O QUE HÁ EM UM TUÍTE? CONSTRUINDO UM LÉXICO SEMÂNTICO BASEADO NA OPINIÃO DE ALUNOS DE EDUCAÇÃO A DISTÂNCIA

WHAT IS IN A TWEET? DESIGNING A SEMANTIC LEXICON BASED ON DISTANCE EDUCATION STUDENTS' OPINIONS

Jéssica Braun de Moraes[1]

jessicabraunm@gmail.com

Resumo: Dentre os diversos desafios que concernem à modalidade de educação a distância está a necessidade de diminuição da taxa de evasão dos alunos. Nesse sentido, a presente pesquisa visou a contribuir com a construção de uma base de dados lexicais com foco em emoções e opiniões que possa ser incorporada em um software preditivo de evasão. Para a construção da base de dados, usamos a ferramenta Torabit para coletar 150 tuítes opinativos de alunos da modalidade de educação a distância e os analisamos à luz da Appraisal Framework, de Martin e White (2005), juntamente a cinco recursos relacionados à Análise de Sentimentos que são fornecidos por Liu (2010; 2012) em suas obras. Ademais, utilizamos o dicionário Aulete, dicionário de Português Brasileiro, para descrever unidades lexicais encontradas no corpus e melhor encaixá-las nas categorias de análise das teorias. Os resultados mostraram 220 tokens de opinião que foram identificados e rotulados de acordo com suas respectivas polaridades, além de incluídos nos domínios atitude (julgamento e apreciação) e gradação (acurada e forte) apresentados pelo framework linguístico utilizado. Ademais, o corpus trabalhado revelou uma grande recorrência do uso de linguagem figurativa, gírias e elementos extralinguísticos, tais como GIFS e *emojis*. Os resultados também indicaram que a abordagem adotada não é eficiente para prover recursos que auxiliam na identificação automáticas de recursos tais como gírias, neologismos, elementos extralinguísticos e linguagem figurada.

Palavras-chave: Educação a distância. Appraisal Framework. Análise de sentimentos.

Abstract: Among the various challenges regarding distance education is the necessity of reducing the student dropout rate. In this sense, the present research aimed to contribute to the design of a lexical database focused on emotions and opinions that can be incorporated into predictive evasion software. For the database design, we used the Torabit tool to collect 150 tweets containing distance education students' opinions and analyzed them in the light of Martin and White's (2005) Appraisal Framework, along with five resources related to the sentiment Analysis field, which were taken from Liu's (2010; 2012) works. In addition, we used the Aulete dictionary, a Brazilian Portuguese dictionary, to describe the lexical units found in our corpus to better fit them into the analysis categories. Results showed 220 opinion tokens, which were identified and labeled according to their polarity. Moreover, these tokens were included in the domains attitude (judgment and appreciation) and graduation (sharp and strong) from the linguistic framework used. The results also showed the adopted approach is not efficient to provide resources that help the automatic identification of figurative language, slang, and extralinguistic elements, such as GIFS and emojis.

Keywords: Distance education. Appraisal Framework. Sentiment analysis.

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[1] Mestra em Linguística Aplicada pela UNISINOS e Especialista em Design e Comunicação Digital pela ESPM.

1 Introduction

When we think about the future of education, we assuredly think about technology and its innovations. Although these two concepts have an imminent relationship to be developed, the connection of them is our modern reality. Many resources, such as distance education platforms, learning analytics, semantic applications, and artificial intelligence applications are referred to as a trend in education within the next 4 years (Cf. JOHNSON *et al.*, 2012; FREEMAN *et al.*, 2017; BECKER *et al.*, 2017).

Regarding Distance Education, the modality has been evolving rapidly in Brazil over the past years, in such ways that its growth outstrips the benefits of the so-called traditional education, supporting new teaching and learning models. In this scenario, the current teaching-learning modality provides students with the flexibility to manage their studies, as well as control over their learning process. According to the recent Distance Education census, made by the *Associação Brasileira de Educação a Distância (ABED)[2]*, the Distance Education modality showed a growth of 17, 6% in 2017. It also presented a bigger number of courses, totalizing 2.108 courses within the modality in the country.

Considering the foregoing facts, the continuous evolution process of this education modality involves solving issues such as the high student evasion rate. Moore and Kearsley (2007) describe a communication hiatus that they present as one of the paramount issues that lead students to evade Distance Education courses. This hiatus is purely due to the lack of communication exchange between students and teachers, which might trigger the former to feel abandoned by the latter and isolated from the group and thus reduce the effectiveness of the class content.

