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Sentiment Analysis Of The Educational Mission Of The Mechanical Engineering Programs In Norte De Santander

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Abstract

In this research a sentiment analysis is carried out where the proposed goals and projection are perceived, taking as a factor the mission of the academic program of mechanical engineering in three universities in the department of Norte de Santander. Through the mission the student can have a perception of what the program does, the advantages and the differences with other programs taught in other universities. Although each program defines its mission, an analysis of natural language can determine whether the message is positive or negative by analyzing its sentiments. The analysis reflects a positive percentage of 60% for the Universidad Francisco de Paula Santander Ocaña, 70% for the central campus and 66% for the Universidad de Pamplona.

Keywords*:* Sentiment Analysis; Mechanical Engineering; University mission; academic programs.

1. Introduction

The mission and vision of an engineering program are the initial basis to show the applicants to enter the program, where the proposed goals and their projection are perceived; the decision to select a university depends to a great extent on both of them and they function as marketing to promote the program. The mission defines what the program does, what its target audience is, the advantages it has and how it differs from similar programs offered at other universities. The vision defines the future projection and what the program wants to achieve.

The mission and vision can become an important factor in an applicant's decision about where to apply for admission to a university. Universities make a great effort to clearly, accurately and conspicuously document these factors; which can also be analyzed by the words they contain in their texts with sentiment analysis (Dake & Gyimah, 2022; Ravi et al., 2015), because relevant details of education or teaching courses can be found (Cereneo et al., 2022). Sentiment analysis is used in many, many areas to engage customers and find out their opinions concerning the offerings of various businesses sometimes posted on a social network such as Twitter (Aguilar et al., 2018; Newberry, 2021; Saura et al., 2018). It is also used by the banking system to know the tone and inferred opinions with the aim of understanding

the attitude of customers (Bharadwaj, 2019; Zhong & Ren, 2022). In supermarkets and shopping malls it is common to use tools to process natural language, so that when stocks are on the rise investors flock (CFI Team, 2022) and they will also do so if products are on sale and even product inventory (Bowman, 2019).

If it is about education, the analysis of feelings measures attempts in some cases to measure the perception of students in some of their careers, the research of Chanchi et al. (2020) analyzes the students of the Systems Engineering program to know about the activities that were developed during the confinement in Colombia of the Covid-19 pandemic, with a sample of 350 students and 7 questions, where students have a positive perception of the activities performed remotely of the academic processes. Just as students were evaluated, it was also performed on teachers, to know the emotions and feelings during the pandemic, where the positive perception is twice as high as the negative, suggesting new tools that can be included in the platform to improve synchronous meetings (Chanchi et al., 2021).

Although there are already created tools, sentence or text classifiers are also developed, for computer programming courses, which tries to adapt the teaching content to cognitive as well as affective needs (Barron Estrada et al., 2018). There are also tools that according to the analysis can recommend to the student where they should locate educational resources, based on the EmEdRe tool, solving one of the most common problems such as specific searches (López et al., 2016). Monitoring students virtually can guide the teacher on their teaching methodology that is why in Colombia they developed a web platform to take actions to improve the learning experience (Piedrahíta-Carvajal et al., 2021), through face recognition, which can help if combined with natural language and textual sentiment analysis.

A textual analysis can help not only with course content, but also with contradictions, performance, and reasons for dropping out of the course (Dalipi et al., 2021). Similarly, it was possible to detect changes in students' relationships during the pandemic and whether they were affected by the transition to virtual learning platforms, so that drawbacks such as increased stress can be corrected (Tan & Dewi Varathan, 2021). A more extensive research analyzes students from France, Germany, Russia and the United Kingdom, collecting data from 2707 students, mainly analyzing job prospects, concluding that sudden changes due to different circumstances can impact students' well-being negatively impacting learning (Plakhotnik et al., 2021). Another study (Son et al., 2020) samples 195 students where 71% indicated increased stress, 91% reported negative aspects, 86% had problems in their sleep routines, 89% had problems concentrating, demonstrating that preventive strategies are needed to improve students' mental health.

