Question Classification based on LSTMs

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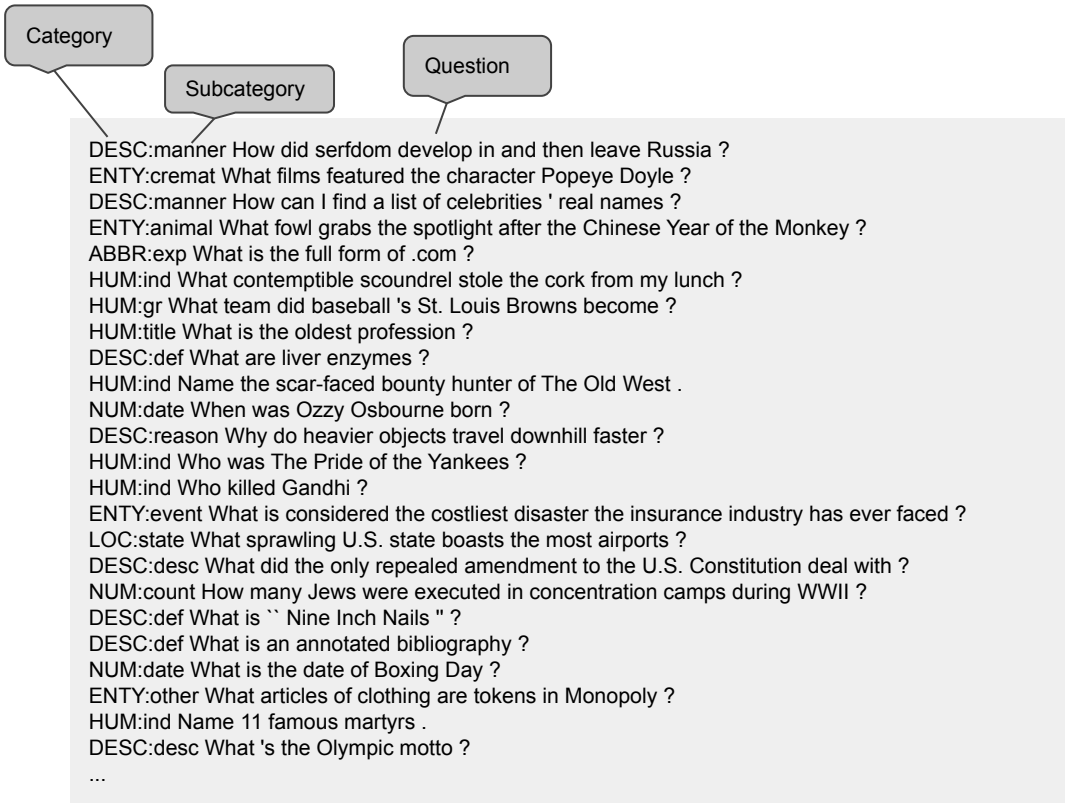
Our Task

Question Classification: Our Task

Given train and test data from a Question Answering System, the main task is to predict the category the questions refers to.

After an Exploratory Data Analysis (EDA) we should use Neural Networks/LSTM and alternatively a Support Vector Machine.



1 Exploratory Data Analysis (EDA)
2 Neural Networks: LSTMs
3 Support Vector Machines
4 Model comparison and scores (F1)
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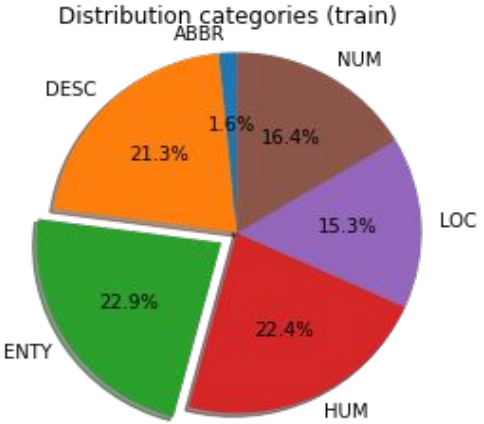
Exploratory Data Analysis (EDA)

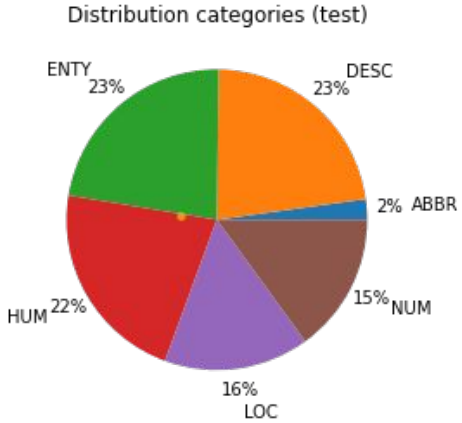
The data sets:
First insights into categories

The training data set consists of approx. 5500 labeled questions and the testing set of 500 data.

