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Motherhood in Peru through the use of Sentiment Analysis, in Facebook

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Abstract

Introduction. Sociodemographic, technological and cultural changes have had an impact on the image attributed to motherhood, historically connected to different conceptions. Therefore, the purpose of the present study was to know the current perceptions and concepts about motherhood in Peru **Methodology.** The opinions contained in Peru Facebook fan pages were recruited with the Sentiment Analysis tool. It also allowed analyzing 28,907 comments. **Conclusions.** Quantity preliminary results showed a positive perception about the “mother” meaning (5127 comments) in comparison to the negative comments (1777). The categorization results, from the qualitative analysis of the comments, formed four groups of meanings: super mom, motherhood as a blessing and the source of affection, motherhood as a rejected option and the search for new concepts of motherhood.

Keywords

Motherhood; sentiment analysis; mother; woman; social networks; opinions.

Contents

1. Introduction. 2. Methodology 3. Results. 4. Discussion and conclusions. 5. List of References.

Traducción de **Lila Cerellino Cernades**
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1 Introducción

What is meant by motherhood is a complex of important meanings for life and human culture. Among them we find these related terms: woman, procreation, and breeding, among others. These seem to have been crossing and varying throughout history and cultures (Molina, 2006; Vidal, 2008), especially since the denaturation of motherhood driven by the critical feminism, from which it began to be taken as object of study of the social sciences (Ramirez-Ramirez, 2013; Grisales, 2015).

Is it that young women consider the maternal function as something less positive and their own children are beginning to be considered as a burden (Molina, 2006)? At least, this image of the woman detached from maternity is the one that seems to predominate in the current media (García & García, 2004; Bernárdez, 2009; Guarinos, 2009). Will this be the concept of maternity perceived in our society? In order to demystify and identify the image of the maternity adequately, it is important to analyze this type of perceptions and to find if there is a positive or negative consideration of the maternity in Peru, and what are the terms more related (or associated) to this, currently.

The changes around the meaning of maternity are also studied due to its implications not only social but also legal, economic and demographic. Among these, we could find the worldwide decline of fertility rates and the postponement of motherhood (United Nations, 2015).

In Peru, from 1986 to 2016 the fertility rate decreased around 42%, from 4.3 to 2.29 children per woman, especially among women from 20 to 29 years old (National Institute of Statistics and Informatics - INEI, 2017). This could be related to the socioeconomic, cultural and technological changes that have occurred during the last decades, which in turn have influenced the way in which motherhood is perceived today.

To understand what is defined as motherhood, it is necessary first to consider what the meanings have been included in it throughout history. Molina (2006) refers in particular to 3 nuclei of associated meanings: procreation, breeding and woman. Until before the industrialization, when the main economical function of the family was of small agriculture units, in which the domestic and productive workspace of women and men was inside the house (Del Campo, 2006; Vázquez de Prada, 2008), the meaning of motherhood, procreation and woman were intimately linked. Motherhood was related to the fertility of the earth; mother was the one who propagated life, the kind being who gave everything with generosity, and who found satisfaction in the care and nutrition of others (Molina, 2006). The most appreciated qualities in women, by men, were concentrated around their ability to have children and manage the home (Del Campo, 2006). The perception of motherhood was strongly related to the physiological aspect of bringing children into the world, to their nutrition and care during the first years; while education and upbringing were mainly parental responsibility (Molina, 2006).

With the industrial revolution, agriculture was replaced by paid work as a way of life (Molina, 2006). In this period, known as the bourgeois family, the father leaved the home to sell his labor force. Thus, their educational functions, along with those of closeness, protection and guidance, originated from the father, passed into the hands of the mother, who also had to take care of the house and the husband (Belardinelli, 1996; Del Campo, 2006). It is then that the woman assumes all the responsibility of the upbringing and that the differences between the private sphere of the family and the public of work were marked (Molina, 2006). In the family, the father is reduced to a figure in the background

(Belardinelli, 1996) whose responsibilities are economic and authority (Ramírez-Ramírez, 2013). State educators and the State assumed the pedagogical and protective functions (Belardinelli, 1996) and motherhood is identified with the upbringing and with the meanings of high responsibility, heavy work and sacrifice (Molina, 2006). To this situation it was added the irruption of the knowledge of experts at the beginning of the 20th century, who began to have more weight in the gestation, the giving of birth and the upbringing (Palomar, 2005). Although the mother loses authority and confidence in her knowing and legitimate knowledge, a great responsibility is given to the maternal function. According to Molina (2006), it is at this time in which the functions of procreation, nutrition, correction of behavior, instruction, moral and affective formation tend to concentrate more on the concept of mother. Motherhood is seen as intensive and exclusive, that is, not only requires total dedication, great investment of resources and knowledge (Molina, 2006) but also that only the mother, and not the father, is indispensable in the upbringing and growth of the child (Puyana, 2003).

As a reaction to this bourgeois family, critical feminism emerges, that, at least initially, with the followers of Simone de Beauvoir, questions the positive meanings around motherhood (Ramírez-Ramírez, 2013), since it begins to be considered as a burden that deprives women of social presence, the main prison for women, and indicates their incompatibility with their personal development (Beauvoir, 1989). This ideology looked for separating the maternal figure from the female identity (Godoy & Vidal, 2013) and stigmatized it, posing motherhood and the desire to be a mother as a myth built by the society that is not natural to women (Valladares, 1994).