The objective of this research is to know through natural language processing using sentiment analysis, if the mission of each program taught in the three universities of Norte de Santander in Colombia presents a positive analysis, for this the mission of the mechanical engineering program at the Universidad Francisco de Paula Santander Ocaña (UFPSO), central headquarters (UFPS) and the University of Pamplona (UNIPAMPLONA) is analyzed, which may have an impact on the selection of the program in any of the universities, since the words that make up the mission can be determinant in the process.

2. Method

Information on the mission and vision in the three universities is extracted through the documents hosted on their website, for example for UFPSO (2022) its mission is as follows: "The mechanical engineering program at the Universidad Francisco de Paula Santander Ocaña, ethically and morally forms professionals capable of applying their ingenuity and creativity in the development of knowledge and technology, through the study of the areas of mechanical and thermal systems design, manufacturing processes and materials engineering, automation and industrial maintenance, with the use of pedagogical

tools that allow students to acquire the skills to perform as professionals and people with social commitment", subsequently each word is extracted to form a token. Likewise for the UFPS (2022), its mission is framed as: "The Mechanical Engineering program of the Universidad Francisco de Paula Santander trains professionals ethically, morally and intellectually capable of satisfying the needs of the society in which they develop, using appropriate technologies, developing creativity, promoting research and fostering values through continuous learning and service to the community". And it ends with the mission of Unipamplona (2022): "The Mechanical Engineering Program assumes the formation of innovative, ethical and competent professionals, based on research as a central practice for the generation of new knowledge that contributes to the integral development of society, in a globalized context, making efficient use of natural and human resources". Subsequently, the same process is carried out with the vision documents of each university, however with the mission a general impression of the program can be given, therefore they are not taken into account for the analysis.

The process itself consists of analyzing each document extracted from the web page, each word is converted into a token, then vectors are created, eliminating repeated tokens, and finally it is classified, obtaining the percentages of positive, negative, neutral and indeterminate tokens, which are also eliminated from the classification (Figure 1). The calculation of the percentage of positives is based on equation 1, where the number of positives is divided by the sum of negatives and positives. To perform the computational process, the Wolfram Language is used (Wolfram, 2022).

