**Ensemble Method for**

**Arabic Hate Speech Detection in Twitter**

**Abstract**

Nowadays, people use Online Social Networks (OSNs) to express feelings and ideas and to communicate and share information. With the freedom space provided by such networks, some people tend to propagate hate speech and insults. An early Detection of such content is crucial for predicting conflicts and could prevent the emotions to become actions or to spread widely.

Hate speech detection work on the Arabic text is sparse and scant compared to other languages like English. Moreover, Arabic corpora of short text in Levantine dialect for hate speech is also scant.

In this paper, we constructed ensemble method for hate speech detection in short text written in Levantine dialect. We used multiple classification algorithms, including Naïve Bayes, Random Forest, and Support Vector Machines, and two ensemble methods, hard voting and soft voting, on our own dataset collected from Twitter.

Keywords: Arabic; hate-speech; offensive language; social networks; natural language processing; text classification; machine learning

# Introduction

With the widespread and increasing use of Online Social Networks (OSNs), people use OSNs to express feelings and ideas and to communicate and share information. With the freedom space provided by such networks, some people tend to propagate hate speech and insults. The shared content may be

Hate speech, offensive language, harassing, racism, insults, and other types of online abusive behavior. Unfortunately, OSNs are a perfect platform for publishing hurtful content such as cyberbullying and hate speech [9].

With the huge amount of content published every minute (e.g. 456,000 tweets are sent on Twitter every minute [14]).

The Arabic language is the fourth used language on the Internet and ranked as the sixth used language on Twitter, and is ranked in the fifth position of spoken language in the world. More than 6% of the world’s population speak Arabic, and there is a remarkable growth in using OSNs in the Arab region.

Arabic text classification and Arabic NLP techniques are relatively hard to implement due to different factors [2] [3]:

* Arabic is rich and complex morphological language.
* Arabic language has different forms such as the dialectical Arabic and each Arabic country has different dialect.
* The colloquial Arabic has many misspellings that differs morphologically and phonologically.
* Arabic has complex orthography and morphosyntactic rules.

In this paper, a dataset is created that is targeting the problem of hate speech on Twitter for Levantine countries. The dataset was collected using several keywords such as racism, insults, and Islam. The dataset was labeled manually with two classes; (Hate and Normal). To capture the hidden relations of words of the dataset, we used word embedding techniques (Word2Vec and the AraVec) for extracting a set of words features. We used multiple classification algorithms, including Naïve Bayes, Random Forest, and Support Vector Machines, and two ensemble methods, hard voting and soft voting, on our dataset. The experiment results showed that using ensemble method can improve the classification performance. The best result is achieved when using soft voting with F1 measure 79.8% on our dataset.

The structure of the paper is as follows. In section 2 we define the hate speech detection problem, while in section 3 we discuss related work. We describe our dataset collected from twitter in section 4. We overview our study approach and elaborate on the proposed method in section 5. We then experimentally evaluate the performance of different approaches in Section 6, concluding the paper in Section 7, by summarizing the findings and proposing future work.

# Problem Definition

It is difficult for machine learning to detect written hate speech because of the short text samples, the lack of continuity, confusion with regard to the identity of the authors and the recipients, and the intention or unclear emotions, as well as the use of slang, mixed language, spelling errors, homogeneous retention, and distortion. Especially when depending on the context, the meanings of words can vary greatly using humor, sarcasm, hints and metaphor. Therefore, it is important to provide a clear and concise definition for hate speech. Following the definition provided by [1], Hate speech is any communicative acts that used to express hatred towards a person or a group on the basis of some characteristic such as race, ethnicity, gender, sexual orientation, nationality, religion, or other characteristic. This is very important when we deal with unlabeled dataset where human annotators are involved.

Hate speech detection task is formulated as a binary classification problem, given an input text T, to output True, if T contains Hate Speech and False otherwise. The model is built by learning from a training set and evaluated later on unseen testing data.

Specifically, the input text is represented by a machine-readable format with retention of informative characteristics. a machine learning algorithm takes this representation as input and assigns it to one of two classes with a certain confidence. During the training phase, the classifier is built with this discrimination information, and then applied on unseen data, in order to measure its generalization ability.

In this study, we focus on manually annotated dataset from Twitter posts. We evaluate the performance of several established text representations (e.g. Bag of words, word embeddings) and several classification algorithms (e.g. Naïve Bayes, Random Forest, and Support Vector Machines). Moreover, we examine whether the contribution of ensemble methods (hard voting and soft voting) to the Hate Speech classification process can provide top performance in the Hate Speech detection task.

