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PEACE: Providing Explanations and Analysis for Combating Hate Expressions

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Abstract. The increasing presence of hate speech (HS) on social media poses significant societal challenges. While efforts in the Natural Language Processing community have focused on automating the detection of explicit forms of HS, subtler and indirect expressions often go unnoticed. This demo presents PEACE, a novel tool that, besides detecting if a social media message contains explicit or implicit HS, also generates detailed natural language explanations for such predictions. More specifically, PEACE addresses three main challenging tasks: *i*) exploring the characteristics of HS messages, *ii*) predicting hatefulness, and *iii*) elucidating the reasoning behind system predictions. A REST API is also provided to exploit the tool’s functionalities.

1 Introduction

The volume of abusive content and hate speech on social media is a growing societal concern. Hate speech — defined as a direct attack against people based on protected characteristics such as race, ethnicity, national origin, disability, religious affiliation, sexual orientation, gender identity, among others [13] — is aggravated by the high portion of hateful content being spread across online platforms, requiring automated approaches to detect them effectively. While significant progress has been made in the field of Natural Language Processing (NLP) to automate the detection of hateful language, NLP systems primarily address direct and explicit forms of HS, often overlooking implicit and subtler forms [5, 6, 13]. The latter type of HS poses unique challenges as implicit HS comprises coded, ambiguous, or indirect language that does not immediately denote hate but still disparages a person or a target group [5, 13].

Recent studies have explored how to identify implicit hate speech, defined as coded or indirect language that disparages a person or group on the basis of protected characteristics. These studies include theoretical analysis and datasets [13, 5, 18, 15], more solid veiled detectors and explanation methods [19, 21, 7, 3]. Despite these efforts, creating effective tools and resources to recognize these nuanced forms of expression remains a challenge. Moreover, very few studies tackled the concept of subtle hate speech, which is defined as delicate or elusive messages that are characterized by the use of literal meanings, in contrast to implicit hate messages where we go beyond literal meanings [13].

In this paper, we present PEACE: **P**roviding **E**xplanations and **A**nalysis for **C**ombating **H**ate **E**xpressions. PEACE is a web tool con-

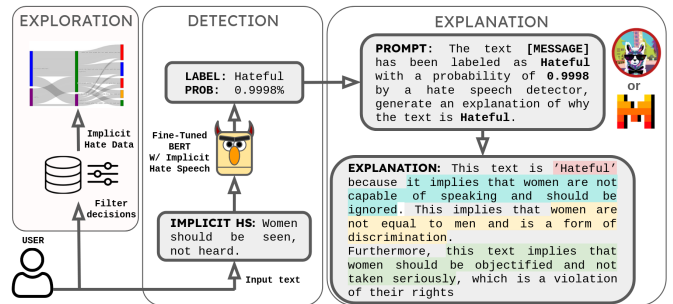


Figure 1. PEACE system overview.

ceived to support content moderators in exploring and evaluating implicit and subtle hate speech on social media. It comprises three main functionalities (Figure 1): *i*) the exploratory analysis of hate speech messages characteristics (*exploration*), *ii*) the prediction of hatefulness (*detection*), and *iii*) the explanation of system predictions (*explanation*). These functionalities incorporate not only a binary classification of whether a message is hateful (including explicit, implicit, and subtle messages following the definitions of Ocampo *et al.* [13]), with a detailed explanation in natural language that clarifies why a message is considered hateful and an exploratory analysis of the message characteristics.

To the best of our knowledge, PEACE is the only automated online tool allowing deep analysis and evaluation of both explicit and implicit hate messages. Few systems tackle similar tasks, such as RECAST [20] and MUDES [14], which identify multi-lingual span-level and sentence-level profanity expressions from the text on the web, MUTED [17] that allows visualizing the hateful intensity of those spans, IFAN [11] that tests an interactive platform for error analysis to debias a hate speech classifier, CRYPTTEXT [9] that provides an interactive interface to monitor and analyze offensive text perturbations online, TweetNLP [1] which is a platform supporting several NLP tasks including offensiveness detection, and McMillan-Major *et al.*’s system [10] which proposes a visualization tool and datasets for hate speech detection. However, none of these systems focus on detecting, in-depth analysis, and evaluating implicit hate speech messages such as PEACE.

NOTE: This paper contains examples of language that may be offensive to some readers. They do not represent the views of the authors.

