Aspect-based Sentiment Analysis on the SentiCoref 1.0 Corpus

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Abstract

1 Introduction

The growing amount of data present on the world wide web, such as news articles, posts on social media and forum threads, calls for methods of information extraction. One type of such information is the sentiment a subject expresses towards an object. Such information can be useful when modelling relationships between users of social media platforms or political bias of news articles.

Sentiment analysis, also referred to as opinion mining and subjectivity analysis, combines information retrieval, natural language processing and artificial intelligence. It is formally expressed as finding a tuple of the form (s, g), where s represents the sentiment and g the target object for which the sentiment is expressed. Aspect-based sentiment analysis is a sub-field focusing on finding and aggregating sentiment of entities or aspects of them. An aspect can be any characteristic or property of the entity. It is used to differentiate sentiment on a more fine grained basis in comparison to document or sentence level sentiment analysis. A single sentence can contain different entities with different sentiments expressed towards them. We can in general differentiate three processing steps: identifying sentiment-target pairs in text, classifying these pairs and aggregating sentiment values for each aspect. The usual concerns of robustness, flexibility and speed of the models are also to be kept in mind (Schouten and Frasincar, 2015).

Traditionally solutions have been divided into lexicon-based and machine learning approaches, either unsupervised or supervised, with the latter sometimes including lexicon-based information as well. However in recent years with the proliferation of word-embedding algorithms there have been several examples of hybrid models. These usually attain a higher degree of accuracy on different sentiment analysis tasks. Bellow we discuss a few recent approaches.

In (Ding et al., 2018), Ding et al. have developed a sentiment analysis tool SentiSW, which classifies texts related to software development. This system was evaluated on a corpus of GitHub repository issues, which they have manually annotated. Their main goal was to predict a binary sentiment (positive, negative) and whether this sentiment is expressed towards another developer (person) or the project. SentiSW uses document vectorization approaches for feature extraction, supervised machine learning algorithms, such as random forest and support vector machines for training and sentiment classification, while using rule based methods for entity recognition.

An example of deep neural network approach is presented in (Tang et al., 2016). They propose neural network architectures for learning word embeddings which capture context of words and sentiment separately. They also combine both embeddings into a hybrid model, which captures both the word context and sentiment. Their evaluation has shown that the hybrid approach yields best results among the traditional embeddings (e.g. Word2Vec) and proposed neural embeddings.

An example of a sentiment lexicon-based technique combined with a word embeddings approach has been implemented by (Sweeney and Padmanabhan, 2017). The goal was to develop a binary classifier of tweet sentiment (positive or negative) toward each related entity. The dataset used for training and testing contained more than a million classified tweets with sentiment labels. Single entity tweets were processed by the Word2Vec algorithm producing distributed vector representations for tweet words and using them for scoring sentiment using a Random Forest classifier. Tweets containing more than one en-

tity were first processed separately using a Tweet specific parser, TweeboParser, followed by extraction of neighbouring descriptor words (Adverbs, Adjectives and Verbs) and sentiment identification of said descriptor words using SentiWordNet lexicon. The descriptor words were further used to score sentiment relating to that entity, allowing for identification of different polarity contained within one tweet. For comparison, a baseline classifier(which the model outperformed) using only the lexicon-based approach was used on the same dataset.

(Biyani et al., 2015) tackled the problem of entity-specific sentiment classification (positive, negative and neutral) in Yahoo news comments. Besides the challenge of identifying irrelevant entities, sentiments in news comments are additionally difficult to classify as they deal with a variety of different domains. The researchers extracted entities with Stanford Named Entity Recognizer, followed by linking each entity targets with its sentiment context. Extracting the context made use of several heuristics. Classification was composed of two steps: first, the context of an entity was classified into polar vs. neutral (irrelevant), using content, lexical and several non-lexical features, and second, the polar entities were classified into positive or negative based on comment-specific features. Several supervised machine learning algorithms were used to implement the classifiers, with Logistic Regression giving the best results in the first step and Naive Bayes in the second. The methods outperformed several baselines.

Our project focuses on evaluation of the SentiCoref 1.0 corpus (Žitnik, 2019). This corpus contains a subset of articles from SentiNews 1.0 corpus (Bučar, 2017a). SentiCoref corpus contains annotations of named entity tags, coreference chains, and a 5-level sentiment for each coreference chain. We develop and evaluate a pipeline for predicting sentiment values for each coreference chain.

2 Methods

2.1 Data preprocessing

We preprocess the data from SentiCoref using Stanza (Qi et al., 2020). We apply built in model for POS tagging on the already tokenized text. In order to be able to use sentiment lexicons, we lemmatise words using the lemmatisation model provided in (Ljubešić, 2020).

2.2 Primitive rule-based algorithm

Initially, we develop a primitive rule based algorithm, which serves as the baseline for further improvements. In this approach we extract neighbouring words around entities of a coreference chain. We assign sentiment values to each of these words using a sentiment lexicon. Sentiment lexicons provide mappings between words and sentiment values these words express. One of such lexicons for Slovene is JOB 1.0 (Bučar, 2017b). It contains over 25,000 words and is based on the SentiNews 1.0 corpus.

However, such approach is lacking in numerous aspects. For example, it does not take into account any syntactic dependencies between words of sentences. This can hinder the performance especially in sentences which contain multiple entities and therefore apply to multiple coreference chains (Sweeney and Padmanabhan, 2017).

3 Results

4 Discussion

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