$$\% = \frac{Positive}{Negative + Positive} \tag{1}$$

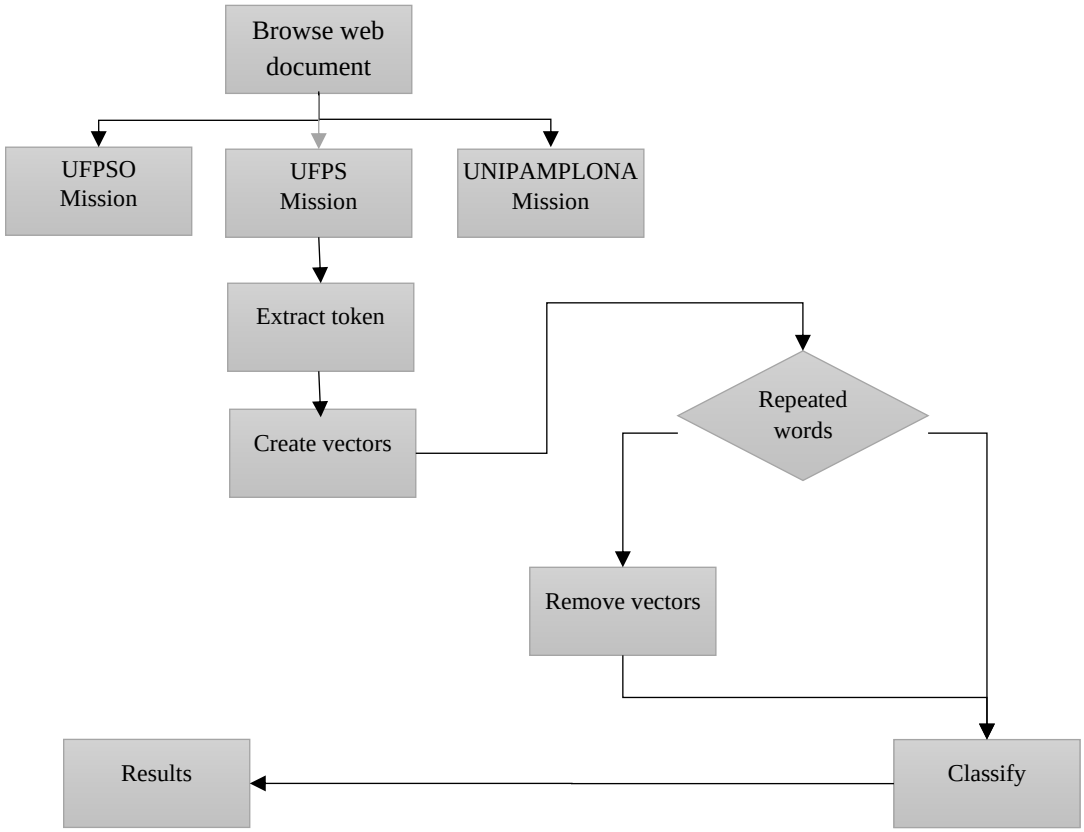

Figure 1. Classification process

3. Results

The UFPSO in its mission presents a message of 74 tokens where emphasis is given to the words of: professionals, engineering and mechanical by repeating twice as many times, keeping a neutral message but being very flat, the amount of tokens can lead an applicant to not find the clear objective of the mission for the mechanical engineering program. After eliminating the repeated tokens the final amount of tokens examined is 42 (Figure 2). The ranking result contains 21 positive tokens 14 negative and 10 neutral tokens (Table 1). The sentiment analysis has a value of 60%, but if the neutral tokens are added the message is quite poor with a result of 46.66%.

Table 1. UFPSO mission tokens.

Positive	Negativo	Neutral
program	mechanical	engineering
Universidad	paula	de
Francisco	applying	morally
santander	development	capable
ocaña	areas	manufacturing
Ethically	thermal	materials
Forms	systems	automation
Professionals	processes	maintenance
Ingenuity	industrial	social
Creativity	use	
Knowledge	tools	
Technology	acquire	
Study	people	
Design		
Pedagogical		
Allow		
Students		
Skills		
Perform		
Professionals		
commitment		

$$\% = \frac{Positivos}{Negativos + Positivos} = \frac{21}{39} = 0.60$$

The UFPSO mission presents several neutral tokens distorting the message and should be replaced or reduced for a more positive impact.

