Project 3 - NLP

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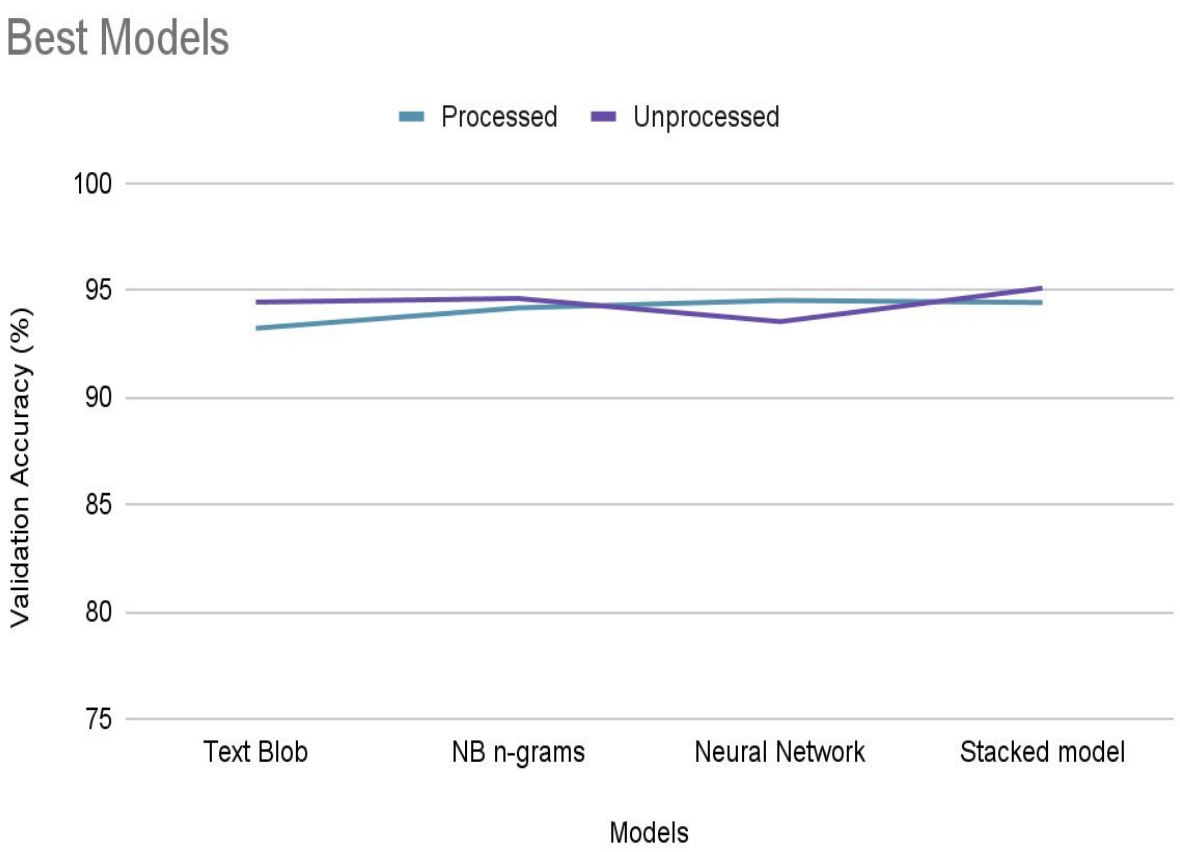
Stacked NB with Random Forest performed best for classifying news headlines – val. accuracy of 95.09%

