

Transfer Learning for Sentiment Analysis using CNN

Ivan Cedric Mabou, Franck Wafo, Stephan Lehmler

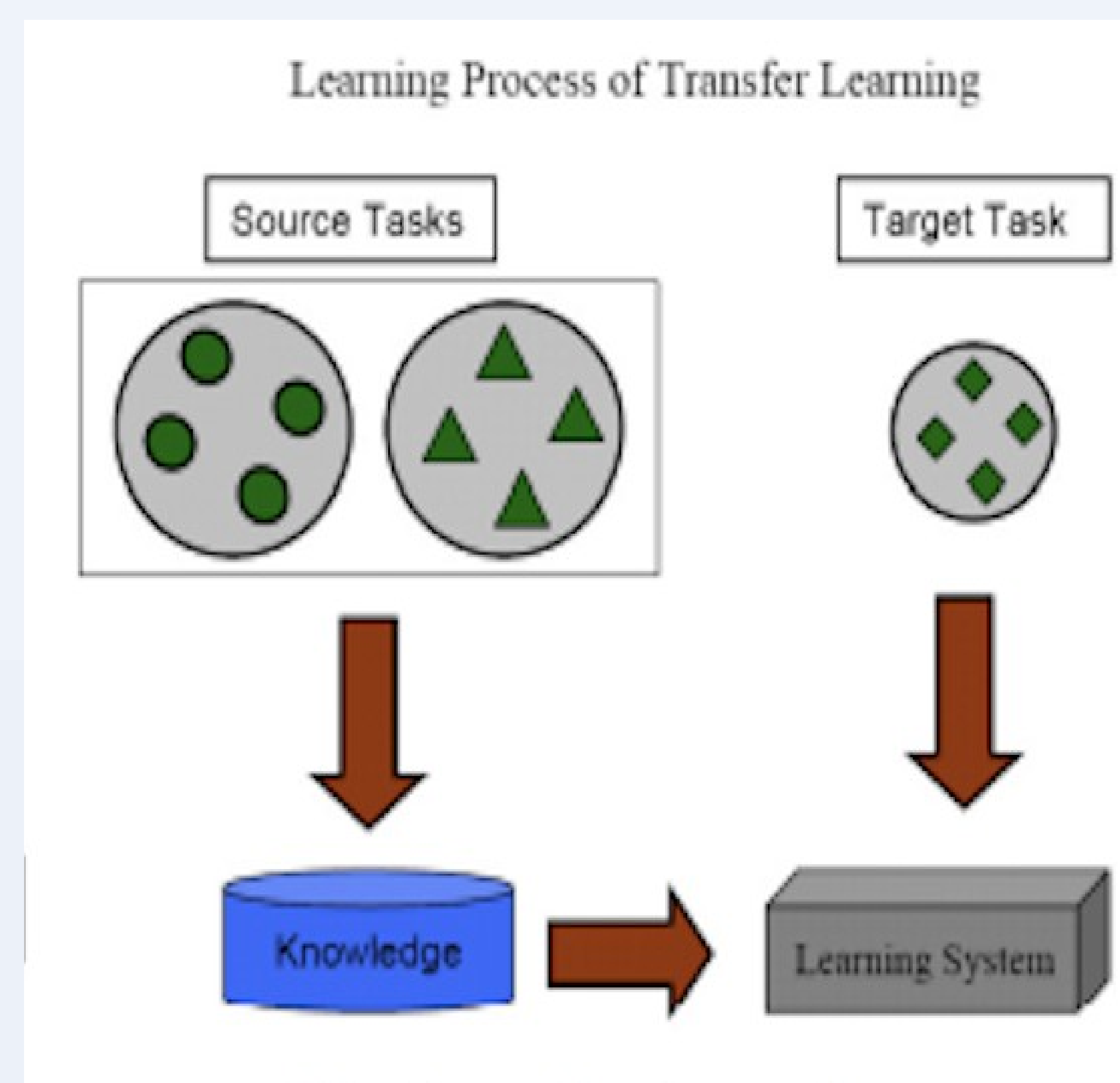
Hochschule Ruhrwest

INTRODUCTION

This study focused on the application of Transfer Learning (TL) to Sentiment Analysis (SA) using pre-trained word embeddings, as well as the transfer of different neural layers. We investigated and demonstrated the extent to which the domain and the task influence TL performance in SA. We conducted transfer experiments on three datasets, one of which was chosen as the source dataset and the others as the