In this sense, the previously mentioned applications, especially the semantic and artificial intelligence ones, present relevant resources to improve the Distance Education scenario. As stated by Elmes (2017), the artificial intelligence field has a huge potential to help better virtual learning and the teaching scenario. Furthermore, amongst its resources available, some applications can provide tools that when implemented on a Virtual Learning and Teaching Platform, i.e., Moodle, can help decrease the incidence of student dropouts and anticipate this type of behavior using sentiment analysis tools.

Thus, understanding the problem of solving the prime issue brought into light in this paper, which is student evasion in Distance Education courses, we describe the work done in

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[2] Cf. Associação Brasileira de Educação a Distância (ABED). **Censo EAD.BR**. 2017/2018. Available at: <http://www.abed.org.br/site/pt/midiateca/censo_ead/1554/2018/10/censoeadbr_-_2017/2018>.

an honor thesis that focused on designing a lexicon that helped in the enhancement of a sentiment analyzer designed to operate on a virtual learning and teaching platform of a university in South Brazil. The reports provided by this software help teachers identify the needs of their students, which allow the educators to be more precise and faster to assist their students, who feel either insecure or confused regarding the course modality, therefore, helping to solve the student evasion situation within the university Distance Education context.

By using the Torabit tool, we chose twitter as our data source for it being a social media network where it is usual for people to speak their minds and give frank opinions about any subject. Hence, 150 tweets were collected and analyzed considering Dias-da-Silva's (1996; 2003) background methodology, considering the following domains: (i) linguistic; (ii) linguistic-computational; and (iii) computational. The focus, however, was on the first two domains, wherein the first one, we analyzed the collected corpus in the light of the Appraisal Framework (MARTIN; WHITE, 2005) along with a set of Sentiment Analysis tools to evaluate opinions, called the quintuple (LIU, 2012).

As previously mentioned, this research is part of a larger project - MAS-EaD - whose main objective is to design a sentiment analyzer capable of detecting students' sentiments and emotions on a university virtual learning and teaching platform. It intends to anticipate student dropouts by alerting the teacher about students who, for instance, feel neglected or lost in the discipline so the teacher can promptly assist them.

In the project's course, strategies have been devised for linguistic-computational representations of the emotion and sentiment lexicon in Brazilian Portuguese. These strategies function as a component of a computational system dedicated to the mining of emotions and opinions, as registered in a virtual learning environment. In other words, the project intends to create a powerful software analyzer of opinions to be implemented in a university virtual learning environment (Moodle).

Given the scarcity of this type of language resources for the Portuguese, this is a great challenge to overcome. Nevertheless, promising results have already been achieved through interdisciplinary work, in the context of a close collaboration between the Graduate Program in Applied Linguistics and the Graduate Program in Applied Computing in a university in South Brazil.

These studies, related to the MAS-EaD project, have been developed since 2012, and the results showed that there are still gaps in our knowledge. The MAS-EaD sentiment analyzer has the main function of detecting the core of student comments. In addition, the lexical database that feeds this computational tool differs from other existing ones for the subjectivity

analysis it provides. The lexical database is a resource built from a corpus of distance education and is oriented to the Distance Education scenario; that is, it is in the field of Distance Education.

The semantic information about adjectives, adverbs, and verbs of emotion and opinion of the project's corpora were analyzed as a result of the analysis of group members' work. However, a study encompassing all the syntactic elements of the sentence was done solely by one of the group project members so far. Cosme (2014) analyzed a corpus of thirteen sentences in the light of the Appraisal Framework in the pursuit of exploring every possibility that this tool could offer to provide linguistic information to enrich the project's sentiment analyzer. Cosme's research was relevant for bringing a linguistic theory that enables the analysis of sentences in their entirety.

Therefore, the present study is important for attempting to improve an existing lexicon in terms of data enrichment, and expansion - the addition of word classes under the aegis of the same framework used in Cosme's (2014) study. Thereby, bringing an informal corpus for the analysis in order to seek speech naturalness and new word classes in a different context from which the other corpora were obtained.

