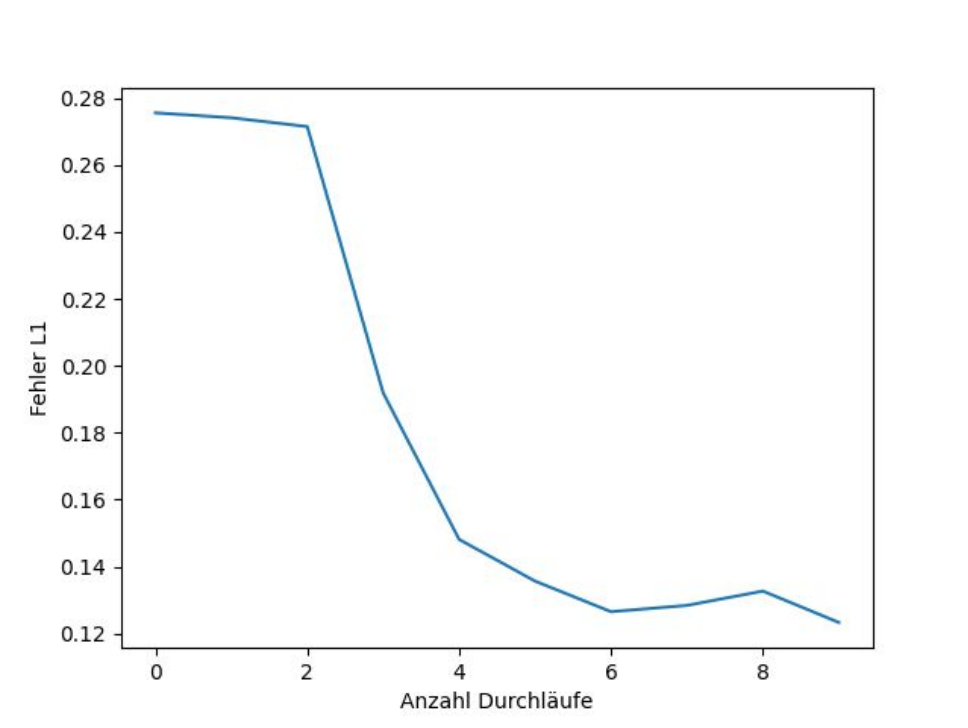
Config 3

Part1: Ta-Lib classes 1-3

Config 4

Part2: Ta-Lib classes 4-7

Result with Ta-Lib



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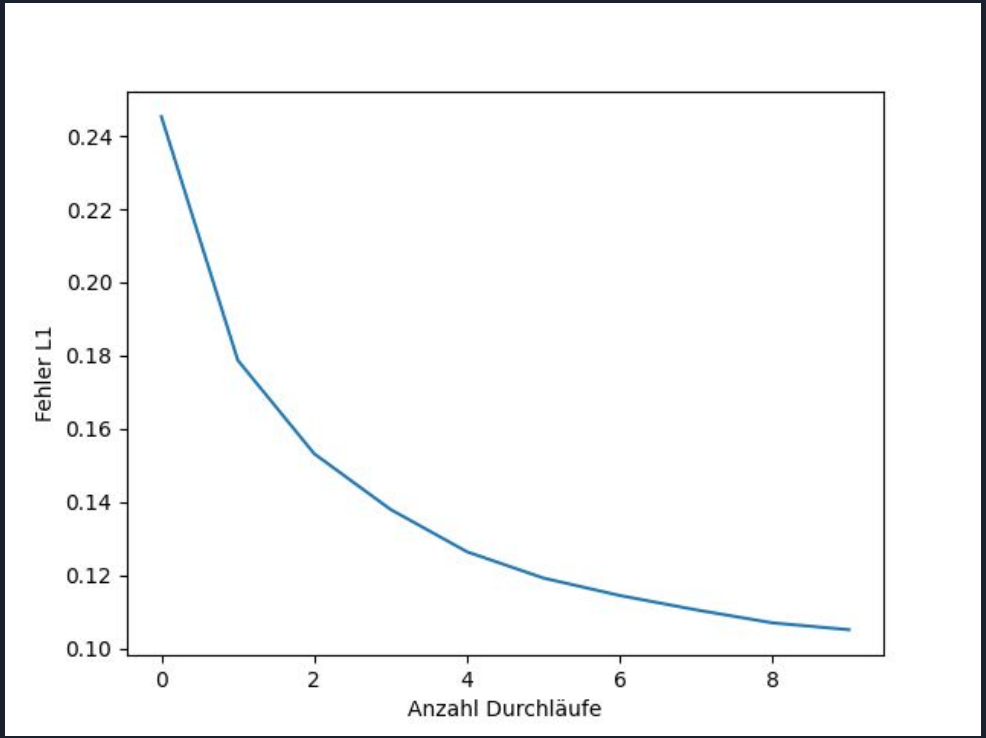
Result without Ta-Lib



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Thanks for your attention

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