Some charts give an impression of the categories (and subcategories) sizes:

Note that the distribution in the test data is roughly the same for the main categories.



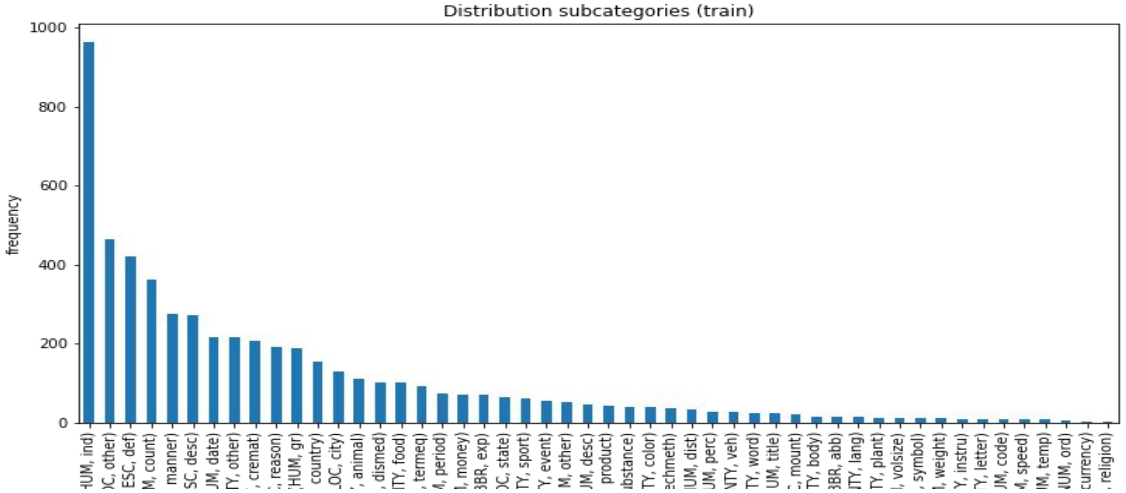


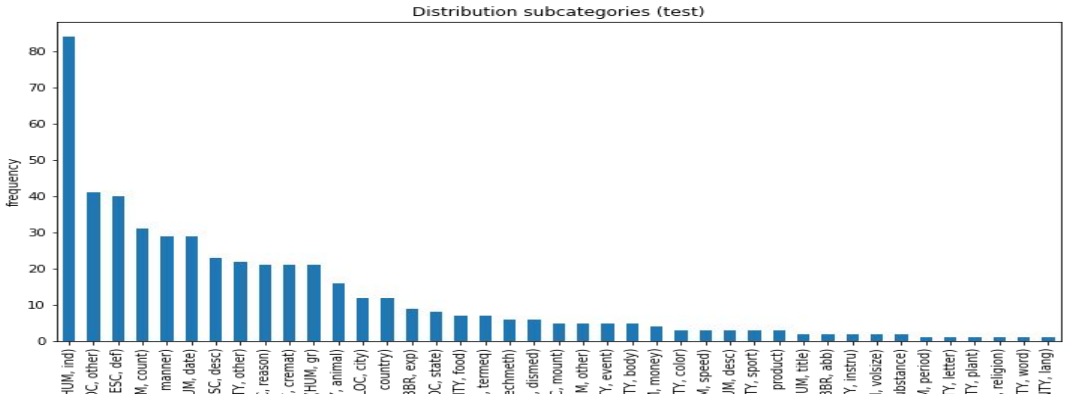
The distribution of subcategories

The distribution of subcategories is very unbalanced. The training data set shows 47 categories, the test data set still 38.

By far most frequent (18%) subcategory is ‘Individual’ (HUM), followed by ‘Definition’(DESC) with 8%.