2 Theoretical Framework

2.1 The Appraisal Framework

The framework chosen to support our analysis is integrated into M.A.K. Halliday's systemic-functional linguistics. According to Martin and White (2005), their framework is an approach that brings multiple perspectives and focuses on language as taxonomy used to express evaluation through attitude (affect, judgment, and appreciation), engagement, and graduation (force, focus of attitude, and engagement). These three semantic domains together are the major purview of the Appraisal Framework (MARTIN; WHITE, 2005).

Table 1: Semantic domains of the Appraisal Framework

SEMANTIC DOMAIN	CHARACTERISTICS
ATTITUDE	Emotions (affect), people's judgment, and evaluation.
ENGAGEMENT	Locutor's point of view (appreciation of objects or events; assessment of other people's evaluations).
GRADUATION	Various levels of strength of attitude and engagement.

Source: Based on Martin and White (2005).

As shown in the table above, the Attitude domain is related to lexical units that express our emotions, while the Engagement domain shows us the locutor's point of view and assessment of things, people, and situations through their choice of lexical units, and, finally, the Graduation domain, which encompasses the levels of strength one applies in their speech through adverbs and adjectives mostly. Through the three domains presented, the Appraisal Framework may explore a language by describing and explaining how it is used in various situations, namely, to evaluate and construct textual figures.

Moreover, it also provides resources to analyze how attitudes, judgments, and emotive responses are shown in texts (e.g., explicitly/ implicitly; presupposed; or assumed) (WHITE, 2012). This framework also allows us to delve into the investigation of the different manners attitudes and judgments that appear in a text, concerning possible challenges or/and contradictions that might come from people with different points of view.

Considering the foregoing, the appraisal is "a semantic category realized explicitly or implicitly through language'', and it is "essentially related to evaluation" (HUFFMAN, 2015, p. 105). White (2001, p. 2) describes this term as

> […] a cover-all term to encompass all evaluative uses of language, including those by which speakers/writers adopt particular value positions or stances and by which they negotiate these stances with either actual or potential respondents.

In this sense, Huffman (2015) notes that to analyze one's speech taking this framework into account, the focus of the analysis needs to be essentially on the locutor's choice of

lexicogrammar. Hence, according to Unsworth (2000), "the choice of lexis can 'colour' representations of experience" and reveal to us the locutor's intention behind a text. In other words, to analyze an opinion text one has to take into consideration the text structure.

As briefly mentioned above, the Appraisal Framework is divided into three major semantic domains, which are also subdivided into subsystems. The Engagement domain gives voice or positioning of the locutor's attitudes and points of view. This domain is subdivided into monogloss, which brings dialogical alternatives to the text, i.e., narratives (HUFFMAN, 2015), and heteroglossic resources, where other voices are allowed to take part in a text through dialogic expansion, in which other alternative sources or voices are entertained or acknowledged, allowing the author to distance him or herself from a claim (MARTIN, 2003).

There are three subsystems in the Attitude domain (WHITE, 2005), namely affect, judgment, and appreciation. The first one refers to lexical units and expressions that are directly related to emotions, i.e., love; the second one, judgment, encompasses lexical units and expressions that reveal ethics and social rules, i.e., traditional. Finally, the third one - appreciation -, refers to the evaluation of objects, people, and situations through their aesthetics principles, as well as to other social value systems (HUFFMAN, 2015). Finally, in the Graduation domain, there are two subsystems, which are force (raise; lower), i.e., very much, and focus (sharpen; soften), i.e., greatly.

The following figure and its examples summarize the theory presented.

Figure 1: The Appraisal Framework
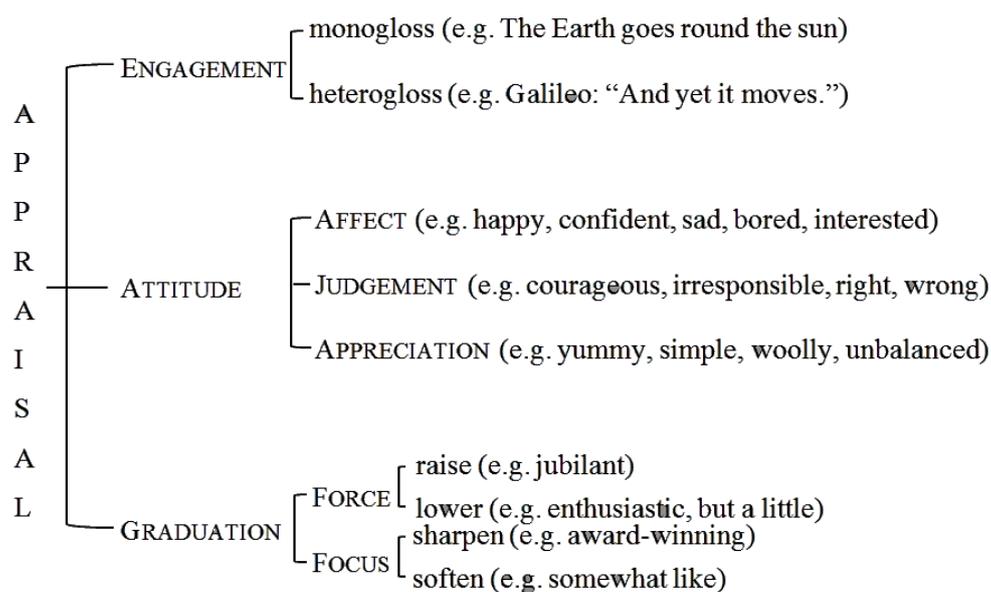
Source: Appraisal Resources (MARTIN; WHITE, 2005).