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2 PEACE Main Functionalities

In the following, we present the three main components of PEACE. We are also providing a public API built on Python and Flask, its respective documentation, and the PEACE UI developed using JavaScript and Flask templates.¹

2.1 Data exploration

Implicit HS Datasets. PEACE allows for the search for specific instances from several social media and dataset sources oriented toward implicit HS. Currently, it covers the standard datasets: Implicit Hate Corpus (IHC) [5], Implicit and Subtle Hate (ISHate) [13], TOXIGEN [6], DynaHate (DYNA) [18], and Social Bias Inference Corpus (SBIC) [15]. The five datasets group the messages regarding their hatefulness, implicitness, and target groups. A summary of the data statistics for each of them can be found in Table 1. For label consistency across the datasets, we replicated the same setting as [12]. For each resource, users can retrieve one or several messages with their hateful, target, and implicit labels filtered by multiple options.

Visualization. To display the retrieved data, users have several visualizations available, including *Sankey*, *WordClouds*, and *Target Frequency* diagrams. Sankey Diagrams display how certain target groups are associated with respect to explicit and implicit connotations. They also show the relevant topics on these two labels estimated using Latent Dirichlet Allocation on the previously described datasets. WordClouds show the most frequent words on the selected group of messages. Lastly, Target Frequency displays the distribution of the target groups being attacked.

Data Augmentation. This module alters existing messages to create adversarial examples; these alterations are ways of obtaining augmented data specifically oriented to implicit messages. The focus is to modify parts in the text that do not affect the implicit hateful stand. We are incorporating the methods described in [13], displaying to the user the changes the new message has with respect to the original one. The implemented methods are: *Replace Named Entities* that replaces a named entity (PER, LOC, ORG, and MISC) in the input sentence by another one according to a previously collected list of NEs; *Replace Scalar Adverbs* that replaces emphasizing adverbs like “considerably” or “largely” with another scalar adverb that might increase or decrease the emphasis of an adjective/verb; *Add Adverbs to Verbs* that adds modifiers to verbs to accentuate them like “certainly”, “likely”, and “clearly”; *Replace Adjectives* that substitutes adjectives with their synonyms; *Replace In-Domain Expressions* that replaces a list of manually crafted expressions often used in HS messages (not captured by the RNE) with other semantically similar expressions; *Easy Data Augmentation* that modifies an input sentence using Random replacement, Random insertion, Random swap, and Random deletion; and finally, *Back Translation* that translates an input message into a different language to translate it back into the original one. Users can select their preferred method and apply it to messages they have written on their own. We also implemented a Python library where developers can access all these methods.

2.2 Implicit hate speech detection and explanation

Users also have the option to input their own messages for analysis. This message will be classified as hateful or non-hateful. In order

| Dataset | Source | Size | % Hate | % Implicit | % Explicit | % Subtle |
|---------|---------------|--------|--------|------------|------------|----------|
| IHC | Twitter | 21480 | 38,124 | 86,702 | 13,298 | - |
| SBIC | Social Media | 147139 | 60,446 | 62,278 | 37,722 | - |
| DYNA | Human-Machine | 123432 | 53,896 | 58,065 | 41,935 | - |
| ISHate | Social Media | 63758 | 71,974 | 54,904 | 21,811 | 23,851 |
| TOX | GPT-3 | 9900 | 42,657 | 45,489 | 54,511 | - |

Table 1. Comparing HS datasets. % Hate Class, % Implicit, % Explicit, and % Subtle are the percent labeled as hate, implicit hate, explicit hate, and subtle hate, respectively.

to do this, the demo uses a binary (Non-HS/HS) machine-learning classifier. After selecting the desired message, the results, including probabilities for each label, are displayed directly in the user interface. Beyond simply classifying messages as hateful or not, the demo also provides the functionality of explaining the system predictions. The user can select between two LLMs that receive as input the prediction of the classifier together with its confidence with respect to the selected class, and the original message. Given this input, the LLM receives the following prompt:

The text: [MESSAGE] has been labeled as [LABEL] with a probability of [PROB] by a hate speech detector, generate an explanation of why the text is [LABEL] in no more than 3 sentences.

This allows users to understand why their selected messages might be considered hateful.

Available Models. The platform supports an advanced BERT model, fine-tuned on implicit hate data [4]. BERT is a pre-trained bidirectional transformer model that uses a combination of masked language modeling objective and next-sentence prediction on a large corpus comprising the Toronto Book Corpus and Wikipedia. The model is fine-tuned with 24823 and 10867 implicit and subtle hate speech messages, respectively, from the ISHate training set following the methodology proposed in [12]. Concerning the natural language explanation generation phase, PEACE supports the Mistral [8] and Alpaca [16] models. For Mistral, we tested the Mistral-7B-instruct-v0.2 version, while for Alpaca, we employed Alpaca-7B.