In the second half of the twentieth century, with the massive access of women to paid work, the availability of reliable contraceptives, the possibility of achieving greater educational achievements (Del Campo, 2006) and the discrediting of the maternal role promoted by feminism (Frischmuth, 2014) a contradiction arose between the maternal role of intensive parenting and the search for the personal women realization (Molina, 2006). Women began to contribute to the household economy and began to enter the labor market more actively (Stuven, Cabello, Crisóstomo & Lozier, 2013; Vázquez de Prada, 2008, Burín, 2008). However, these changes were not accompanied by the contribution of men to the family domestic environment and their requirements (Tobío, Agulló, Gómez & Martín, 2010), therefore, women had to combine their work outside home with domestic chores, with an exhausting second turn (Del Campo, 2006).

All these social transformations also had two important consequences: the decline in fertility rates (Ramírez-Ramírez, 2013) and the postponement of motherhood (Montilva, 2008, Londoño; Bedoya & Osorio, 2016), which forecasted a decrease in the labor force in the future of a large part of western countries, where the fertility rate is lower than the generational replacement level (2.1 children per woman) (Longman et al., 2012). It also appeared greater risks for the mother and the baby (Paredes, 2013) in a large number of countries, where the average age of the woman having the first child has increased towards around 30 years (United Nations, 2015). Latin America is also suffering this process in an accelerated way, data from the World Map of the Family (Lippman, Wilcox & Ryberg, 2014) showed that Brazil and Chile had the lowest fertility rates together with Argentina and Colombia. Peru seems to follow the same path. Data from 2016 show that their total fertility rate fell to 2.29, especially in the age range of 20 to 29 years (INEI, 2017).

With all these social, cultural and demographic changes, it seems that in the 21st century the concepts of motherhood and woman are no longer synonymous; maternity has gone from being the primary objective of every woman to a more life option (Arango, 2014). With the emergence of new

reproductive technologies such as artificial insemination, the transfer of embryos and surrogate mothers, the procreation of sexual activity has been dissociated to such an extent that the identification of motherhood and paternity remain unclear, even in the legal ground (Del Campo, 2006). This separation of the traditional components and processes of biological motherhood has entailed important social and ethical implications, not only in the legal framework but also in the practice of motherhood, contributing to the denaturalization of this. (Ramírez-Ramírez, 2013). Although historically feminine identity was clearly identified with the task of the maternal, which was the end of its realization as a woman (Londoño, et al., 2016), now motherhood is considered a secondary element in the life of women, after the achievement of study and professional goals (Fuller, 2005; Arango, 2014; Reid, 2014). Also in Latin American countries where a traditional maternity concept still prevails along with other trends (Puyana, 2013), women have begun to consider the maternal function as less attractive than it was in other periods (Molina, 2006), especially among those with higher education (Grisales, 2015). In this way, it seems that the new ideals of women living in our time are directed in a different way from that of motherhood.

Among the trends that go in this direction, emerged in recent years, are women who have chosen not to be mothers voluntarily (Ramírez-Ramírez, 2013; Luna & Mejía, 2017), also known as the Generation NoMo (No Mother). This word was popularized by the British association Gateway Women, which not only claims the respect of society to live in this way but also highlights the joy of living according to that condition. Books such as *Rocking the Life Unexpected*, by Jody Day, or *No Kids: 40 Good Reasons not to Have Children*, by Corinne Maier, have become quite famous for providing emotional support to these women and for presenting the no-mother as a model of life much more desirable to be (Laguardia, 2014). In the same way are the childfree or childless style, in which the man is also unlinked to the desire of having children, since these are considered to be a burden of high economic cost (Blackstone, 2013). Another current trend is the women called PANK (Professional Aunt No Kids), whose term, coined by Melanie Notkin, considers the segment of women who project and transmit their motherhood through the care of the children of other people, especially their nephews. This phenomenon described by Fuentes (2015), he discovered that the aunts between 45 and 64 years are the ones who spend more money on their nephews and participate in a meaningful way in their lives, even in making decisions about their education and care. Finally, in a greater quantity, there are also the women who do not refuse the possibility of marriage and motherhood, but have the conviction that marriage is not necessarily forever and that motherhood is something not constitutive of women (Zaragoza, 2012; Reverter, 2001); and those women who delay their motherhood in order to first reach economic and social accommodation (Montilva, 2008).

All these trends have become media themes and controversial issues disseminated by the media (Mayoral & Mera, 2017, López, 2004), which, with the new technological revolution and the emergence of social networks, have seen it enhanced their capacity to reflect the way of life and the trends that come from the real world (Bernárdez, 2015), as well as to be able to make a private message public (Cornejo & Tapia, 2011; David Caldevilla, 2010; Cáceres, Ruiz, & Brändle, 2009). In this way, the new trends in favor of or against motherhood and its symbols have also gained notoriety in social networks (Rubio, 2003; Braidotti, 2002). Among the virtual phenomena that have emerged concerning this is The Mom Shaming, which is a type of virtual harassment experienced by women who post photos about their motherhood in social networks, for which they are frequently attacked and labeled as bad mothers due to some behaviors that users or followers of these women consider negative and inadequate in the education of their children and home management. The National Survey of Child Health of C.S. Mott Children's Hospital, revealed that among the most criticized topics in social

networks, in order of priority, are the discipline 70%, nutrition 52%, sleep 46%, breastfeeding 39%, safety 20% and child care 16% (National Poll on Children's Health, 2017).

Another example of the controversies generated in social networks around the meanings attributed to motherhood, are the critics directed to organizations or companies that present a politically incorrect attitude about motherhood, such as the one that was made to the Gatorade company because of the congratulation to the Olympic medalist Paola Espinosa for the birth of her son. This generated many comments qualifying as absurd the congratulations to the athlete, since, according to these criticisms, the fact that the athlete had to give up their professional routines for being a mother, was not a reason for pride (Atomic feathers, 2017).