2.2 Sentiment Analysis

Considering the growth of data of all kinds in the recent decade and the necessity brands and companies must understand and evaluate their target consumers' attitudes and sentiments on social networks, sentiment analysis tools have become a key technology to monitor people's opinions. In this sense, Sentiment analysis arises as to the field responsible for technologies that help us analyze peoples' opinions, feelings, evaluations, appreciations, attitudes, and emotions concerning, for instance, people, services, and products (LIU, 2010). In this sense, it aims at determining a locutor's positioning towards a determined subject, which is also called attitude.

According to Liu (2012, p. 12), there is something called sentiment lexicon that has a paramount function regarding sentiment analysis. In other words, there are some words and expressions that better illustrate one's opinion regarding, for example, a target object, product, and situation. However, as table 2 shows, there are some adversities regarding it.

Table 2: Adversities regarding the sentiment lexicon

Type of adversity	Examples
A positive or negative word used that might be used in reversed polarity.	*This new ice cream flavor is so **good** I could not even finish it!*
A sentiment term that appears in a sentence expressing no sentiment.	*Is this new ice cream flavor **good**?*
Sarcastic and ironic opinions with or without sentiment tokens	*This new ice cream flavor is so good it tastes like chewed gum.*
Sentences without sentiment tokens.	*This ice cream tastes like heaven.*
The amount of information on the internet	X
Non-structured data	X
Slang, abbreviations, orality, and extra-linguistic elements	*This new ice cream flavor is **dope**.*

The use of other linguistic resources to change the polarity of a token/sentence (e.g., adverbs)	*This ice cream is good, **but** it is too sweet.*

Source: Based on Liu (2012).

According to the author (ibid.), the types of adversities presented in the table are a challenge when it comes to analyzing opinions automatically since, as competent speakers of a language, we tend to make use of diverse types of strategies to give our speech the tone we want. For instance, we can use a positive word to ironically describe food that tastes bad, as the first example of the table shows. In this sense, Liu (2012) notes the necessity of studying these adversities and hence introduces a set of tools (presented in the next section) to analyze an opinion in a text.

2.2.1 The quintuple: a tool for analyzing sentiments in an opinion text

Opinions are composed of five main elements, which are target, aspect, sentiment, evaluator, and the time when it was expressed (LIU, 2010; 2012).

Table 3: The quintuple

TARGET	Object / thing/ entity/ person etc. being evaluated (e.g., I love **soccer**)
ASPECT	An aspect of the target (e.g., The house's **garden** is beautiful)
SENTIMENT	If the opinion is negative, positive, or neutral (e.g., I **hate** Coca-Cola)
EVALUATOR	The owner / voice of the opinion (e.g., **Lucas** told me he strongly dislikes eating salads)
TIME	The moment in which the opinion was given (e.g., She used to enjoy taking long naps, but **now** she thinks it is a waste of time)

Source: Based on Liu (2010).

To better understand the elements exposed in the table above, we can take the following sentence as an example: *I love Janice's new blue coat.* In this case, the evaluator (I – personal pronoun) is stating that they love (opinion) the target (blue coat) in the present (time [I love – present simple]). In this example, most elements shown in the table above are present in the sentence, and hence prove to be useful to help a computer program identify an opinion inside a text as it divides the word classes into specific classes for opinion identification; in other words, targets and aspects appear to be mostly nouns, sentiments adjectives and adverbs, and evaluator pronouns. Additionally, as shown in the examples from the table, the time is revealed by the verbs and their tenses.