3 Experiments and Results

We summarize the performance of the models employed by PEACE using the test sets of the implicit datasets described in Section 2.1.

Detection. We tested the fine-tuned BERT model, together with other implicit detectors from the literature: HateBERT [2], Contrastive BERT, Contrastive HateBERT [12] and the LLMs Mistral and Alpaca. We calculated the macro average F1-score in each test set. Additionally, we calculated the percentage of implicit (I), explicit (E), and subtle (S) messages captured by the models (see Table 2). We can see that, in general, BERT, fine-tuned on implicit and subtle hate messages, outperforms the other models in binary (Non-HS/HS) detection and implicit classification tasks. Similarly, they obtained results comparable to those of Contrastive HateBERT in the subtle task. For this reason, PEACE relies on BERT fine-tuned on implicit and subtle data.

Explanation generation. We employ Alpaca and Mistral models to generate natural language explanations for messages containing implicit HS from IHC. In order to evaluate these explanations, we followed the same approach of [7, 19, 3] and concentrated on: Fluency (F) that evaluates whether the explanation follows proper grammar and structural rules, Informativeness (I) that assesses whether the explanation provides new information (e.g., additional context), Persuasiveness (P) that evaluates whether the explanation seems convincing, and Soundness (S) that describes whether the explanation

¹ The PEACE web server, dependency modules, models, experiments, and system demonstration video can be found at: <https://gitlab.inria.fr/nocampo/peace>.

| Model | ISHate | | | | IHC | | | SBIC | | | TOXIGEN | | | DYNA | | |
|----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | F1 | (%) I | (%) E | (%) S | F1 | (%) I | (%) E | F1 | (%) I | (%) E | F1 | (%) I | (%) E | F1 | (%) I | (%) E |
| BERT | 0,863 | 0,849 | 0,831 | 0,769 | 0,627 | 0,744 | 0,810 | 0,658 | 0,516 | 0,634 | 0,641 | 0,767 | 0,823 | 0,647 | 0,757 | 0,805 |
| HateBERT | 0,866 | 0,801 | 0,837 | 0,769 | 0,614 | 0,674 | 0,814 | 0,628 | 0,478 | 0,571 | 0,626 | 0,714 | 0,775 | 0,641 | 0,674 | 0,760 |
| Cont. BERT | 0,837 | 0,715 | 0,714 | 0,692 | 0,629 | 0,557 | 0,708 | 0,530 | 0,301 | 0,414 | 0,600 | 0,564 | 0,619 | 0,635 | 0,580 | 0,705 |
| Cont. HateBERT | 0,852 | 0,737 | 0,805 | 0,795 | 0,616 | 0,681 | 0,801 | 0,618 | 0,468 | 0,562 | 0,603 | 0,722 | 0,762 | 0,632 | 0,691 | 0,760 |
| Mistral | 0,782 | 0,538 | 0,846 | 0,667 | 0,649 | 0,618 | 0,903 | 0,620 | 0,628 | 0,425 | 0,743 | 0,617 | 0,545 | 0,642 | 0,788 | 0,738 |
| Alpaca | 0,392 | 0,704 | 0,608 | 0,590 | 0,416 | 0,666 | 0,717 | 0,468 | 0,650 | 0,674 | 0,459 | 0,639 | 0,732 | 0,079 | 0,120 | 0,131 |

Table 2. Classification task (Non-HS vs HS) across the five selected datasets. We calculated the macro average F1-score and percentage of implicit (I), explicit (E), and subtle (S) messages correctly detected by Fine-tuned BERT, HateBERT, Cont. BERT and Cont HateBERT. Mistral and Alpaca are also evaluated to compare their detection capabilities w.r.t the other models. Subtle labels are only part of the ISHate dataset.