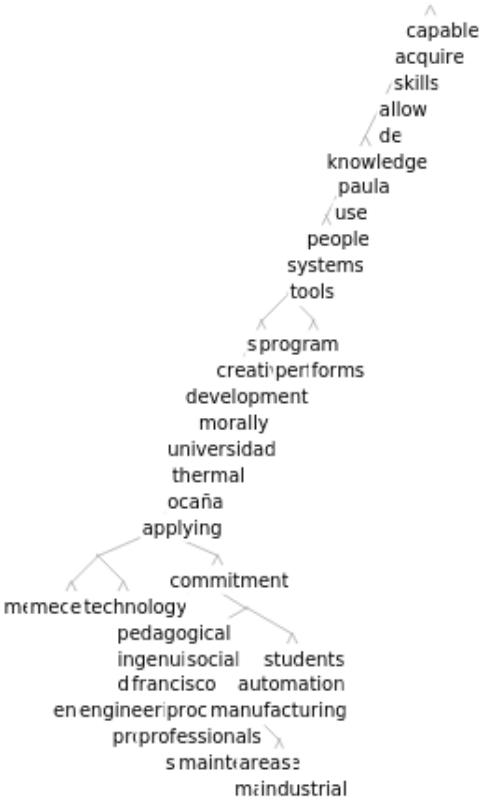

Figure 2. UFPSO Word Nodes

On the other hand, UFPS has 47 tokens in its mission, and when eliminating the repeated tokens, 31 remain to be analyzed, of which 17 are positive, 7 negative and 7 neutral (Table 2). The positive percentage is 0.70, which shows that the sentiment analysis is more positive than that of the UFPSO, and has fewer neutral tokens, reinforcing the final message. It is also noteworthy that the number of words used is lower and the message is more positive (Figure 3).

Table 2. UFPS mission tokens.

Positivo	Negativo	Neutral
program	mechanical	engineering
universidad	paula	de
francisco	operate	trains
santander	using	morally
professionals	appropriate	capable
ethically	continuous	society
intellectually	service	values
meeting		
needs		
technologies		
developing		
creativity		
promoting		
research		
fostering		
learning		