target datasets. We also considered two tasks: Binary SA and Multi-label SA. First, we performed transfer learning based on a binary SA. Second, we performed transfer learning based on a multi-label SA. Our observations show that even a less semantically similar dataset can provide better text classification than a highly similar dataset. Moreover, we found that the accuracy value after multi-label SA was lower than that of binary SA.

OBJECTIVE

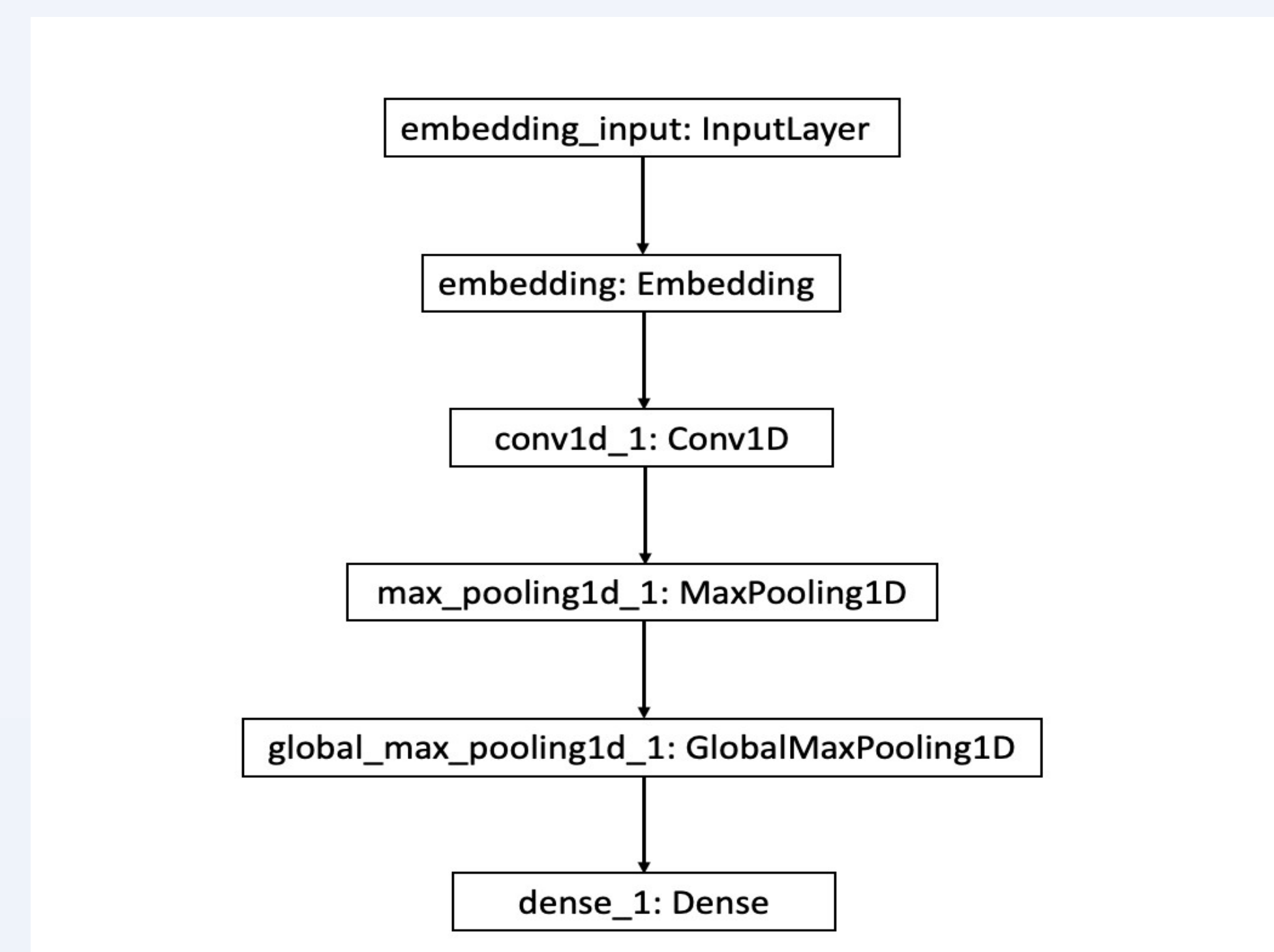
- investigate to which extent transfer learning is being influenced by the domain and task