3 Methodology

This study adopts a task-driven qualitative approach, following Dias-da-Silva's (1996; 2003) framework of domains that complement each task involved in this investigation. Those are (i) the linguistic domain; (ii) the computational linguistic domain; and (iii) the computational domain. The first domain involves the linguistic description of the phenomena found in our corpus, while the second one is preoccupied with representing the linguistic objects present in the corpus formally; finally, the third domain comprises the encoding of the linguistic information generated in the two first domains, as well as the design of the software. It is important to mention, however, that this work only encompasses the two first domains proposed by Dias-da-Silva (ibid.).

Following the methodological steps, in order to collect data for this investigation, we chose a social media monitoring tool named Torabit[3] to collect a genuine corpus on students' opinions on the distance education modality. Torabit was chosen for providing us with access to content published in private accounts. As this tool is designed to monitor tags on social media, especially tags related to brands and companies, its usage had to be adapted. Therefore, we tailored our search for specific terms defined as Distance Education keywords. Thus, we created a filter to target tweets, from March (2014) to June (2017), containing the following tags *Educação a Distância, Ensino a Distância, EAD,* and *Moodle[4]*. We chose to limit this period to 3 years due to Liu's (2012) affirmation that says that an opinion may change throughout time

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[3] Available at: http://www.torabit.com.br/
[4] Author's translation: Distance Education, Distance Learning, DA (Distance Education abbreviature), and Moodle.

in order to try and see if any of the people in our corpus would change their opinions during that period and tweet about it.

Concerning our corpus collection, we chose Twitter as our source of data. The online social media networking mentioned was chosen for being famous for users who speak about various topics, giving frank and unbiased opinions about them, and, most importantly, for most users are not afraid of speaking their minds. In the first moment of our corpus compilation, four hundred tweets were collected; one hundred sentences for each keyword searched. However, after a careful triage in which we deleted all spam messages, links for websites, and news headlines, our final corpus was composed of 150 tweets.

Finally, in order to analyze our corpus and examine each sentence, we took the foundation of the Appraisal Framework along with the Sentiment Analysis components previously presented as a base to create a framework with our categories of analysis. We also used the Aulete dictionary[5] to help describe the lexical units in the course of the analysis.

4 Analysis

Taking into consideration the aforementioned theories and their categories, we analyzed[6] four representative tweets to each of the keywords presented in our methodology section, namely *Educação a Distância, Ensino a Distância, EAD,* and *Moodle*.

4.1 Educação a Distância

"Educação a distância é uma palhaçada! Imagina só? Por isso q esse país ñ vai pra frente![7]"

In the tweet above, the **evaluator** is not present in the sentence. However, it states that the **target** (*Ensino a Distância*) is a big joke, describing it using a noun that carries a negative polarity (*palhaçada*). According to the Aulete dictionary, *palhaçada* is a noun that suggests that something, or an event, is an act of a clown, a ridiculous scene. The use of this noun reveals that the evaluator uses the domain **attitude**, and, in consequence, the **affect** subsystem to describe their discontentment in the present (**time**) towards the target, and hence provide a negative opinion (**sentiment**).

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[5] Available at: <http://www.aulete.com.br>.
[6] For the analysis, we kept the authors' original texts.
[7] Author's loose translation: Distance education is a joke! Can you imagine? That's why this country doesn't evolve!

4.2 EaD (Distance Education)

"E eu sou obrigada a cursar ead. Pq eles n disponibilizam algumas cadeiras presenciais[8]".

In this tweet, we have a present **evaluator** (eu) who addresses their opinion towards the **target** (EaD) without hiding themselves in the text. Their choice of lexicon (*obrigada*) reveals a high discontentment with a present (**time**) obligation towards the target and, subsequently, their (supposedly) indignation for not having options to study in a traditional class environment. This choice of lexicon fits into the **attitude** domain, in the **judgment** subsystem as, according to the Aulete dictionary, the word is used to express something that is imposed on someone, a rule. Thus, revealing a negative opinion (**sentiment**).

4.3 Ensino a Distância

"Cada dia eu gosto menos de vir pra sala de aula. Viva o Ensino a Distância[9]."