community		

$$\% = \frac{Positivos}{Negativos + Positivos} = \frac{17}{7} = 0.70$$

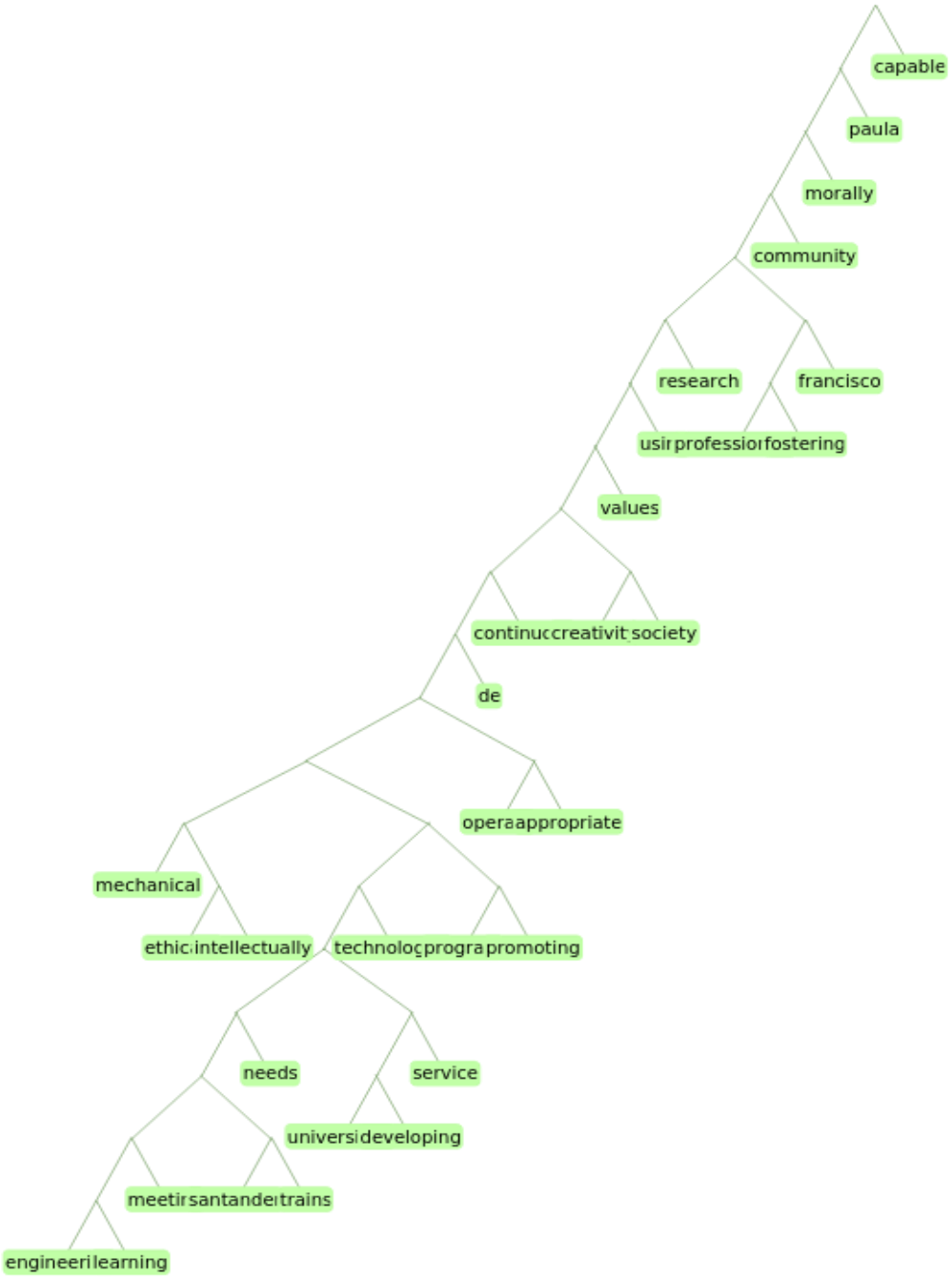

Figure 3. UFPS Word Nodes

Unipamplona in its mission has 46 words, and finally 28 tokens to analyze, with a total of 14 positive, 7 negative and 7 neutral, the percentage of positive analysis is 0.66 and none of the words are repeated. The sentiment analysis for Unipamplona places it between the two universities (Table 3 y Figure 4).

Table 3. UNIPAMPLONA mission tokens.

Positivos	Negativos	Neutral
ethical	mechanical	engineering
professionals	assumes	formation
based	generation	competent
research	integral	central
practice	development	society
new	context	human
knowledge	use	resources
contributes		
globalized		
making		
efficient		
natural		

