

Stance Detection: Concepts, Approaches, Resources, and Outstanding Issues

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ABSTRACT

Stance detection (also known as stance classification and stance prediction) is a problem related to social media analysis, natural language processing, and information retrieval, which aims to determine the position of a person from a piece of text they produce, towards a target (a concept, idea, event, etc.) either explicitly specified in the text, or implied only. The output of the stance detection procedure is usually from this set: {*Favor*, *Against*, *None*}. In this tutorial, we will define the core concepts and research problems related to stance detection, present historical and contemporary approaches to stance detection, provide pointers to related resources (datasets and tools), and we will cover outstanding issues and application areas of stance detection. As solutions to stance detection can contribute to significant tasks including trend analysis, opinion surveys, user reviews, personalization, and predictions for referendums and elections, it will continue to stand as an important research problem, mostly on textual content currently, and particularly on social media. Finally, we believe that image and video content will commonly be the subject of stance detection research soon.

CCS CONCEPTS

• **Computing methodologies** → **Natural language processing**; **Machine learning**; **Language resources**; • **Information systems** → **Information retrieval**; **Web and social media search**.

KEYWORDS

Stance detection; Social media analysis; Deep learning; Data streams

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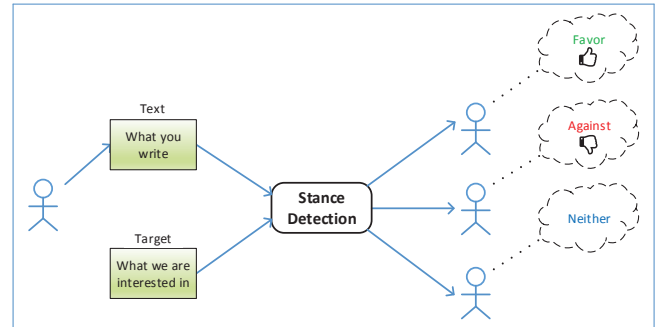


Figure 1: Typical stance detection procedure [19].

1 INTRODUCTION

Stance detection has recently emerged as an important research problem in natural language processing (NLP), social media analysis, and information retrieval (IR), as revealed in the number of related papers published particularly since 2015 [19]. It is a research topic considered closely related to sentiment analysis [12] and is commonly defined as the detection of the stance (as *Favor*, *Against*, or *None*) of the text producer towards a target [26, 27]. A visual representation of the stance detection procedure is given in Figure 1 for illustrative purposes, as excerpted from [19].

Apart from sentiment analysis, there are other research problems closely related to stance detection, including emotion detection [30], sarcasm detection [15], irony detection [43], controversy detection [10], and argument mining [23], among others. These related research problems in addition to subproblems of stance detection are demonstrated in Figure 2, as excerpted from [19].

Stance detection is known to have several application areas such as prediction of election/referendum results [21], information retrieval [32], rumour classification [56], and fake news detection¹ [22]. Particularly based on the latter two application areas, two subproblems of stance detection have emerged, namely, *rumour stance detection* and *fake news stance detection* [19]. Definitions of these subproblems along others (*multi-target stance detection* [33] and *cross-target stance detection* [45, 48, 50]) will be provided within the course of this tutorial.

An important contribution to the stance detection research is a series of shared tasks on stance detection between 2016 and 2017: an initial competition on English tweets [26], another on Chinese microblog posts [49], and another related competition on Spanish