Executive summary

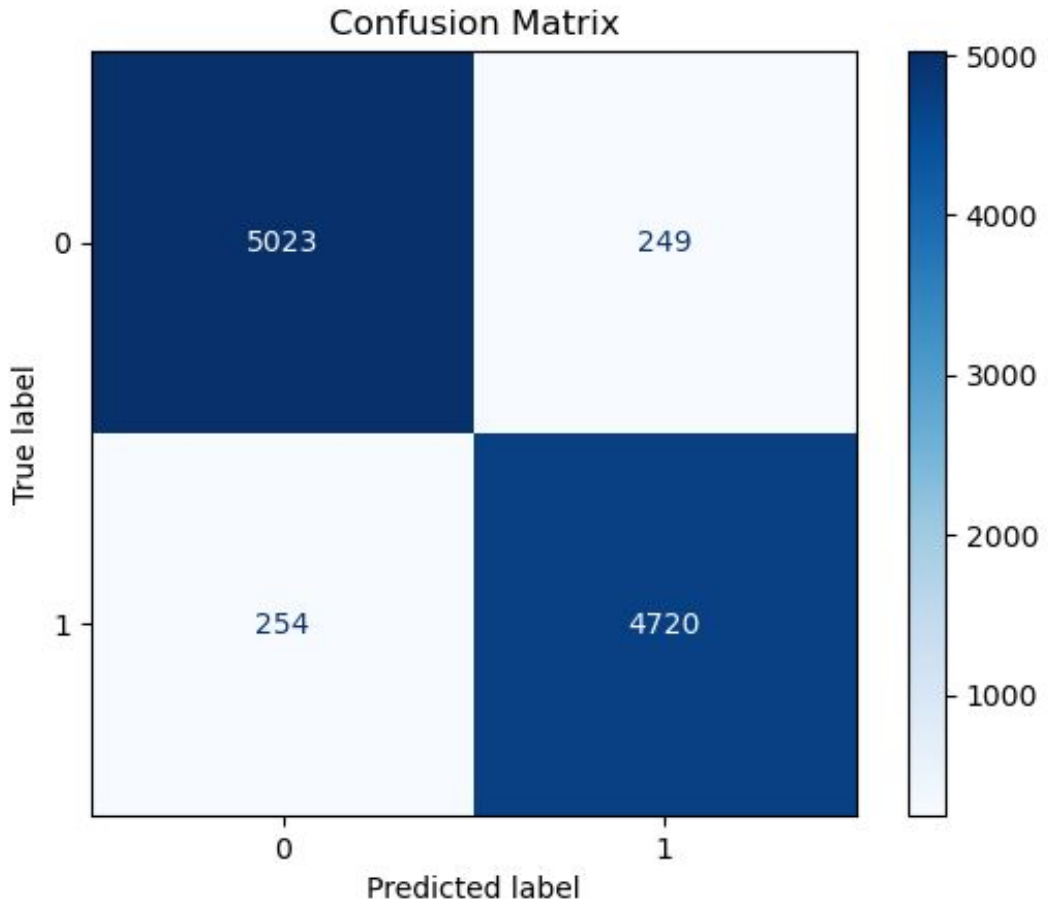
- Final validation accuracy: **95.09%**
- Model: **Stacked NB**[1)] model with Random Forest
  - Multinomial NB
  - Complement NB
  - Bernoulli NB
  - Random Forest

  Meta Classifier = Logistic Regression
- **Alternatives** tested:
  - Various types of Naive Bayes, incl. Bag of Words, n-grams, Voting Classifier
  - Other common models
  - Visualization techniques (UMAP, TSNE)



1) NB = Naive Bayes 2) LogReg = Logistic Regression

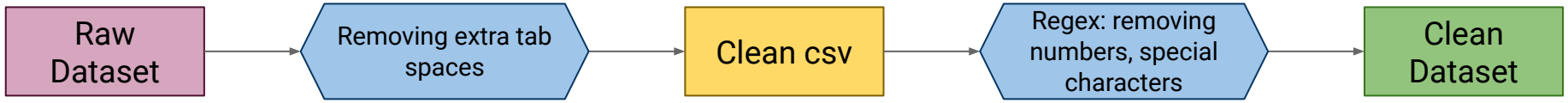
Confusion Matrix for our best model (validation set):



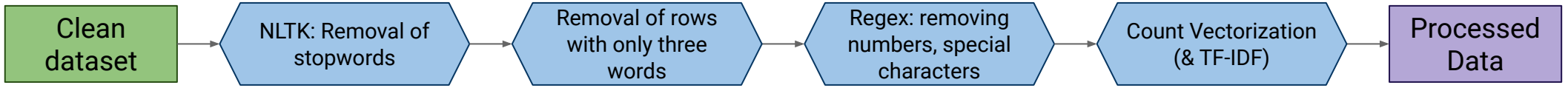
Best model on basic data cleaning - stopwords and TF-IDF worsened model performance

Preprocessing

Basic data cleaning (**best results**)



Full processing (**worse results**)



