pysentimiento: A Python Toolkit for Sentiment Analysis and SocialNLP tasks

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Abstract. Extracting opinions from texts has gathered a lot of interest in the last years, as we are experiencing an unprecedented volume of user-generated content in social networks and other places. A problem that social researchers find in using opinion mining tools is that they are usually behind commercial APIs and unavailable for other languages than English. To address these issues, we present *pysentimiento*, a multilingual Python toolkit for Sentiment Analysis and other Social NLP tasks. This open-source library brings state-of-the-art models for Spanish and English in a black-box fashion, allowing researchers to easily access these techniques.

1 Introduction

Extracting opinions and states-of-mind from user-generated context has drawn a lot of attention in the past years, particularly since the eclosion of Social Networks. Applications for these techniques come in many flavors, such as commercial uses, political campaigns, and even studying the changing patterns of emotions during the COVID-19 pandemics [8].

An issue that inhibits users of these opinion-mining technologies is that there is not a big spectrum of libraries for these tasks; mainly, one has to resort paid APIs provided by companies, or rely on models that are very out-of-the-date or even unavailable for a given language different from English.

In order to foster research using sentiment and other opinion-mining analysis as black-box tools, we present *pysentimiento*, a multilingual toolkit for these tasks. *pysentimiento* provides state-of-the-art transformed-based models for Sentiment Analysis and Emotion Analysis in an out-of-the-box fashion, with current support of Spanish and English. This library is released as free and open-source software [4] for anyone interested in using it for research purposes. We now describe the datasets we used, the models we trained, the results, and the selected default models in our library.

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[4] Code is available at `http://github.com/pysentimiento/pysentimiento`

Table 1: Statistics of the datasets used in this work

Task	Language	Source	Train	Test	Total
Sentiment	es	TASS Task 1	7,245	7,264	14,509
	en	SemEval 2017 Task 4	49,645	12,284	61,929
Emotion	es	TASS Task 2 (EmoEvent)	6,732	1,677	8,409
	en	TASS Task 2 (EmoEvent)	5,477	1,826	7,303

1.1 Previous Work

Appart from the commercial APIs, there are not many options of libraries providing out-of-the-box models for Sentiment Analysis. *VADER*[7] is a lexicon and rule-based library for Sentiment Analysis in English, specially crafted for Social Media. It provides multilingual support through translation from the target language to English.

Textblob is a library providing pretrained models for many NLP tasks using classic machine learning models such as Naive Bayes. Support is primary in English, with some adapters for other languages.

Transformers[14] is a library providing pretrained language models such as *BERT*[3] for classification and language-generation tasks. It also provides pipelines for Sentiment Analysis and other NLP tasks but –as far as we know– only English models are provided.

2 Data

We tackled two tasks: Sentiment Analysis and Emotion Analysis, both on Twitter datasets. For the former, we used two datasets: *TASS 2020* Task 1 [4] and *SemEval 2017* Task 4 Subtask 1[12]. Both datasets were labeled with general polarity using positive, negative and neutral outcomes. We merged together the Spanish subsets for each dialect, summing up to 6,000 tweets (CHECK THIS!). The English dataset has around 50k tweets for training and around 12k for testing.

Regarding Emotion Analysis, we used *EmoEvent* [1], a multilingual emotion dataset labelled with the six Ekman's basic emotions (*anger*, *disgust*, *fear*, *joy*, *sadness*, *surprise*) and also a "neutral" emotion.

Table 1 summarizes this info along the number of instances used for train and test.

3 Method

Transformer-based models have become state-of-the-art in NLP, both for classification and generation tasks, displacing models based on recurrent networks. BERT [3] and GPT [11] are flagships of these models.

Table 2: Classification results. First lines show the models

	Model	Sentiment		Emotion	
		Micro f1	Macro f1	Micro f1	Macro f1
en	distilbert	0.649	0.642	0.503	0.383
	mbert	0.645	0.643	0.516	0.394
	bert	0.686	0.684	0.559	0.439
	roberta	0.686	0.684	0.563	0.445
	bertweet	**0.697**	**0.696**	**0.584**	**0.476**
es	distilbert	0.602	0.599	0.600	0.463
	mbert	0.609	0.604	0.610	0.474
	beto	**0.672**	**0.667**	**0.688**	**0.548**

We performed experiments with several models. For English, we tested *BERT base*[3], *RoBERTa base*[9], *BERTweet*[10] and multilingual models, namely *DistilBERT*[13] and *mBERT*[3]. Spanish has lesser availability of models: we used *BETO*[2], a Spanish-trained version of BERT, and the aforementioned multilingual models.

Models were trained in a fairly standard way, using small triangular learning rates ($\sim 10^{-5}$) [6] for 5 epochs (10 in the case of SemEval dataset as it is big enough). For the emotion datasets we used class weights in the cross-entropy loss as it is somehow imbalanced.

Training (and posterior delivering) is done using *transformers*[14] library.

4   Results

Table 2 contains the results of the experiments for both tasks and languages. In English, the best performing model is *BerTweet* but just with a slight difference with *RoBERTa*. Both are powerful models known to have better performance than *BERT*; particularly *BERTweet* is very suited to these SocialNLP tasks as it is entirely trained on tweets.

We can observe that in Spanish *BETO* yields the best results for a large margin (around 6 F1 points) against *mbert* and *distilbert*, something expected as it is well known that monolingual models greatly outperform multilingual ones. Although there are models similar to *BERTweet* in Spanish [5] we were not able to test them as they were not available in *huggingface*'s model hub.

5   Conclusion and future work

In this work we presented *pysentimiento*, a multilingual toolkit for Sentiment Analysis and Emotion Analysis. We provide state-of-the-art models and an easy-to-use interface in Python, expecting this will help researchers interested in opinion mining from social networks.

For the time being, we support these two tasks. We plan to expand to more tasks, such as hate speech detection, irony detection, and others. Also, we plan to

provide more powerful pretrained models for other languages (mainly Spanish) to enhance performance in other languages than English.

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