However, there are also positions that seek to claim the role of women as mothers. The Brelfie was imposed a while ago as a type of selfie, with women who post photos breastfeeding their babies. This phenomenon has occurred to a greater extent on Facebook and Twitter, observing a greater number of followers in the European Week of Breastfeeding in 2015, in order to eliminate taboos about breastfeeding. However, this also caused controversies about the mother's exposure in a situation considered as private by some (Asociación Española de Pediatría, 2015).

The so-called digital platforms have reduced the global gaps between people by expanding the scope of interpersonal communication (Comscore, 2013). While in these the opinion and personal approaches of some of its authors tend to dictate the trend and meaning of the news that reach the network (Flores, 2009) –and therefore often induce changes in user behavior (David Caldevilla, 2010)-, they are also privileged platforms for the diffusion and exchange of diversity of opinions (Arab & Díaz, 2015). Due to this and the advantages they offer, such as quick access to opinions and trends as well as their ability to include significant samples at a low cost, these platforms are being implemented as a valuable and very useful research resource (Fumero & García, 2008), especially as a source of information gathering (Lago, Direito, Rodríguez & López, 2016; Fernández & Fuelleo, 2014).

In some cases, they are used as an additional complement to the classic surveys, as in the case of electoral campaigns, which were used to analyze the vote intention (Ceron, Curini & Iacus, 2014), or in replacement of these. It has been discovered that the extraction of data from social networks such as Facebook, MySpace, Digg, Twitter and JISC, can more accurately predict certain information, compared to other techniques such as surveys and opinion polls (Asur & Huberman, 2010).

Taking into account these advantages and that it is the woman who most frequently consumes the Internet spaces (Estébanez & Vásquez, 2013), some investigations have arisen such as that the one from Kristine Blair and Pamela Takayoshi (2003), who have studied the self-esteem linked to the prototypes of the current woman, using virtual platforms. Others have analyzed the influence of social networks as an enriching source for current women and the elderly (Fernández & Fuelleo, 2014; Osorio, et al, 2014). Likewise, it has been studied the relationships of women in social networks, as in the research of Lizama (2009), who carried out a semantic analysis of the opinions and stories in a virtual group of women in order to understand the concept of women about their sexuality and the association of various factors to the socialization of it. However, no precedents have been found of a study that analyzes the perception of motherhood in these virtual platforms.

For this reason, the objective of this study is to use social networks to collect and analyze current perceptions of the motherhood and the mother in a large scale, given that these have become one of the most significant virtual spaces for claiming the concept of women (Bernárdez, 2009; Braidotti, 2002; Bernárdez, 2001), and where women are the biggest users (Estébanez & Vásquez, 2013). In turn, the social network Facebook was chosen since it is preferred by netizens in 89% (Comscore, 2013; Raimondo, Reviglio & Diviani, 2016) and because Facebook messages, by their nature, are more succinct and easier to classify than Twitter tweets (Ahkter & Soria, 2009). However, finding, monitoring opinions and distilling the information found in these messages is a difficult task, due to the large amount of information they contain, therefore to overcome the human limitations for this task, it is necessary to realize a technique that allows automated data mining (Liu, 2012). Because of this, in our research we have decided to use the computational tool called Sentiment Analysis, in order to manage a greater amount of information, to analyze the polarity of the content found and to detect the terms most associated with the concept of maternity.

Sentiment Analysis is a tool used actively in data mining, Web mining and text mining (Liu, 2012). This is one of the most active research areas within the Natural Language Processing (branch of Artificial Intelligence), since its scope goes beyond Computer Science, because it analyzes the opinions, which are central to almost all human activities and influence in an important way in our behavior (Liu, 2012). Thus, through this tool, it is possible to detect opinions about a topic or trend and to identify the role of feelings in comments (Thelwall, Buckley, Paltoglou, Cai & Kappas, 2010). In addition, this is one of the most used computational complements in social networks (Liu, 2002) and that has expressed crucial advantages with respect to other traditional methods (Jurasky & Martin, 2008; Bishop, 2006), because of being more reliable in text interpretation.

The applications of Sentiment Analysis have been given in almost all domains: extraction of political opinions, comparison of opinions through cultures, languages, spam opinions, propagation of opinions in social contexts, in how the opinions of the web influence the real world and the analysis of emotions in the social context and the virtual world (Liu, 2012). Particularly, in the research of Bedi and collaborators (2015), techniques similar to those used in the present study were used for the classification of words with the help of Machine Learning and pre-processing of texts, in order to predict the onset of psychosis in young people. Other studies based on Sentiment Analysis, and the study of samples in social networks such as Facebook and Twitter, have analyzed the opinions and perspectives that users have regarding gender (Larson, 2017; Prabhakaran & Rambow, 2017; Keith, 2017), regarding to social welfare (Schwartz et al., 2016), or have been used to detect states of depression in its users (Wang, Zhang, Ji, Sun & Wu, 2013) and in politics (Mihaltz & Váradi, 2015). It has also been proven effective as a complement to electoral surveys (Ceron et al., 2014), to predict future trends in the market (Asur & Huberman, 2010), and to detect significant emotional changes in an e-Learning environment (Ortigosa, Martin & Carro, 2014).