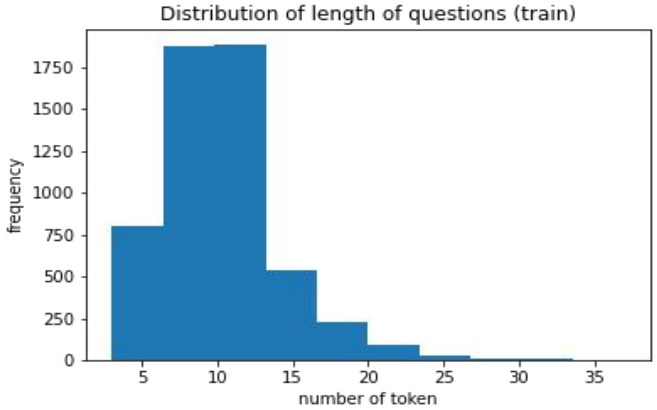
Note: ‘Other’ appears in three different categories.

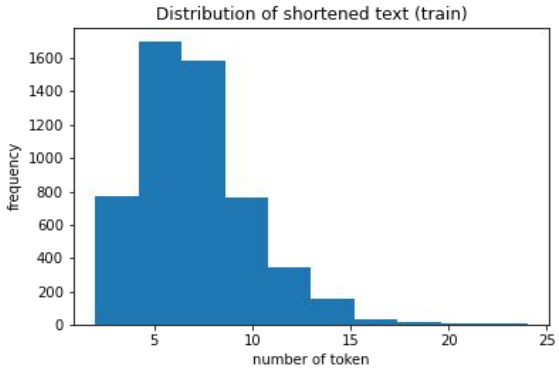


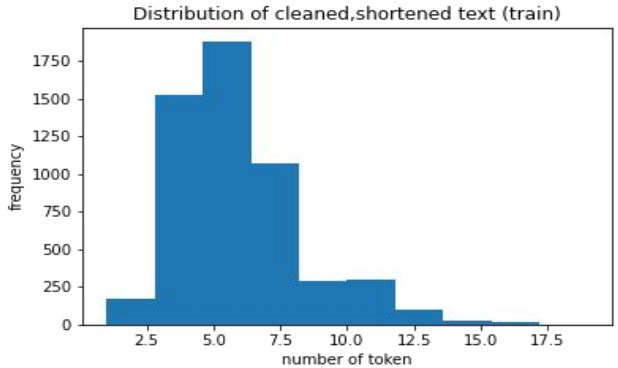


Some more EDA on the question texts

Analysis of the question texts cover the length of the question, i.e. number of tokens (words, punctuation marks, special characters).