| Strategy | Hate Speech | Explanation | (F) | (I) | (P) | (S) |
|----------------|--|--|-----|-----|-----|-----|
| Only Alpaca | What two kinds of people are totally different but always look the same? Asians and hepatitis patients | The text is hateful because it perpetuates stereotypes about Asians and hepatitis patients by suggesting that they are two groups that are totally different but always look the same. This is a false and offensive generalization that reinforces negative perceptions of both groups. | 5 | 2 | 3 | 5 |
| Only Mistral | Homeless Where do Western Hobo’s go for food? Food shelter. Where do Asian Hobo’s go for food?. Dog shelters | The text does not appear to be hateful on its own. It is asking a question about where hobos from different cultural backgrounds obtain food. However, the use of the term "Hobo" may be outdated and perceived as derogatory by some. It’s important to note that using labels to stereotype or belittle individuals based on their economic status, ethnicity, or any other characteristic is disrespectful and hateful. The suggestion that Asian hobos specifically go to dog shelters for food is incorrect and potentially harmful, as it perpetuates negative stereotypes and could lead to harm against homeless Asian individuals and dog shelters. | 5 | 2 | 2 | 3 |
| Bert + Alpaca | women should be seen, not heard | This text is 'Hateful' because it implies that women are not capable of speaking and should be ignored. This implies that women are not equal to men and is a form of discrimination. Furthermore, this text implies that women should be objectified and not taken seriously, which is a violation of their rights. | 5 | 3 | 5 | 5 |
| Bert + Mistral | as it was intended .. #whitegenocide #kalergi | The text contains the hashtags #whitegenocide and #kalergi, which are often associated with racist and conspiratorial beliefs. The former reference to a supposed plan of genetic elimination of the white race, while the latter connects to an alleged plan of interracial breeding by Count Coudenhove-Kalergi, promoting a mixed European race to unify Europe. Such content promotes hateful and discriminatory ideologies, making it a potential threat towards peaceful and inclusive coexistence of different races and ethnicities. | 5 | 5 | 5 | 5 |

Table 3. Human Evaluation examples comparing Explanations with Vanilla Mistral/Alpaca VS Fine-Tuned BERT + Mistral/Alpaca.

is valid and logical. All metrics use a Likert scale and range from 1 (lowest score) to 5 (maximum score). We selected a sample of 100 messages, randomly extracting 20 from the test set of each dataset.

| | Avg. (F) | | Avg. (I) | | Avg. (P) | | Avg. (S) | |
|---------------------|----------|------|-------------|-------------|-------------|-------------|----------|------|
| only alpaca | 4.84 | 4.92 | 2.52 | 2.69 | 3.48 | 3.52 | 4.02 | 4.04 |
| only mistral | 5.00 | | 2.86 | | 3.56 | | 4.06 | |
| bert+alpaca | 4.96 | 4.98 | 2.92 | 3.15 | 3.84 | 4.00 | 4.16 | 4.10 |
| bert+mistral | 5.00 | | 3.38 | | 4.16 | | 4.04 | |

Table 4. Human Evaluation comparing Explanations with Vanilla Mistral/Alpaca VS Fine-Tuned BERT + Mistral/Alpaca. Results in bold are statistically significantly with respect to the “only” configuration.

For 25 of those messages, explanations are generated with only Mistral, 25 with only Alpaca, 25 with fine-tuned BERT + Mistral, and the last 25 with fine-tuned BERT + Mistral. For the latter two strategies, we provide to the LLM the label predicted by the supervised binary classifier and its confidence. More precisely, we provide to the LLM the fine-tuned BERT output, as it is the best performing model in our classification task. Two instructed annotators provided the scores for this sample by looking at the hateful message and its corresponding generated explanation. From Table 4, we see the average scores for each metric and configuration, showing that the explanations from the pipeline method are statistically significantly more Informative and Persuasive than the ones generated by the LLM only, without the label of the supervised classifier ((I) 3.15 vs 2.69, and (P) 4.00 vs 3.52, respectively). Similarly, the same effect occurs in

per model configuration ((I) 2.92 vs 2.52, and (P) 3.84 vs 3.48 for alpaca, and (I) 3.38 vs 2.86, and (P) 4.16 vs 3.56 for mistral). For Fluency and Soundness, the results are comparable to those of the vanilla counterpart. Statistical significance is tested using the Mann-Whitney U Test with a P-value < 0.05. Table 3 shows some examples with their scores.

4 Conclusion

We presented PEACE, a novel tool for the detection and explanation generation of hate speech. It is the first system focusing specifically on implicit and subtle hate speech messages by allowing not only for the classical binary classification of whether a message is hateful or not, but also a detailed explanation of the reasons why a message is classified as hateful. Additionally, PEACE provides different diagrams for exploratory analysis of the messages’ characteristics and data augmentation strategies for implicit and subtle hate messages. As for future work, we plan to include more of the detector’s internal knowledge in PEACE to generate explanations apart from the detector’s prediction, as the extraction of relevant detector’s rationales or implied statement in line with Yang *et al.* [21], the use of implicit hate demonstration examples as Damo *et al.* [3] and Wand *et al.* [19], and the target hateful intention as in Huang *et al.* [7]. Also, given the subjectivity of implicit/subtle labels and explanation generation, human evaluation is still needed, requiring standard metrics evaluated with a higher number of annotators and providing structured test suites for hate speech explanation.

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