Since our study aims to analyze the informal messages published in social network pages, in which expressing emotions is often important to show social support or as a part of online arguments, algorithms that identify the feelings in these are necessary (Thelwall *et al.*, 2010). The Sentiment Analysis tool makes it possible to detect and identify the role of feelings in the opinions expressed in social networks comments (Ortigosa *et al.*, 2014), even in texts written in Spanish. The previous work of Salas (2017) showed satisfactory results in the analysis of opinions in Spanish, where he found a

high assertiveness index in the categories of positive, negative and neutral opinions, based on a percentage of proximity with an associated feeling.

Finally, in the present research, after the analysis of feelings in the sentences of various Facebook pages that share information for women, a deeper content analysis is also proposed, based on the results found. This is made in order to determine the trend of opinions that express a positive and negative feeling about the theme of motherhood, in order to categorize the meanings found around the concept studied. In this way, it is intended to contribute to the knowledge in the areas of women and family, hoping that the results found can serve as a reference for the preparation of public policies and to promote greater interest in research that addresses these issues.

2 Methods

2.1 Methodological strategies

The type of study presented corresponds to a non-experimental explanatory one (Hernández, Fernández & Baptista, 2014) since it reveals the meanings behind the opinions expressed in social networks regarding the topic of motherhood and mother woman. Likewise, an attempt is made to discover where the trend points with respect to the positive and negative opinions of the users of the social network Facebook, relating the concepts found, through the analysis of the words found, with the literature reviewed.

2.1.2. Population and sample

The number of comments extracted from men and women, from January 2014 to July 2017, was a total of 4,778,633, from 40 Facebook pages, from this universe, a non-probabilistic sample of 28,907 comments was extracted, strictly related to the subject under study. This was done through a qualitative analysis with the cutting and classification technique (Hernández, Fernández, & Baptista, 2014).

Additionally, the meanings behind the most relevant negative and positive words could be interpreted, classified and codified with the study. In this stage, a total of 5127 positive trend comments and 1777 negative trend comments were analyzed manually.

2.1.3. Data collection instruments

To collect the information, the social network Facebook was used. The criteria used for the selection of pages was oriented towards the feminine groups of Facebook and topics about the current woman as a mother, these groups were open to the general public, where the most popular publications could be accessed when searching the group using the search option on the Facebook page. The key words we used were: Woman, Mother, Feminine, Modern Woman, Mamita, Mamacita, Current Woman, Maternity among others. The topics discussed in these pages were about motherhood, feminism, modern and current women, women's news, opinions about reality shows where the female characters were seen as mothers, among others. The opinions were extracted using the API (Application Programming Interface) that Facebook offers, during a few weeks a programmed algorithm, extracted, in an automated way the topics, the comments, and the people who made the opinions. The data was stored in a MySQL database.

2.1.4. Procedure

The procedure used in this study involves the realization of three major stages. The first stage is the construction and definition of an automatic comment classifier. The second stage is the definition of data for training and analysis. Finally, the third stage involves obtaining and analyzing preliminary results.

Definition of Data Sets

Construction of the Training Set

In order to obtain the necessary phrases for the training set, we created a Facebook fan page ([https://www.facebook.com/pg/MamitaOMamacita/posts/?ref=page internal](https://www.facebook.com/pg/MamitaOMamacita/posts/?ref=page_internal)) with the purpose to obtain about 500 positive, negative and neutral comments. The comments were about the perception of the meanings of “mother” and the perception of the meanings of hypersexualized woman (made for a later study), then we classified these manually.

In order to carry out this stage, 2 types of actions were made:

- Recurring publications. - This process lasted about 3 months, in which posts were published daily, minutes before the hours of greatest user connection (11 am and 4 pm). The number of publications was greater on days when people in Peru made more use of Facebook (Tuesdays, Fridays and Saturdays). The content of these post was news, videos, statements of public figures, as well as controversial images or phrases in relation to the concepts of older and current mothers (Molina, 2006, Arango, 2014, Reid, 2014) all these incited by questions for the sake of exchange of opinions and the publication of comments. However, an attempt was made to produce diversity on the positive or negative meanings associated with the idea of a mother, in order not to promote only a type of mother image or to incite the same kind of comments by the followers of the page.
- Page Promotion. - This was done to obtain the commitment of the people, especially women of childbearing age, to the page. The page was promoted through: Facebook publicity at a national level, face-to-face activities in Arequipa, and contests about the biggest confluence of people and online contests (held on Valentine's Day and Women's Day), which is in the number of comments and the online dissemination of the page for the increase of followers.

The web page reached more than 80,500 people, however only about 100 comments of each of the proposed polarities could be collected (positive, negative and neutral). It is possible that this is due to the fact that the tone of the publications of the page with respect to the subject of women and of mothers was of a neutral type, that is to say that it did not lean towards any particular type of vision, nor did it criticize only one position, so although there were many followers of the page and publications were shared, there were not many people willing to post their commentss.

Because for the training of the algorithm, it was necessary around 500 comments of positive type, 500 negative and 500 neutrals (the last ones were necessary to discard sentences without polarity) it was also decided to send a survey through Survey Monkey to 10 000 contacts asking them to mention their positive and negative opinions about being a mother.

In total, around 3000 comments about women as mothers were received, which had to be processed manually to meet the following requirements:

- The length of the comment had to be no more than 15 words, in the case that it was, they had to split to generate 2 or more comments
- Each comment should be unequivocally of one polarity. For example, if the comment said: "Being a mother carries an undesirable responsibility, but that seems to be gratifying for some women". This comment was divided into two parts, one was classified with negative polarity "Being a mother carries an undesirable responsibility" and another with positive polarity "... it is gratifying for some women".
- Each comment should be original and different from another, the comments that were repeated should be deleted.