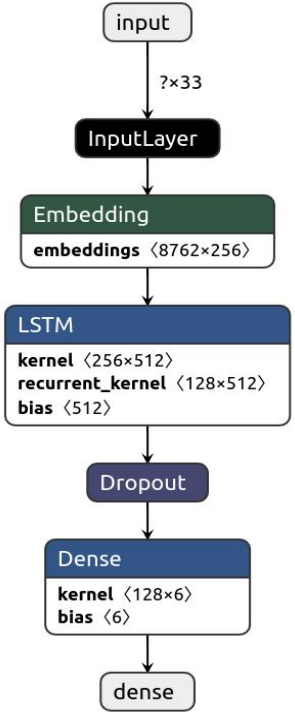




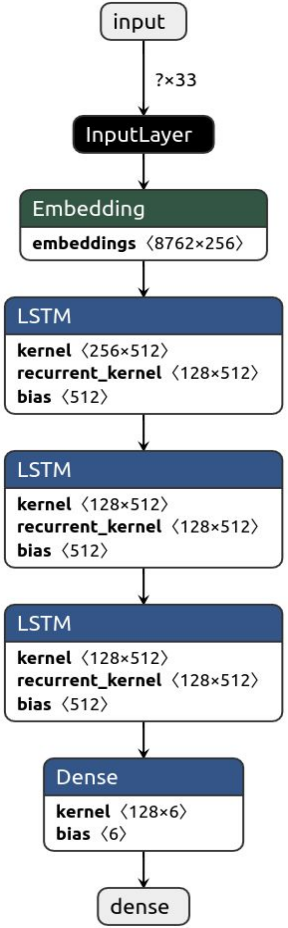
Neural Networks: LSTMs

The LSTM Architecture

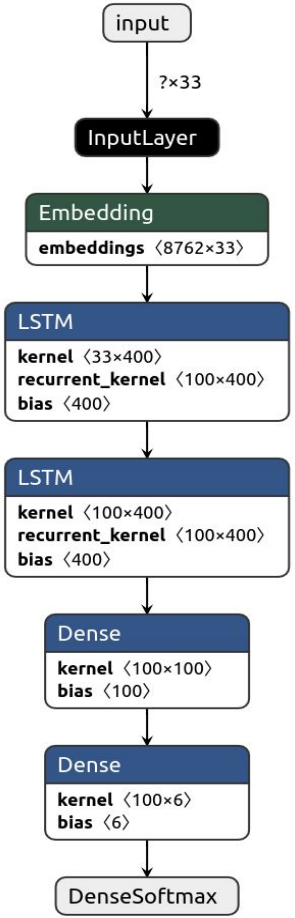
The architecture of …



Model 1

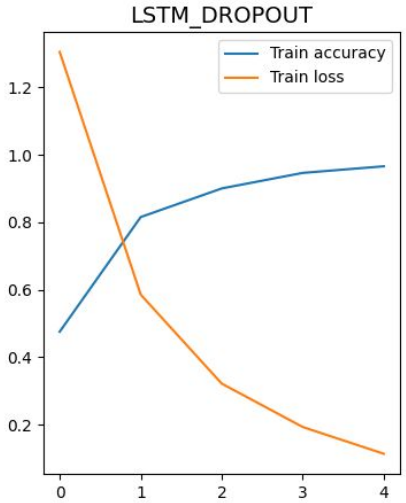


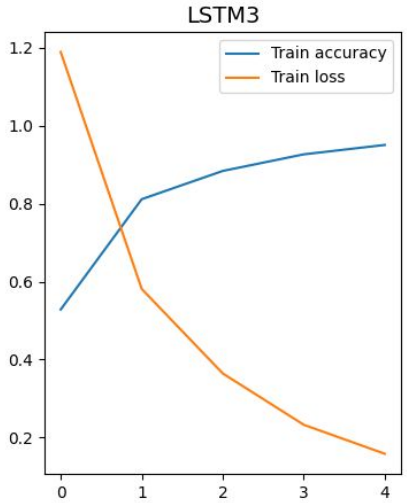
Model 2

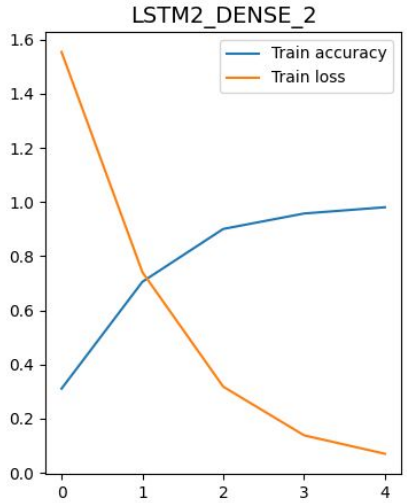


Model 3

LSTM Training Accuracy







Support Vector Machines

The SVM Pipeline

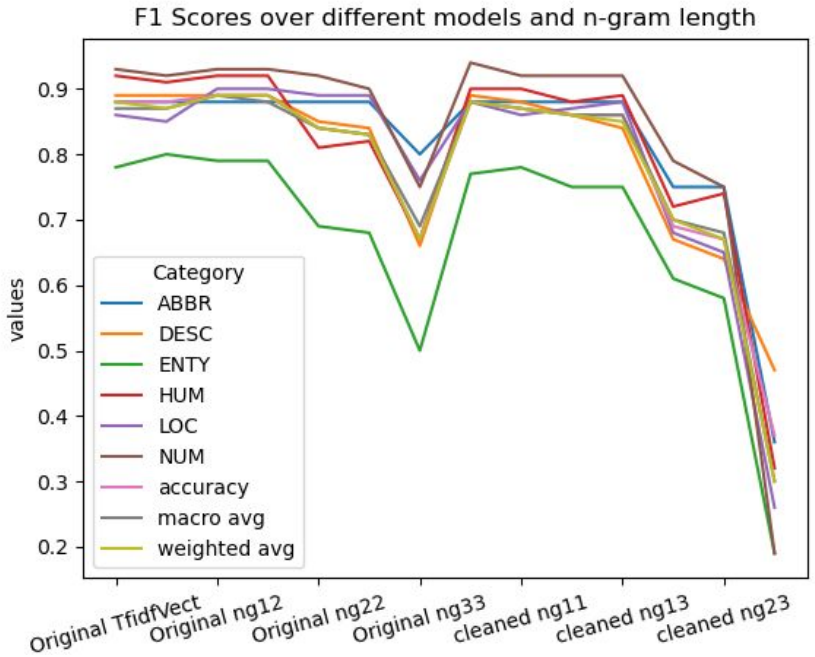
```
from sklearn.pipeline import Pipeline

from sklearn.feature_extraction.text import
CountVectorizer

pipe_cv_ng12 = Pipeline(steps=[

   ('data_cv',
CountVectorizer(stop_words=[],
ngram_range=(1, 2))),

   ('model', svm.LinearSVC())

])
```

SVM

Accuracies on training set are tested with cross validation and finally after hyperparameter tuning we use the testset.