¹<http://www.fakenewschallenge.org/>

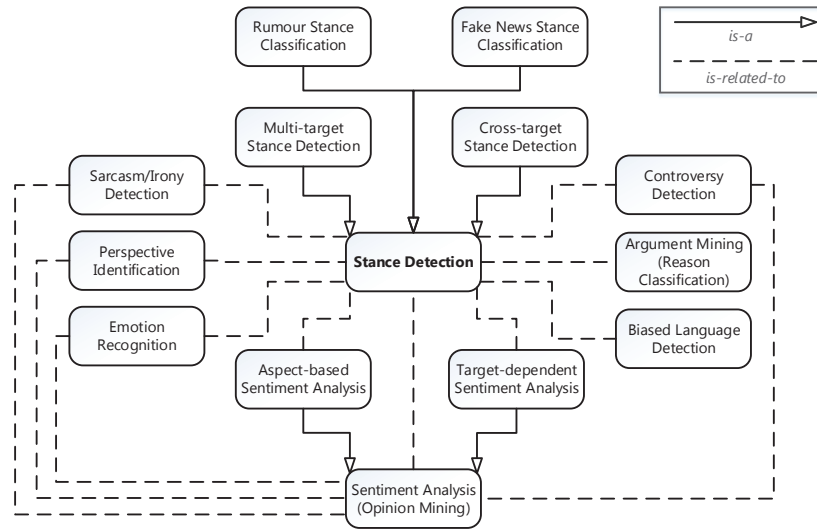


Figure 2: Stance detection and related problems [19].

and Catalan tweets [38]. More recently, a stance detection shared task has also been performed for tweets in Italian [8]. In addition to the evaluation of different approaches for stance detection on microblogs in different languages, these competitions have facilitated the compilation significant annotated datasets [8, 25, 26, 49] for stance detection.

Earlier work on stance detection utilized different rule-based and machine learning based algorithms on a variety of text genres including congressional-floor debates, online debate forums, student essays, and tweets [4, 11, 13, 29, 39]. Related studies seem to have increased noticeably after the aforementioned initial shared task on stance detection in English tweets [26]. Hence, particularly considering those studies after (and including) this shared task; traditional machine learning approaches like SVM [1, 16, 17, 26, 27, 32, 47] and logistic regression [8, 28, 51, 52], deep learning approaches like LSTM [2, 9, 35, 36, 44] and CNN [42, 46, 53], and ensemble methods [24, 37, 40] have all been employed for the task of stance detection. Though machine learning approaches like SVM are the most commonly utilized ones up until 2019, more recent studies tend to apply deep learning algorithms, similar to the case of many tasks in NLP and IR [3, 19].

There also exist significant research efforts to produce annotated datasets and benchmarks for stance detection [18, 20, 31, 34, 55]. Currently, stance-annotated datasets exist for a number of languages including English [25, 34], Catalan [38], Chinese [49], Czech [14], Italian [21], Spanish [38], and Turkish [18]. Yet, in addition to these language-specific datasets, recent work on the compilation of multilingual stance-annotated datasets [20, 41, 55] (where these datasets include annotated samples in other languages such as German and French) will facilitate related research and thereby will hopefully lead to important findings.

There are several lines of future research after having a firm base knowledge about the stance detection problem. Examples include cross-lingual and multilingual stance detection [19, 20], stance

detection in data streams [6, 54], stance detection on non-textual content, context-sensitive stance detection [19], and exploring the application opportunities of new methods [5, 7].

This tutorial aims to cover the core concepts in stance detection together with related research topics, significant approaches to this problem published so far, relevant datasets and other practical resources, application areas, and finally, outstanding issues not sufficiently addressed in the related literature so far. We believe that this tutorial will be beneficial to interested NLP and IR researchers alike, as well as related practitioners.

2 OBJECTIVES OF THE TUTORIAL

The objective of this tutorial is to provide an overall understanding of the stance detection problem, which has significant and widespread application opportunities. Particularly, the tutorial attendees will:

- grasp the main stance detection problem, its subproblems, and also those problems closely related to stance detection,
- learn about the evolution of the stance detection literature, and about common algorithms and approaches to this problem,
- be provided with pointers to related datasets and tools so that they can readily begin conducting stance detection experiments themselves,
- learn about the related application areas as well as open research topics regarding stance detection,
- learn some common and favorable practices employed by stance detection researchers and practitioners.