Finally, the training set had the following configuration:

Topic	Positive comments	Negative Comments
Woman as a mother	846	679

Extraction of Data for Themes

Because the proposed pages contained a large amount of information regarding the diversity of topics, it was necessary to filter the comments that are relevant to the research topics. An initial strategy was to identify the most frequent keywords in the training set and, according to these keywords, extract the comments in which these words coincide. However, this approach was not satisfactory, so a list of words had to be constructed manually. These keywords were in some cases combined to be able to actually extract comments related to the topics.

It is necessary to indicate that this part of the process had to be carried out twice to obtain the current results. The first time a list of words associated with the word mother of 188 words was built, with which a total of 51 308 comments were obtained. However, when analyzing the results related to these words, it was found that most of the results did not correspond to the concept of the mother, so another more specific word list had to be made again (synonyms of mother or very close concepts) to this). For example: mother, motherhood, woman with children, pregnant woman, woman who has given birth, among others. This new list was composed of 90 words. As a result of this process, we extract 28907 comments

2. Building a classifier for Sentiment Analysis

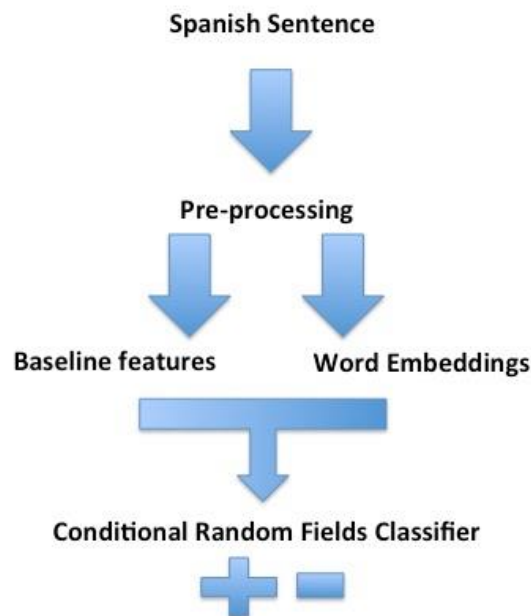


Figure 1: pipeline for building a sentiment analysis classifier

In Figure 1, we have the pipeline for building a classifier. The steps are detailed as follows:

- The training set is composed by several sentences written in Spanish. Each sentence has been labeled either as positive or negative.
- Training sentences are pre-processed basically, common words, connector words, and syntactic elements are excluded. We also identify URLs, emoticons which will be useful for building the automated classifier.
- Two kind of features are constructed. Base features: words and its context, *Part-of-speech-tagging*, suffixes and prefixes. We have also used features based on *word embeddings*, such as Word2vec and Glove. This features are useful due to group together semantically similar words.
- Finally, both kind of features are input to a probabilistic classifier, *Conditional Random Fields*, which decides about the polarity of a comment.

In addition, the more relevant aspects within positive and negative comments were identified. This process involves to identify relevant words in comments, and decide about its polarity (positive and negative). This kind of analysis is called *aspect-based sentiment analysis*.

3.- Obtaining and Analysis Preliminary Results

As a rule, there are two main approaches for the basic task of sentiment analysis, which is to decide about the positive or negative in a sentence: The first approach lies on a dictionary of positive and

negative words. Sentence polarity is decided according a score that measure whether positive or negative words in the vocabulary are relevant in a sentence.

The second approach is based on machine learning, i.e., learning a mathematical model from training data that allow us to classify a set of variables given as inputs. There are several approaches for learning models in the literature. In this article, we follow the second approach because, in terms of accuracy (lowest error rates of classification), it has obtained better results in the past.

The algorithm chosen was Conditional Random Fields (CRF), due to it has had a good performance in text classification tasks such as *Named Entity Recognition* (Copara, Ochoa, Thorne & Glavas, 2016). CRF is a probabilistic classifier that models the conditional probability of a class variable given a set of features variables, i.e., $p(Y|X)$. Thus, this classifier avoids modeling the joint probability of variables $p(Y, X)$, which is more convenient from a computational perspective.

In the context of text classification, X denotes the set of words in a given sentence. On the other hand, Y denotes the class variables, which assumes positive, negative or neutral values. In order to classify a sentence, X variables assume specific values, given word, and the most probable class is chosen: $\operatorname{argmax}_y P(Y|X)$.

Markov networks are useful to define $P(X|Y)$. In Markov networks a joint probability of a set of variables is given by product of a set of factors (which are completely connected components in a probabilistic independence graph).

In CRF, the conditional probability distribution of the class given the features is directly modeled using factors, as follows:

$$p(\vec{y}|\vec{x}) = \frac{1}{Z(\vec{x})} \prod_{C \in \mathcal{C}} \Psi_C(\vec{x}_C, \vec{y}_C).$$

This formule denotes the product of several factors related to the independence graph. This product is divided by a normalization term, $Z(x)$, which allow us to define a legal probability distributuion.

The normalization term, is defined as follows:

$$Z(\vec{x}) = \sum_{\vec{y}'} \prod_{C \in \mathcal{C}} \Psi_C(\vec{x}_C, \vec{y}'_C).$$

It is worth noting that this term is only defined on x . Thus, this simplification allows us to model the conditional probability distribution $P(X|Y) = P(X, Y)/P(X)$.

In this article, the previous algorithm was trained using a set of two thousand labeled examples (supervised learning). In order to measure its performance, we perform *10-folds* cross validation.

Accuracy was used as metric (proportion of positive and negative instances correctly classified). The *accuracy* obtained was 93 %, which denotes a classification error of 7%. This result was compared with a Naive Bayes algorithm which obtained 90 % of accuracy.

