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Depression Detection Through Identifying Depressive Arabic Tweets From Saudi Arabia: Machine Learning Approach

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Abstract

Depression is a mental illness that affects a person's feelings and causes them to be negative. According to the World Health Organization, 280 million people suffer from depression, and it is a main cause of suicide and carries a great burden of disease. Given that social media is the number one source nowadays for expressing a person's emotions and feelings, it provides a proper environment to harvest raw data and detect signs of depression by analyzing the content shared by users. In this paper, we proposed a model for the detection of depression using Twitter as a source of information as it is one of the most popular social media platforms. Moreover, we found that research on such topics is lacking for the Arabic language and Arab users even though Arabic is the 4th most used language on Twitter. Therefore, we aimed to detect depression by identifying depressive tweets using natural language processing (NLP) tools and techniques to reveal the sentiments expressed by Arabs in their tweets and the polarity of depression. We have applied machine learning algorithms: Support Vector Machine (SVM), K-Nearest Neighbors (KNN), Logistic Regression (LR) and Naïve Bayes (NB) on tweets that are of the Saudi Dialect of the Modern Arabic Language to identify depressive tweets. Along with a combined Term Frequency - Inverse Document Frequency (TF-IDF) and N-gram feature extraction approach, we concluded that combining TF-IDF with N-gram produces better results. We also found that Logistic Regression outperformed the other algorithms with an accuracy of 82%.

Introduction

280+ Million people suffers from Depression

70% of Patients does not get diagnosed

Arabic is the **top 4th language** used online

11.1 Million active Arab users on twitter

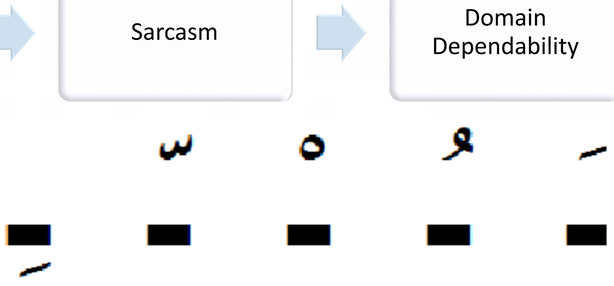
Our Contribution to the body of knowledge:

- Building a labelled dataset of Arabic tweets.
- Propose a sentiment analysis model that identifies depressive tweets with a combined feature extraction approach.
- Comparative experiment between most common ML algorithms.

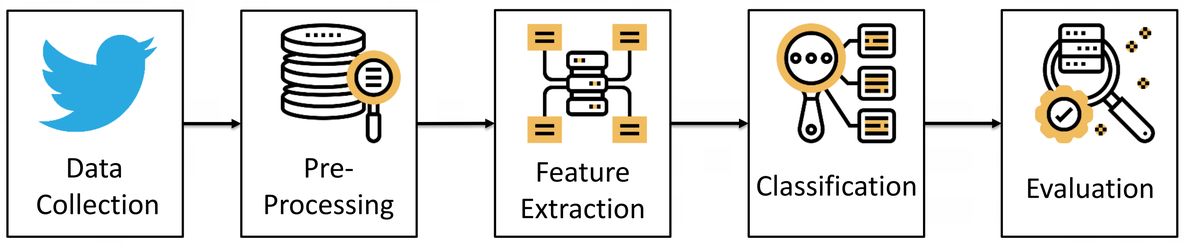
Arabic Language Challenges

Polarity Fuzziness → Quality of Review → Sarcasm → Domain Dependability

Arabic Morphology



Methodology



The Main Contribution resides in combining the best of two feature extraction methods in search of better classification. **We are combining TF-IDF with N-gram**

Experimental Results

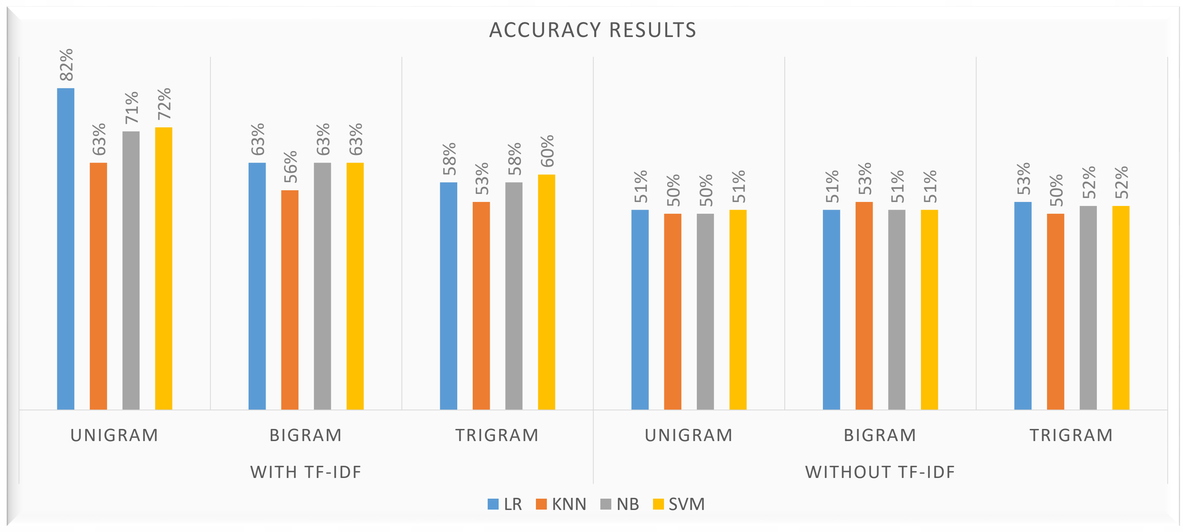
1. Dataset Construction

Labeling the tweets was conducted manually by two Arabic speakers, and based on Diagnostic and Statistical Manual of Mental Disorders (DSM5) standards.

Label	Category	# of Tweets	Label	Category	# of Tweets
Depressed	Negative Feelings	914	Normal	General	2076
	Self-Reported	530		News/Informative	306
	Frustration	376		Negative Feelings	172
	Loneliness	289		Religious Motivation	156
	Loss of Interest	224		Duaa	145
	Feeling Worthless	197		Gratitude	141
	Greif	131		Love Related	130
	Death/Suicidal	130		Wisdom/Advice	95
	Fatigue	115		Positive Motivation	62
	Affected Sleeping	53		Physical Health Related	21
	Mood Swings	42		Empathic	2
Total Tweets		3001	**Total Tweets**		3306

2. Classification Results

we have applied a 10-fold cross validation step to each of the classifiers. Figure below shows the outcome of the classifiers in terms of the accuracy.



Conclusion and Future Work

Our Paper serves the community by:

- Help to build an effective decision support tool for the mental health sector for Arabs
- Act as an informative tool for psychiatric researchers.
- Bridge the gap between CS, Arabic language and other specific domains
- Delivers a technological surveillance mechanism for Arabic Language

In the future, the dataset is to be reviewed and labels validated by psychology experts in order to reach a more accurate level of labeling. We could also increase the size of the dataset and conduct a deep learning algorithm comparison to improve its performance and potentially achieve better accuracy than ML classifiers.