$$\% = \frac{Positivos}{Negativos + Positivos} = \frac{14}{7} = 0.66$$

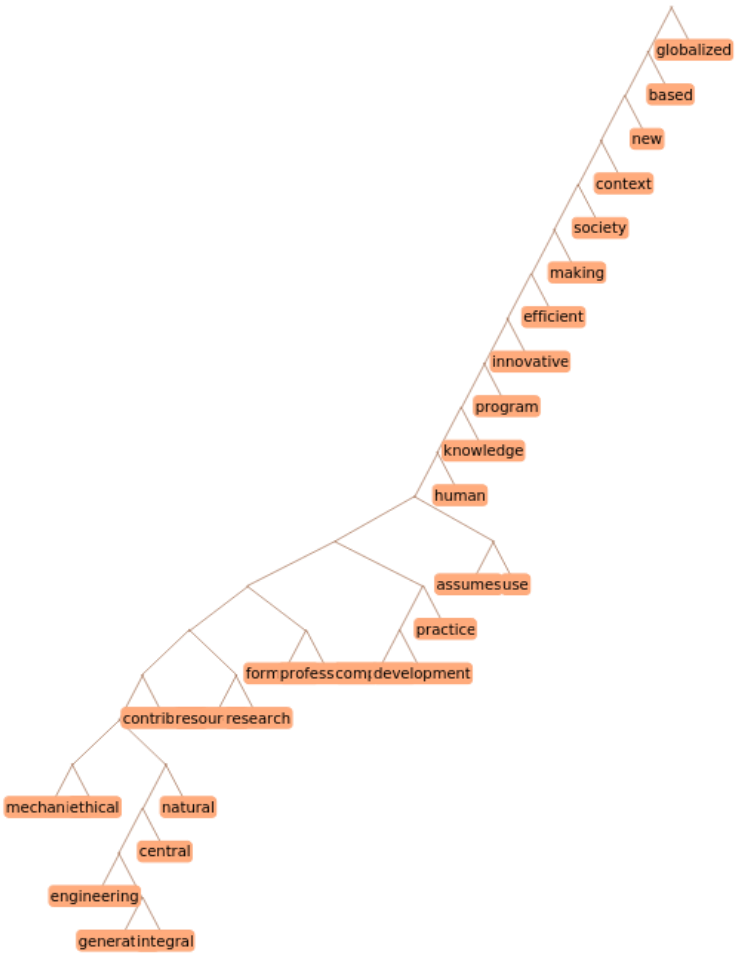

Figure 4. UNIPAMPLONA Word Nodes

When observing Figure 6, it can be seen that although UFPSO maintains more positive words, it also increases in negative words and has enough neutral words, which decreases its percentage of effectiveness to 60%, and although UNIPAMPLONA is the one with the shortest vision message, it is located between the two with 66%, and 70% for UFPSO, which shows that a shorter length is needed but with more precise words that maintain the message and can attract new candidates to enter the universities in the mechanical engineering program (Figure 5).

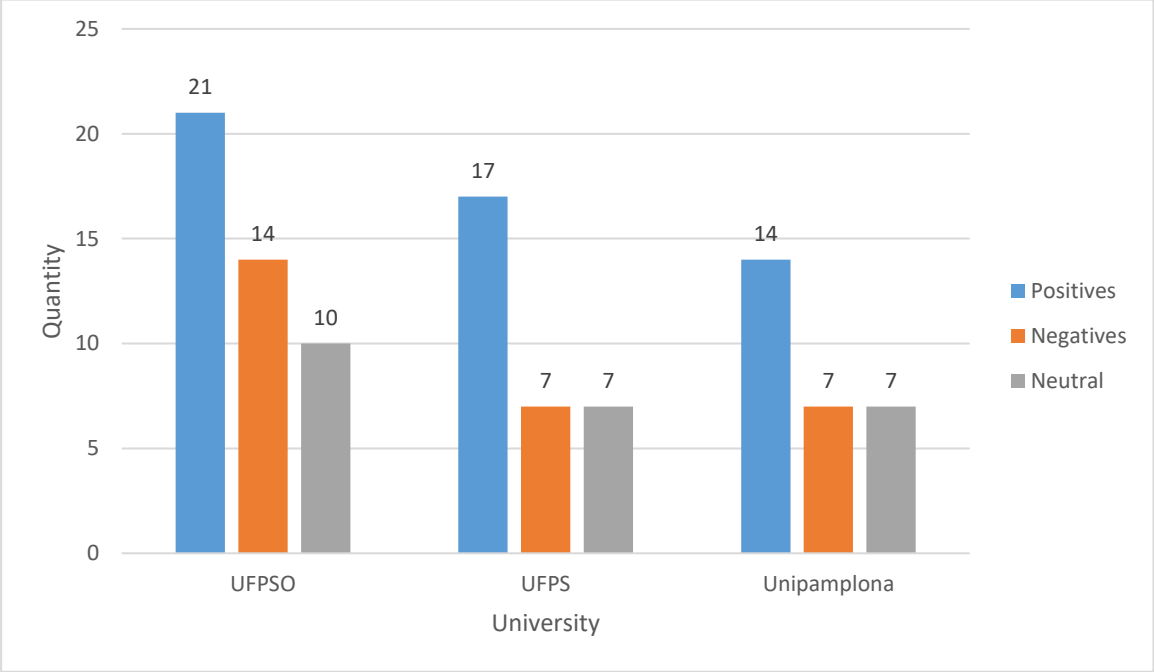

Figure 5. Sentiment analysis for the mission of the three universities.

4. Conclusions

The amount of words that contain the message of the mission of the mechanical engineering programs in the universities of Norte de Santander does not correlate with a greater amount of positive tokens, which could influence the applicant to select the program in some of the universities. A shorter but more definitive message with positive words can be important in the perception of the applicants and more concrete about what they want to be trained in each academic program.

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