After executing the CRF algorithm on the target test dataset, Woman as a mother, the automated classification turned out:

Positive comments	20.858	72.16%
Negative comments	8.049	27.84%
Total	28.907	100.00%

We also perform aspect based sentiment analysis. We find several aspect words which are more common in the context of woman as a mother. These aspect words also have polarity associated (positive or negative).

The algorithm to find out relevant positive and negative aspects can be summarized in four stages:

- Applying a POS (*Part-of-Speech Tagging*) algorithm for the Spanish language which, based on a given input text, determines their syntactic functions, for instance, if a token is noun, verb, and so on.
- Identifying compound nouns, usually aspects about a theme are relayed to nouns, that can be simple like house, or composed like brother's house.
- Extracting more frequent compound nouns (aspects) within a set of comments and assigning a main aspect for each sentence that make part from a comment.
- Finally, extracting more frequent aspects in positive and negative sentences (previously classified with a sentiment analysis algorithm).

We found 400 several words related to this theme, 200 of positive trend and 200 of negative trend. Frequency of these words vary from 1840 to 8. Since the aim of this is to work is to gain insights about woman as a mother, we left the most significant words in our analysis, more frequent aspects in comments.

For each polarity the ten most representative words were chosen. In both cases, a frequency greater than 60 was obtained.

After, every comment related to each word was reviewed, by doing so we perform a qualitative analysis using cut and classification technique (Hernández, Fernández, & Baptista, 2014). This allow us to interpret, classify and encode meanings behind each of these words. We manually analyze 5127 positive comments and 1777 negative comments.

The following process was used in order to classify the meaning within each word:

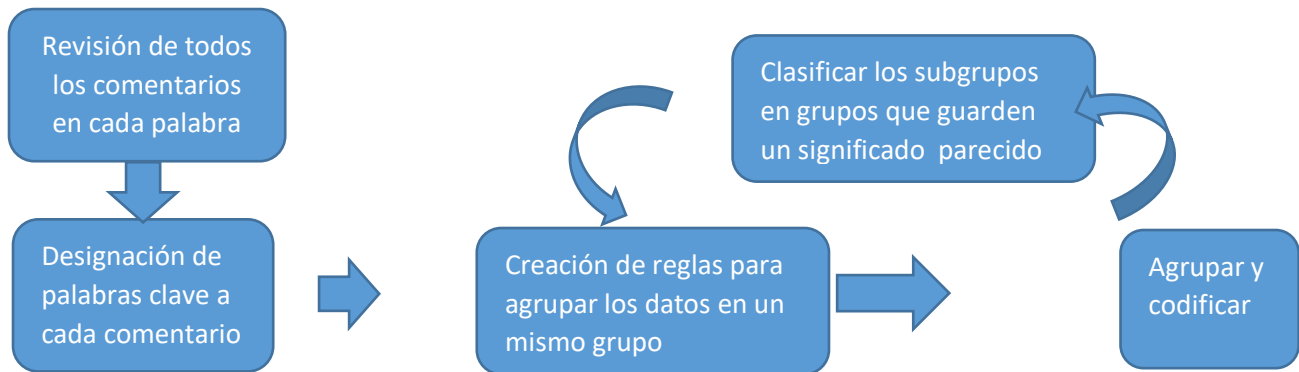


Figure 2: Qualitative analysis process

After this process the meaning of each word were classified in three groups, considering the greater number of comments within each meaning.

Example:

MOTHER. - Source of admiration, respect, importance
Bless
Society imposition

Finally, we chose the most relevant meanings for each word, to construct six bigger groups of meanings related to mother theme and proceed to their interpretation.

3 Results

The sentiment analysis algorithm turned out 20858 positive comments, i.e, 72% of the analyzed comments. We could argue that there is greater number of positive opinions related to maternity. However, a posterior analysis allows us to clarify these results.

The classifier also found different 400 words linked to this theme, 200 positive and 200 negative. Figures 3 and 4, depict mother shape word clouds constructed from polarity words. It is worth noting that the size of a word denotes its frequency in comments.

Word frequencies ranged from 1840 to 8. Thus, we decided to analyze only the ten most frequent words for each polarity. This 20 words were matched to 5,127 positive comments and 1,777 negative comments. Then, we performed a qualitative analysis using cut and classification technique to interpret, classify and encode comments (Hernández, Fernández, & Baptista, 2014).



Figura 2. Palabras en comentarios positivos



Figura 3. Palabras en comentarios negativos

By performing the analysis of each word, we were able to find out that the semantic of these words was related to the context in which the comments were written, i.e, the same word could have several meanings. While most of the time, there were words corresponding to their classified polarity; sometimes, the meanings were related to a different polarity or do not have polarity at all. Through a qualitative analysis of all comments linked to each word, we found categories by grouping the meanings regarding their semantic relevance within the word.