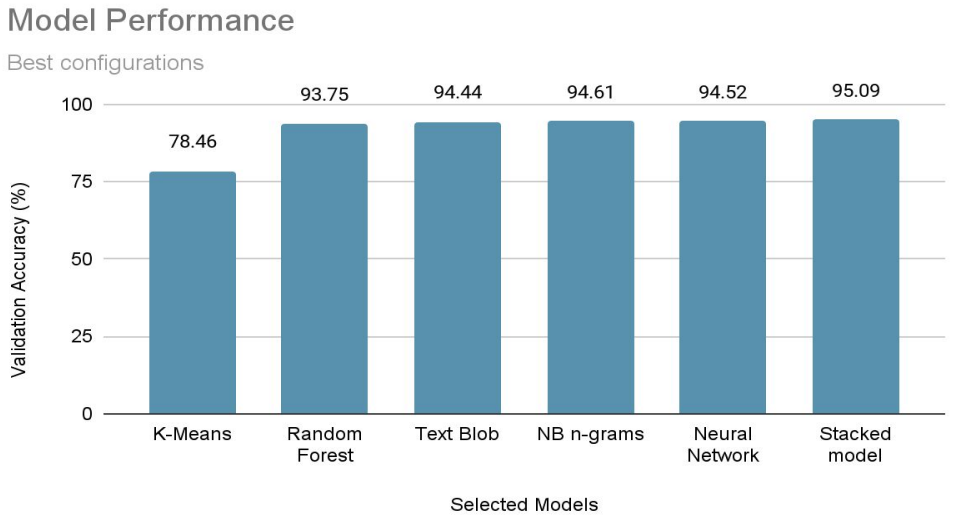
Additional techniques (**no significant improvement**):

- Lemmatization (worked well on K-Means and KNN without applying stopwords)
- Word2Vec and Word Embedding (discarded)

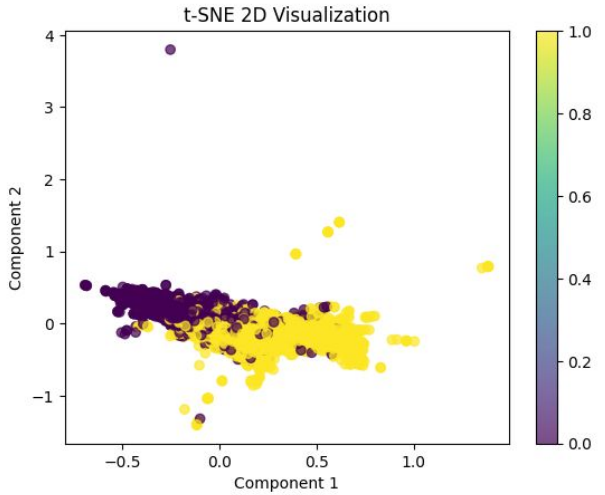
Many different models were tested, stacked model with best validation accuracy

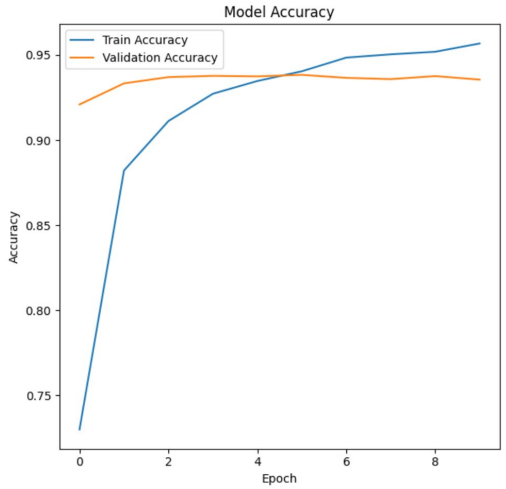
Model specifications

- Text Blob (needed some preprocessing)
- Naive Bayes with Bag of Words
- Naive Bayes with n-grams
- Models with TF-IDF:
  - Naive Bayes
  - Random Forest
  - K-Means, K-Nearest Neighbours (best with lemmatization, but without stopword)
  - SVC
  - UMAP, TSNE
- Others:
  - Word Embedding
  - Ensemble Voting (SVC, NB and LogReg[1)])
  - Ensemble Stacking (best)
  - Neural Network (2x Dense/BatchNorm/Dropout)



Selected graphs other models





1) LogReg = Logistic Regression

Takeaways

Key takeaways

- Challenges:
  - **Many model options** -> a lot of trial and error, choosing is difficult
  - **Overthinking** techniques to use (tempting to apply EVERYTHING)
- Key learnings:
  - Simple models **performed well** (in comparison to word embedding etc..)
  - **No improvement** with tuned parameters -> only highly time consuming to run
  - K-Means and KNN **performed worst**
  - **Best results** with only basic preprocessing
  - Stacking models can **improve performance**