# Related Work

Hate Speech detection has been a growing attention research topic over the past few years. Some studies have tried to address the problem on the OSNs, there is a very little focus for the Arabic language [5].

In this section, we provide a short review of the related work for Arabic Hate Speech detection. Examples of such tasks can be found in [6] where the authors explore various approaches to detect hate speech and offensive language which include deep learning, transfer learning and multitask learning, while [5] aim to validate the effectiveness of twelve machine learning algorithms and two deep learning against a dataset collected from the social network platforms (Facebook, Twitter, Instagram, and YouTube). In another work [7], the authors used a specific word list as a seed to create a training set, to experiment with and create an offensive language detector. Authors in [8] proposed a method to detect abusive language, they used SVM with n-gram features for the classification where they achieved an F1-score of 0.82. They collected their own dataset from YouTube comments. [10] created a dataset of religious hate-speech discussions on Twitter, they used this data to train an RNN based classifier for automatic detection of hate-speech, they achieved 0.84 Area under the ROC curve. The authors also used their dataset to create multiple hate-speech lexicons. In [11], authors collected a dataset using several keywords such as racism and implement a deep learning model. [12] implement a classifier that combines both CNN and RNN in a joint architecture) achieved 0.73 macro-F1 score on the dev set. [13] constructed their method for data preprocessing and balancing and presented a Convolutional Neural Network (CNN) and bidirectional Gated Recurrent Unit (GRU) models used. [15] introduced a Levantine Hate Speech and Abusive (L-HSAB) Twitter dataset with objective to be a benchmark dataset for automatic detection of online Levantine toxic contents.

## Dataset and Preprocessing

The dataset acquisition step is the most time-consuming part of the text classification process [25].

The acquisitioned dataset may contain unnecessary data such as non-Arabic characters, repeated characters, emoji, or URLs. Therefore, the data should be cleaned and filtered before training for best results. This step is done using the following technics:

* Remove stop words.
* Remove non-Arabic words.
* Cleaning: removing unknown characters, diacritics, punctuation, URLs, etc.
* Arabic Dialects Normalization.
* Elongation removal: removing the repeated letters.
* Remove duplicated samples.

The researchers in Hate Speech detection Literature have their own dataset, collected from different sources. Some of these studies annotated their data as Hate or not, while the others annotated their data as hate, abusive or clean. Most of the studies collected (or “borrowed”) a dataset from twitter [6-10-11-12-13-15-23], YouTube [8-24] or from different OSNs [5-21]. Authors in [22] collected a dataset from a known channel news “AlJazeera.net”. The following table characterize the datasets proposed by different studies: data source, number of samples, percent of hate samples (we considered the hate and abusive as hate):

|  |  |  |  |
| --- | --- | --- | --- |
| **Ref.** | **Size** | **Hate %** | **Dialect** |
| [5] | 20000 | Balanced | Most popular accounts and pages |
| [6-12] | 10000 | 4.5 | Arabic tweets containing the vocative particle “يا” |
| [8-24] | 15050 | 38.65 | YouTube channels uploading videos about Arab world celebrities |
| [11] | 1634 | 52 | Tweets containing some specific words |
| [13] | 10000 | 24 | Same dataset in [6-12] but balanced |
| [15] | 5846 | 37.56 | Levantine, collected from the timelines of politicians, social and political activists and TV anchors |
| [21] | 6039 | 36.51 | Tunis |
| [22] | 32000 | 81 | Modern Standard Arabic (MSA) |
| [23] | 3950 | 42.66 | tweets referring to different religious groups |

## Text representations for Hate Speech

Text representations is the mapping of written human language into a collection of useful features which are understandable by a hate speech detection model. Following, the different text representation used models:

* N-grams [16].
* TF-IDF Weighting [17].
* Word Embeddings [20].

Different researchers have employed different variety of feature representation techniques for Arabic hate speech, N-grams-based [7-8-10-15-21], TFIDF-based [12-15] and word embedding [6-11-12-13-23-24].

## Classification approaches

Several classification algorithms have been deployed, such as Support Vector Machine, Logistic Regression and others. SVM was used in [5-8-12-13-15-21], while Logistic Regression was used in [12-13]. Naïve Bayes was used in [15-21], while CNN and LSTM were used in [6-11-13-23-24]. Authors in [5] use twelve algorithms (MultinominalNB, ComplementNB, BernouliNB, Decision Tree and others).

It is noticeable that the studies in Arabic hate speech detection are still scant. The algorithms used are mostly limited to SVM or combined LSTMN and CNN.

Researches shows that classifiers trained on imbalanced dataset may tend to have a high number of false negatives

# Dataset

# Proposed Model

# Experiments and Results

# Conclusion and Future Work

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