Pan and Yang [2010]

MATERIALS & METHOD

- Datasets**
 - IMDB
 - Movie reviews
 - Women's Clothing E-Commerce Reviews
- Pre-trained word embedding model**
 - Word2vec
- CNN Model**
 - Filters: 32
 - Kernel size: 8
 - Activation: relu
 - Loss: Binary & categorical crossentropy
 - Optimizer: Adam



Method

Balance	Data Set Balancing
Save	Save Vocabulary
Transform	Tokenize Corpus
Hold-out	Split Data Set in Train and Test Set
Load	Load Word Embeddings
Build	Create CNN Model
Transfer	Save Model's Features

RESULTS

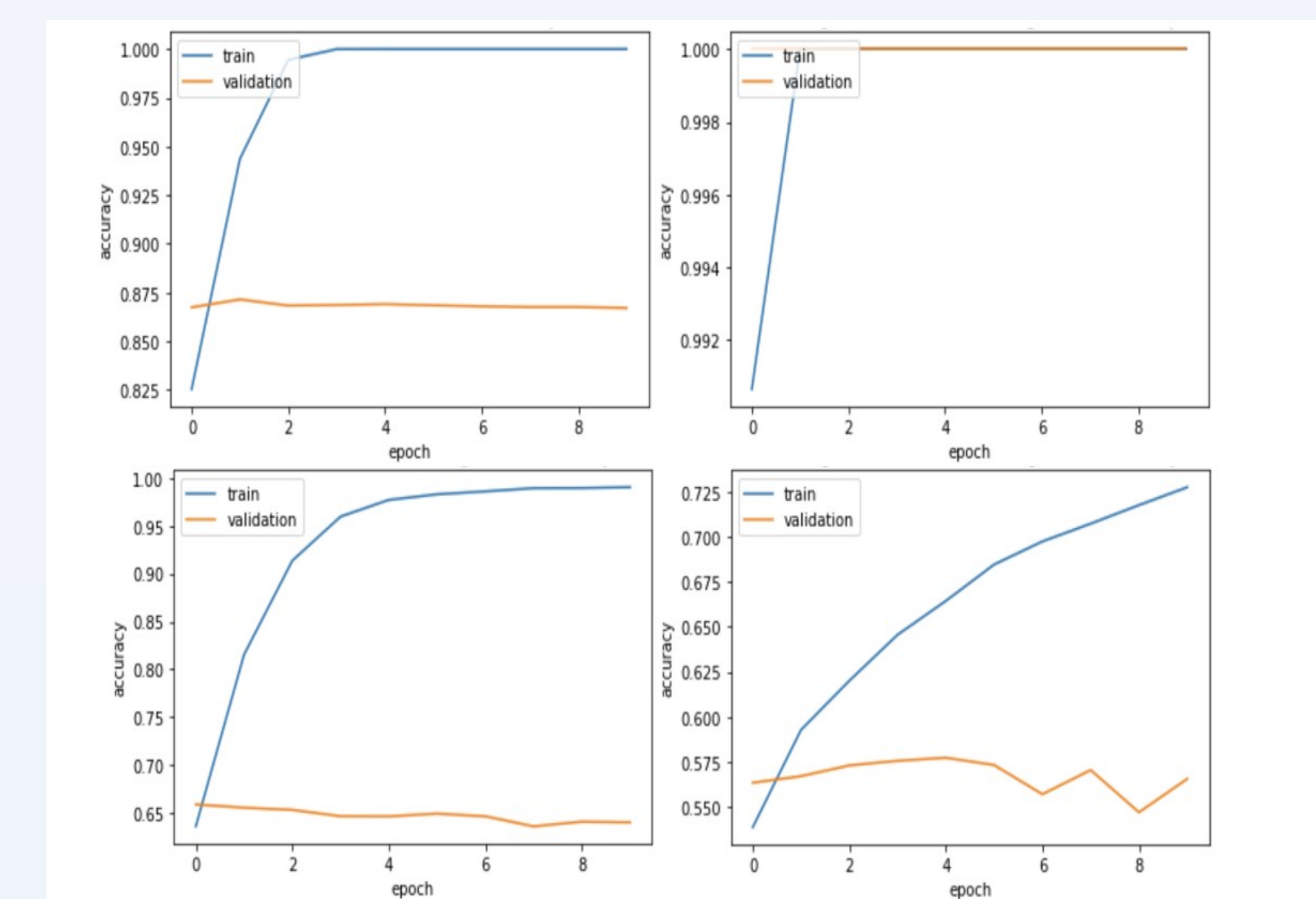
We performed a sentiment analysis based on transfer learning. We distinguished our analysis between binary and multi-label sentiment analysis. As evaluation metrics, we only chose the fitting Time, and Accuracy. As our Source domain, we chose the IMDB Movie Reviews . Then, to construct a classifier that can identify text that expresses sentiment, We followed a machine learning approach. More specifically, we used a deep learning approach.

