CSE 573

Project Proposal Presentation

Stance Detection

Group 9

Group Members

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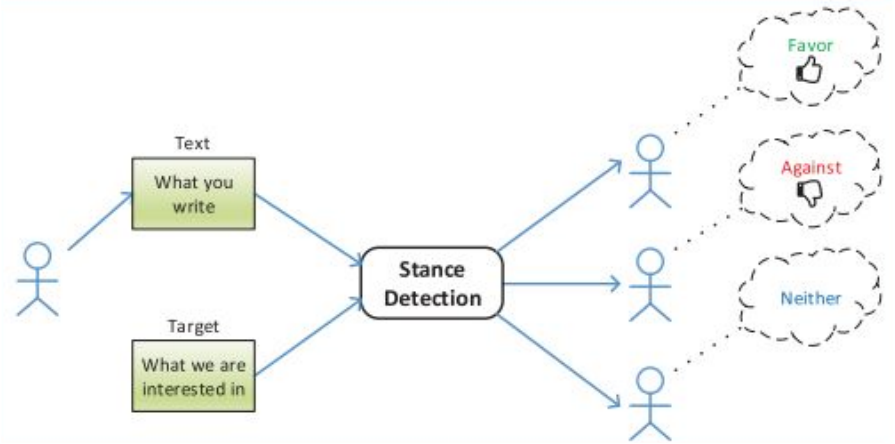
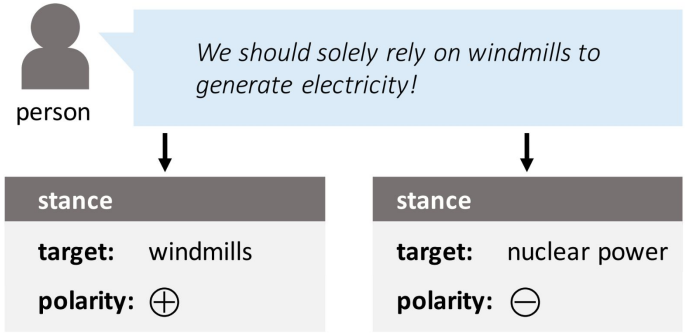
What is Stance Detection?

- **Stance detection** is an NLP task that **involves identifying the attitude or perspective of the author of a piece of text towards a particular target.**

- The target can be a person, an organization, a policy, a product, or any other entity that is the subject of the text.





Problem Statement

- In our project, we aim to determine the stance of given individuals towards certain topics by evaluating their tweets.
- We perform this analysis using deep learning models such as Bi-LSTMs and BERT along with Support Vector Machines.
- Later, we discuss and compare the findings from the various techniques used in this study.

Datasets

- We are training our models on SemEval-2016 Task 6A dataset. This dataset contains 2,914 Tweets related to five different topics:
  - Atheism
  - Climate change
  - The feminist movement
  - Hillary Clinton
  - Legalization of abortion.
- Each Tweet has been manually annotated by humans and assigned a stance label of positive, negative, or none towards the topic.
- We are also further augmenting our training set by scraping more tweets related to the above topics plus recently trending topics as well. We aim to assign labels to these tweets by running a clustering algorithm on them.

State-of-the-Art Methods

Supervised Machine Learning

- In supervised machine learning for stance detection, the model is trained on human-labeled data that contains examples of text with labeled stances toward specific topics.
    - SVM - used in more than 40 studies on stance detection, either as the main best-scoring approach or as the baseline approach.
    - Logistic Regression - second most frequent classifier
    - Naive Bayes - third widely employed algorithm of the traditional feature-based learning genre.

Deep Learning

- Deep learning models offer a powerful and flexible approach to modeling the complex relationships between text and stance. They use neural network architectures to learn representations of the input text that capture the relevant features for stance detection.
    - Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) are two of the most widely used deep learning models for stance detection.
    - More recently, transformers, such as the BERT model, have emerged due to their ability to capture contextual relationships between words in the input text.

State-of-the-Art Methods

Semi-supervised Learning

- This is a mix of Supervised and Unsupervised Learning techniques.
- Pre-existing methods here are based on supervised label and followed by unsupervised classification.
- Stance detection methods heavily rely on clustering methods due to its benefits and easier correlation that is possible between words.

Transfer Learning

- Transfer learning for stance detection involves using pretrained models on a large corpus of text and then fine-tuning them on a smaller annotated dataset for stance detection
    - Methods such as ULMFiT, OpenAI GPT, ELMo, and Google AI's BERT have recently revolutionized the field of transfer learning in NLP by using language modeling during pre-training

Research and Development Plan

Data Preprocessing

1. **Data Cleaning** - Removing URLs and mentions, replacing emoticons with their corresponding sentiment, correcting any spelling errors in the text.
2. **Tokenization** - Splitting the text into individual words to enable us to represent the text as numerical vectors.
3. **Removal of stop words** - Removing common words (like *and, the, a, an*, etc.) to focus more on the important and informative parts of the text.
4. **Stemming and Lemmatization** - Clustering similar words together for pinpointing pertinent keywords and extracting the most significant features.

Data Augmentation

1. **Data Expansion** - Scraping Twitter for more tweets related to the existing topics plus recently trending topics.
2. **Synonym expansion** - Including synonyms to capture diverse opinions understand more nuanced contexts.
3. **Phrase expansion** - Expanding the use of related phrases to improve the comprehensiveness of the analysis.
4. **Query reformulation** - By reformulating the query, the model can become more adaptable to predict the stance regardless of the specific way in which an opinion is expressed.

Research Plan

Models

1. **BERT with SVM**
   - With its ability to analyze word and phrase relationships in a sentence, BERT is an ideal tool for capturing the context and meaning of the text.
   - We propose to use pre-trained BERT-Base model to generate a set of features, which will then be input to an SVM classifier for predicting stance. SVM is a suitable choice because it can establish clear decision boundaries for the three stances (Favor, Against, and None).

2. **Bidirectional Long Short-Term Memory Networks (Bi-LSTMs)**
   - Bi-LSTMs are suitable because of their ability to process sequential text in both forward and backward directions, allowing them to capture contextual information from the entire input sequence.
   - Furthermore, Bi-LSTMs can overcome the issue of vanishing gradients in deep neural networks by utilizing LSTM cells, which maintain information over time.

Evaluation Metrics

1. **Accuracy** - Ratio of total number of correctly classified tweets to the total number of tweets used.
2. **Precision** - Proportion of tweets that are correctly classified as ”favor”, ”neutral”, or ”against” among all the tweets that the model predicted to belong to these categories.
3. **Recall** - Number of correctly predicted tweets in each category by the total number of actual tweets in that category.
4. **F1 Score** - Combination of both precision and recall. It computes how many times a model made a correct prediction across the entire dataset.

Management Plan

Task	Deadline	Members Responsible	Status
Data cleaning and preprocessing	16 March	Tanuja Renu Sudha	Done
Data Augmentation	23 March	Sai Rathnam Pallayam Ramanarasaiah	In progress
Web Scraping	1 April	Baibhav Phukan	Yet to be picked
Model Training	5 April	Sai Vikhyath Kudhroli, Avish Khosla	Yet to be picked
Performance Evaluation	8 April	Gautham Maraswami	Yet to be picked
Final Report	28 April	All	Yet to be picked

References

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THANK YOU