Table 1 and 2 show the results regarding the polarity analysis. In each one, we can observe the most relevant meanings for each word:

Table 1. Words more representative of the positive trend towards motherhood

POLARITY WORD	POSITIVE (+)	NEGATIVE (-)
MOTHER	Source of admiration, respect, importance. Blessing, impactful and rewarding positive experience	Imposition of society to oppress women / Women do not need to be to fulfill themselves.
MAMITA	Love to the mother	Ironic contemptuous term of naming a woman.
MOM	Personal experience of hard work and great responsibility. Blessing, change in life, important and rewarding.	
CHILDREN	Challenge experience, responsibility that only the mother can assume.	Criticism to irresponsible mothers and the idea that the happiness and the

	Blessing, experience of positive and rewarding impact in life.	culmination of a woman's life is having a children/ Heavy, unsatisfactory burden.
LIFE	Blessing, is not generated by the mother / Indicates the change of motherhood in women, the most important event. Private property of the person, the quality of each, and the freedom to choose, without interference from others.	
WOMAN	Deserving of respect towards their free choice, vindication Affirmation of the positive of being a woman. Motherhood in her is fulfillment and blessing.	
SON	Motivation of responsibility, demand in the face of difficulties / The mother is very important for the life of the child. The arrival of the son is a blessing and a transcendental moment / Positive daily experience.	
MOTHERS	Source of respect, admiration and gratitude for the important work done despite its difficulty. Experiences and anecdotes, desire to be a mother.	
DAUGHTER	Experiences of affection and anecdotes of the mother towards her daughter / advice on the upbringing of a daughter Responsibility and sacrifice that implies having a daughter. Happiness and gratitude for being a mother.	
LIGHT	Expectation and hope with giving birth as a close event. Positive experience of having given birth.	

Table 2. Words more representative of the negative trend towards motherhood

POLARITY WORD	NEGATIVE (-)	POSITIVE(+)
MAMMY	Ironical and despective name to call a woman	Expression of affection to a woman (not a mother) Love to the mother
MOTHER	Criticism and warning to mothers who do not adequately perform their work. Imposition of society to oppress women / Women do not need to be to fulfill themselves.	Need to denounce the old mother stereotypes and expand and claim their concept.
SONS	Warning and advice about the difficult work and great responsibility of the mother. Criticism of irresponsible mothers and the idea that the happiness and the culmination of a woman's life is having them / Heavy burden, unsatisfactory	

MOM	Criticism regarding the attitudes of a woman (when she is a mother she must become respectable). Blessing, experience of positive and rewarding impact in life.	Experience of great rewarding responsibility, advice to assume it.
LIFE QUALITY	Relationship between motherhood and loss of quality of life.	
TIME	Decrease in the availability of time with the arrival of the children: little free time for the mother, little time to spend with the children and need time to carry out activities together. Private property of the person, which each one cares for and on which one has the freedom to choose, above all in relation to being a mother.	
YEARS		Valuation on the number of years that I know is a mother, and the age of the children, nostalgic and positive perception.
MOMS	Criticism regarding the attitudes of a woman (when she is a mother she must become respectable).	Claim the qualities of the mother and expand her concept / worthy of respect and appreciation.
WOMEN	Need to defend independence and free choice to decide to be mothers. Criticism regarding the attitudes of women in the show business.	Admiration and respect for women who chose to be mothers despite the difficulties.
SON	Responsibility, difficulty of raising a child, since it has to be well educated / criticized when this work is poorly performed.	

From Table 1, most of the words have a positive semantic, but within some words, the same word has a negative meaning regarding maternity. The word *mamita (mommy)*, for instance, it is referred negatively to woman, it is not necessarily used to denote a mother; it can be referred to refer tenderly a woman friend or sometimes a tender way to refer the own mother.

Finally, we consider the most important findings in these words, in order to construct 4 bigger categories of meanings about maternity opinions.

Table 3 Categorías resultantes del análisis del contenido de las palabras

CONCEPT	MEANINGS BEHIND CONCEPT
SUPERMOM	<ul style="list-style-type: none"> - Source of admiration, respect, importance and gratitude for the important work done despite its difficulty - Challenge experience, responsibility that only the mother can assume - The responsibility that comes with it demands that the woman get ahead regardless of the difficulties. - The mother is very important for the life of the child

	<ul style="list-style-type: none"> - Criticism of irresponsible mothers - Criticism and warning to mothers who do not adequately fulfill their task of educating. - Warning and advice about the difficult work and great responsibility of the mother - When the woman is a mother she must become respectable - Relationship between maternity and loss of quality of time, lack of availability of time to fulfill maternal tasks and free time. - Admiration and respect for women who chose to be mothers despite the difficulties.
MOTHERHOOD AS A BLESSING AND AS A SOURCE OF AFFECTION	<ul style="list-style-type: none"> - Blessing, gift, happiness - Positive and rewarding positive experience - Related to giving and receiving of love - The most important change in a woman's life - Cumulo of experiences and positive anecdotes - Illusion, expectation and desire to be a mother - Gratitude for being a mother - Assessment of the stage of motherhood and of the experiences with the children.
MOTHERHOOD AS A REJECTABLE OPTION	<ul style="list-style-type: none"> - Imposition of society to oppress women - The woman does not need to be a mother to perform - Children are not the happiness and the culmination of a woman's life - Children are a heavy burden, unsatisfactory. - Need to defend independence and free choice to decide to be mothers
NEW CONCEPTS OF MOTHERHOOD	<ul style="list-style-type: none"> - Need to denounce the old mother stereotypes and expand and claim their concept - Tips are shared to support the practice of motherhood. - Claim the qualities of the mother

4. Discussion and conclusions

The notion of motherhood has changed throughout history, particularly in relation to the notions of foster care and the image of women (Molina, 2006), especially during the SXX and twenty-first century, in which there have been various socio-economic changes, cultural and technological advances that have influenced the way in which the maternity is perceived today. One of the milestones in this change has been the entry of women into the workplace, from which the proportion of women workers has grown dramatically (Sánchez, Herrera & Perrotini, 2015), at the same time that the age of integration into the labor market was started to give at earlier ages and their output to later ages (International Labor Organization (2015). This situation has led, in the postmodern era there is a contradiction between the search for competitive and professional gains by women and the demands of parenting (Molina, 2006).