Considering previous tutorials on this topic, we come across a single tutorial titled “*Detection and Characterization of Stance on Social Media*” which was carried out within the course of *14th International Conference on Web and Social Media (ICWSM-2020)*. Below listed are the differences between our tutorial on stance detection and above-mentioned previous tutorial:

- Previous tutorial focuses on social media only while our tutorial will have a broader coverage including other input genres as in fake news stance detection where news articles are under consideration.
- Being a more recent tutorial on the topic, our tutorial will cover more recent work which is a significant advantage as considerable body of work is published on stance detection each year.
- In our tutorial, we will pay particular attention to the sub-problems of stance detection and other closely-related problems, as we believe that each one of these topics are fruitful research topics to pursue for both IR and NLP researchers and practitioners.
- Our tutorial will also cover significant application areas and outstanding issues like stance detection on data streams which are relevant to both IR and NLP.

3 RELEVANCE TO THE IR COMMUNITY

Stance detection can be considered as a research problem at its juvenile stage since the earliest study that we come across on the topic dates back to 2006 [39] only. But, as emphasized previously, related shared tasks at conferences such as SemEval-2016 [26] have led to a surge on the number of studies conducted on this topic.

We can claim that stance detection is at the crossroads of social media analysis, IR, and NLP. Therefore, related studies have been commonly published at the related conferences such as SIGIR, COLING, WWW, SemEval, EMLNP, ECIR, and EACL. For instance, stance-related studies published at SIGIR conference series include [10, 44, 45]. Some of the journals where stance detection studies have been published include *ACM Computing Surveys*, *ACM Transactions on Internet Technology*, *Social Network Analysis and Mining*, and *Computer Speech & Language*.

Hence, we believe that after attending this half-day tutorial on stance detection, researchers and practitioners of social media analysis, IR, and NLP can learn about the state-of-the-art on stance detection and can readily start to create their own research agenda on one of the open research issues regarding stance detection.

4 INTENDED AUDIENCE

This tutorial aims to present the core concepts, approaches, resources, application areas, and further research directions of stance detection. Stance detection is an important research problem and has several application areas related to information retrieval. Therefore, we hope that many related researchers and practitioners of social media analysis, information retrieval, and natural language processing (with introductory knowledge) can benefit from this tutorial. There are not any particular prerequisites for the attendees. The presentation files of the tutorial and a list of the relevant bibliography will be provided to the attendees in electronic formats.

5 TUTORIAL OUTLINE

Below provided is the outline of our stance detection tutorial.

- (1) Introduction
- (2) Core concepts and related problems

- Definitions of stance detection, multi-target stance detection, cross-target stance detection, rumour stance classification, and fake news stance detection.
 - Interrelationships with related problems: sentiment analysis, emotion recognition, sarcasm/irony detection, controversy detection, and argument mining
- (3) Stance detection competitions (shared tasks)
 - SemEval-2016 Task 6: Detecting Stance in Tweets
 - Shared Task of Stance Detection in Chinese Microblogs at NLPCC-ICCPOL-2016
 - Shared Task of Stance Detection in Spanish and Catalan Tweets at IberEval-2017
 - SardiStance: Stance Detection Task in Italian Tweets at EVALITA-2020
 - (4) Historical and contemporary approaches
 - Earlier studies on stance detection
 - Machine learning based approaches
 - Deep learning based approaches
 - Ensemble learning approaches
 - (5) Resources (datasets & tools)
 - Common datasets for stance detection
 - Learning tools used and system implementations
 - (6) Application areas
 - Opinion surveys/polling
 - Public health surveillance
 - Information retrieval
 - Stance summarization
 - Rumour classification
 - Fake news detection
 - (7) Outstanding issues with an emphasis on data streams
 - Cross-lingual and multilingual stance detection
 - Stance detection on non-textual data and robots
 - Context-sensitive stance detection
 - Stance detection in data streams
 - (8) Concluding remarks

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