1. Binary Sentiment Analysis

Source: IMDB: 87% in 297.54 s
IMDB -> WCR: 100% in 65.79 s
IMDB -> MR: 64.05% in 838.63 s

2. Multi label

IMDB -> WCR: 56.58% in 309.43 s



Accuracy

Sentiment Analysis	IMDB	IMDB -> WCR	IMDB -> MR	Accuracy In %
Binary	87	100	64.05	
Multi-label	-	56.58	-	

Training Time

Sentiment Analysis	IMDB	IMDB -> WCR	IMDB -> MR	Time in S
Binary	297.54	65.79	838.63	
Multi-label	-	309.43	-	

CONCLUSION

In this paper, we have conducted extensive empirical studies of TL for sentiment analysis. We have investigated the extent to which the choice of target domain and task affects the transfer performance of features learned in a source domain. For our study, we selected 3 data sets, two of which were from the same domain. One of the datasets from a similar domain was used as the base dataset and the model trained on it was also used as the base model. Its weights were saved and reused for training the other two models. Further, in a two-stage analysis, we compared the accuracy and training time of our TL-improved CNN models. Our results from the first analysis show that domain similarity does not necessarily lead to better sentiment classification when TL is used. Even a semantically less similar dataset can give better transfer results than a very similar dataset. In our second analysis, we investigated the transfer performance of the features learned from our baseline model in a multi-label sentiment classification. The model achieved 56.58% accuracy on the WCR dataset after evaluation. Our results show that accuracy after multi-label classification was lower than binary classification. The model dropped from an accuracy of 100% to an accuracy of 56.58%. Thus, this result suggests that in addition to domain, task also has an impact on transfer performance.

REFERENCES

S. J. Pan and Q. Yang. A survey on transfer learning. IEEE Transactions on Knowledge and Data Engineering, 22(10):1345–1359, 2010. doi: 10.1109/TKDE.2009.191

CONTACT

franck.wafonguembu@stud.hs-ruhrwest.de
ivan.mabououabo@stud.hs-ruhrwest.de