In this situation, on the one hand the mothers have had to combine their work outside the home with household tasks and child-rearing with a tiring second shift (From The Field, 2006). Data such as those found in Colombia, exemplify what happens in many families in Latin America, where this entry of women into the labor market generates guilt because of the shortage of time to fulfill their role as mother (Puyana, 2003). On the other hand, this has led women to evaluate the time to formalize a relationship, which is occurring at an increasingly younger age older (Sole & Parella, 2004; United Nations, 2015; Londoño, Bedoya & Tamayo, 2016), and also seeking the postponement of motherhood in pursuit of economic and social accommodation first (Montilva, 2008).

All this indicates that at present, maternity is considered as a child element in the life of the woman (Fuller, 2005; Arango, 2014; Reid, 2014) and has ceased to be the end of its realization as a woman (Londoño, Bedoya & Osorio, 2016). That is also the message that predominates in the media (García & García, 2004; Bernárdez, 2009; Guarinos, 2009). For this reason, the present study sought to investigate the current perception of motherhood, in order to be able to properly identify the image of women mother in Peru. To this end, was used as a source all pages of the public groups in Facebook that will deal with this issue, by means of the technique of Sentiment Analysis.

The objective was to analyze users' perceptions of these pages and find out which is the predominant trend toward motherhood in Peru, if it is positive or negative. Furthermore, the aim was to find the terms associated with this finding, although even the traditional concepts of the exercise of motherhood persist, while motherhood coexist contrary to trends as well as new meanings in training.

- Among the main results, it was found that 72% of Peru comments on pages contain positive feelings toward motherhood and the image of mother. Which at first it seems to indicate that Peru is not considered motherhood as incompatible task with the personal development of women (De Beauvoir, 1989) or that this is considered a myth constructed by society that is not natural to women (Valladares, 1994). However, further analysis of the words most associated with both positive and negative trend, should be discussed. For among the "positive" meanings attributed to motherhood there are different nuances that could indirectly indicate a negative perception of motherhood. Given this, the four categories of meanings resulting from the gathering of meanings found in each word, which would constitute the most important concepts about motherhood will be discussed: supermom, motherhood as a blessing and a source of affection, motherhood as a rejectable option and new concepts of motherhood.

Among the concepts found in the perception of "super mom", which were found in most reviews, it seems to encompass only positive comments. However, these are loosely related to the modern conception corresponding to exclusive and intensive motherhood maternity, corresponding to large investment of energy, resources, knowledge, ability to love and subordination of their own desires for the mother (Molina, 2006). The results mentioned several times the difficulty of being a mother, the responsibility involved and the lack of time to fulfill their duties. While these are expressed in key admiration, respect and importance, they are also presented as unworkable. It is an idealized concept of motherhood as a giant, which curiously is among the reasons why many young women have chosen not to be mothers. (Ramirez-Ramirez, 2013; Moon and Mejia, 2017). Similarly, although the word "responsibility" was given a positive connotation, it should take into account the real meaning that it has for the present generation. According to Castillo (2009) we are currently living in an era where freedom is the value premium to any other, so the responsibility is seen often as an impediment to freedom and therefore this generation look at the word "responsibility "with suspicion, so far as possible exercise is avoided.

Also, within this concept criticism of mothers who do not properly fulfill their task of educating and what respectable must become a woman to be a mother is mentioned, which suggests in turn how difficult it is to express motherhood, even in networks social, where mothers often are harassed with feedback they receive from their own families and support groups as other mothers (National Poll on Children's Health, 2017).

One of the categories constructed from the concepts found is the "motherhood as a blessing and source of affection", within this, motherhood is defined as a gift, a source of love and happiness, as well as blessing. Comments pointed especially the shocking and rewarding positive experience that is becoming a mother and be one every day. This group of meanings is the most related to a physiological concept that involves bringing children into the world, nutrition and care during the early years (Molina, 2006). And also it refers to the old conceptions about it. Where the meanings of motherhood, procreation and women were closely linked to the meaning of life, generosity, and satisfaction in the care and nurturing of others (Molina, 2006).

However, meanings related to negative sentiment towards motherhood as the third group of categories which encompassed the concepts related to "motherhood as rejectable option" were also found in these emphasizes that motherhood is an imposition of society to oppress women, whereby the nature of maternal instinct is conceived as a socially constructed myth (Valladares, 1994)

Arguments about women not needing to be a mother to perform and that children are not the happiness and summit of the life of a woman, but rather imposed a heavy burden are presented. This concept challenges the positive meanings around motherhood (Ramírez-Ramírez, 2013) considering it a burden for women (De Beauvoir, 1989). This category of meaning is directly related to the first wave of critical feminism that detaches the mother figure of female identity (Godoy and Vidal, 2013), as well as the comments grouped in this, stands the discourse on the need to defend the independence and free choice of women to decide to become mothers.

Finally, those meanings which could not be included in any of the above categories were grouped under the category "New concepts of motherhood" which refers to the need to denounce the old stereotypes of mother and to expand and vindicate its concept and qualities, while they evidence the need for collaboration to exercise motherhood. As Molina (2006) pointed out, we are in an era of a new discussion on maternal identity, where their roles and functions are not clearly defined, but rather open to new relationship spaces.

The importance of this research respond to a need for demystification of motherhood and the need for analysis of the rapid demographic changes such as decreased fertility and postponement of motherhood is not only evident in Europe and North America, but also in Latin America, where this confusion about the roles of motherhood, presents many times overburdened women of responsibility and guilt (Puyana, 2003) before a visible contradiction between the maternal role of intensive farming and the pursuit of personal fulfillment of women (Molina, 2006).

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