Different approaches:

Test with several text test sets and different n-gram length.



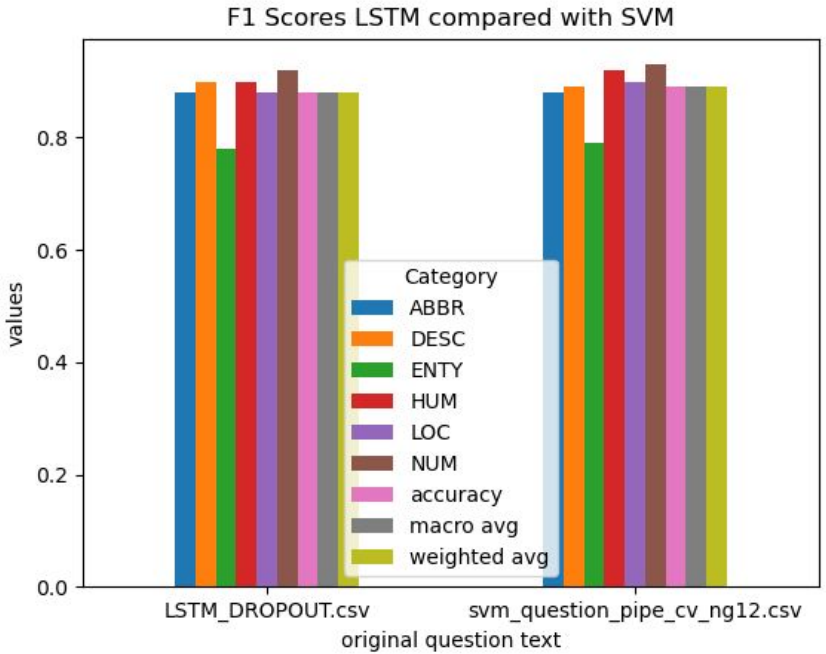
Model comparison and scores (F1)

Model comparison

Both models are similar in their scores - have only small differences in some of the categories

Both model to compare result processed the original text without cleaning

Interesting findings: The LSTM was better in categories where the SVM had problems with.

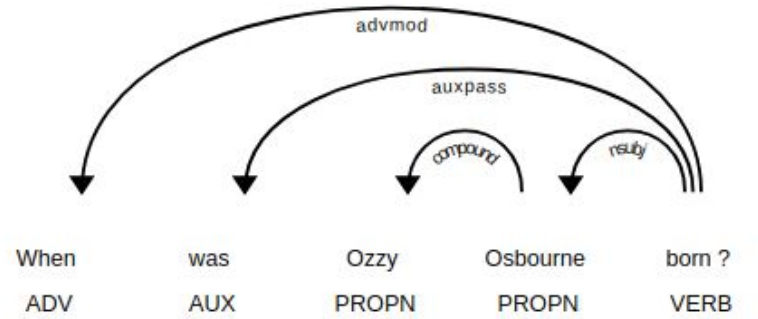


Outlook

Outlook

We also had some ideas to include spaCy to ‘make more out of the question text’. For example on might also include POS or furthermore alphanumeric characters, lowercase etc. But this is postponed to another project.

```
When was Ozzy Osbourne born ?
```




```
token - lemma_ - lower_- pos_ - tag_- dep_ - sentiment - is_alpha - is_stop
-------------------------------------------------------------------------
0 When - when - when - ADV - WRB - advmod - 0.0 - True - True
1 was - be - was - AUX - VBD - auxpass - 0.0 - True - True
2 Ozzy - Ozzy - ozzy - PROPN - NNP - compound - 0.0 - True - False
3 Osbourne - Osbourne - osbourne - PROPN - NNP - nsubj - 0.0 - True - False
4 born - bear - born - VERB - VBN - ROOT - 0.0 - True - False
5 ? - ? - ? - PUNCT - . - punct - 0.0 - False - False
```