In the tweet above, we have a present **evaluator** (eu) targeting two different instances in the present **time**. The first **target** is *sala de aula*, whilst the second one is *Ensino a Distância*. Regarding the first target, the evaluator uses both the **graduation** (**force** - menos) and the **attitude** domains (gosto) (**affect**) to state that each day they like less their traditional classroom; in other words, a negative opinion (**sentiment**). However, considering the second target, the locutor uses an interjection (*Viva*) to express how much they appreciate and salute the target *Ensino a Distância*. According to the Aulete dictionary, *Viva* is an interjection that expresses enthusiasm, support, or felicitations and hence fits into the **attitude** domain (**affect** subsystem). Considering the keyword searched *Ensino a Distância*, which is our focus, the locutor expresses a positive opinion (**sentiment**) towards it and hence considers the opinion, as a whole, positive as the locutor is using the first target as a mere example to draw a comparison between the learning modalities (traditional vs. distance learning).

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[8] Author's loose translation: And I am obliged to take Distance Education courses, because they didn't make in-class courses available.

[9] Author's loose translation: Every day I like less coming to class. Hurray to Distance Learning!

4.4 Moodle

"Odeio o Moodle!1!!¹⁰"

In the tweet above, the **evaluator** (*eu* - omitted) states that they hate (in the present **time**) the **target** Moodle. The choice of lexicon (*odeio*) reveals both the **attitude** (subsystem **affect**) and **graduation** (**focus** - odeio) domains, as according to the Aulete dictionary the lexical unit expresses *deep* rancor and enmity; in other words, the locutor is suggesting a stronger sentiment than dislike. In this sense, the opinion presented is negative (**sentiment**).

5 Results and discussion

After a careful analysis of our corpus, we found that 84% of the opinions examined were negative, whilst 16% were positive. Thus, from our 150 tweets corpus, we identified 126 sentences as negative and 32 as positive. Amongst those sentences, we extracted 220 opinion tokens which were labeled and identified according to their polarity and, later, organized in our emotion and sentiment lexicon. For those tokens, 164 showed a negative polarity (e.g., *porcaria, palhaçada*), whereas 56 showed a positive polarity.

It is important to highlight that this work added two more-word classes to the already existent lexicon of the MAS-EAD project (nouns and interjections) besides expressions and slangs. Moreover, 141 tweets were labeled into the subdomain attitude, while only 2 were classified into the subdomain judgment. The 7 other tweets (out of the 150) were identified as part of the subdomain appreciation.

Concerning our choice of time for the corpus compilation, we noticed that there were no occurrences of people changing their opinions on the keywords targeted over the years. On the contrary, in 5 cases, the same Twitter user gave a similar opinion to their original one in a space of 2 - 2,5 years, which weakens Liu's (2012) theory of people changing their opinion over time in respect of a product. Considering that the Distance Education modality, and higher education in general, appeared to be understood as a type of product to the students whose sentences were analyzed, one may conclude that there are more issues regarding the learning modality that need to be asserted and studied further than just the evasion rate.

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¹⁰ Author's loose translation: I hate Moodle!1!!

6 Final Remarks

It is an undeniable fact that there are still many challenges involving the Natural Language Processing field and its development, especially concerning studies on Sentiment Analysis. As Liu (2012) states, there is a necessity to study the many adversities we face when proposing solutions to the challenges the Sentiment Analysis field poses.

After a careful analysis of our corpus, we concluded that the Appraisal Framework is not efficient for providing resources to help automatically identify textual elements such as slang, neologisms, figurative language (i.e., irony, sarcasm, and metaphors), extralinguistic elements, i.e., memes, and comparisons by context. Thus, there are still some language phenomena to be studied and translated into sets of speech or language data and a machine-readable form in order to assist and augment the linguistic capability of the MAS-EAD Sentiment Analyzer. As previously mentioned, the theory chosen to be approached and applied in our analysis showed itself insufficient in terms of tools to detect phenomena such as irony and comparisons by the context in textual contexts. Therefore, there is a necessity of testing other theories or even develop our own method of analysis to create a stronger set of linguistic rules to feed the software's system as only morphosyntax rules lack elements for feeding a good quality sentiment analyzer.

In this sense, for future studies, we intend to develop an investigation and verify the use of figurative language in opinion texts and the ways we can develop linguistic strategies and implement them into a Sentiment Analyzer. Another important aspect to be investigated for future works is the use of extralinguistic elements (e.g., emojis and GIFs) in a text to determine whether a sentence is positive or negative, as well as which linguistic theory (or theories) we can explore to obtain better results.

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