

Democracy, social networks and new way of representation: Use and impact of Twitter in Brazil's 2018 legislative elections

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ABSTRACT: *The concepts of democracy and political representation have been constantly changing. Today, the most impressive change comes from the world wide web. The internet has provided a number of unimaginable possibilities 30 years ago, and among these contributions are social networks. The latest electoral processes around the world have shown some prominence in social networks before, during and after polling day. Twitter is one of the main tools used in the political arena for the move up and promotion of electoral support, so the question is: how has Twitter been used as a new means of fostering political representation in the digital age? The research assumes as main hypothesis that greater use of this tool enables the candidate for an elective office, better electoral performance, and change the profile of use between periods, post and pre-election. To this end, we sought to understand and explain the impact of Twitter on the process of competition in Brazil, how presidential candidates used this tool and what impact it had on the votes of federal deputies elected in 2018. The investigation followed the path of the hypothetical-deductive method and allowed two approaches to data treatment: descriptive for the profile of use of candidates for presidency of the republic in 2018 through the tool Twitonomy and MAXQDA; and quantitative, performing a series of statistical tests with primary Twitter data from federal deputies elected in 2018 and their respective parties, and secondary data provided by the TSE. The main results point out that Twitter, as well as other social networks, incorporate and initiate a new aspect of the concept of political representation; presidential candidates seek to use the tool more intensely during the election period and seek to anoint support, share links and publicize their future radio and TV appearances. Statistical tests showed that there is a positive impact of using Twitter on deputies' roll-call votes, with the following variables: party followers, candidate tweets and campaign spending having a greater impact on the Artificial Neural Network model.*

KEYWORDS - Artificial Neural Network, Twitter, Social networks, Representation

I. INTRODUCTION

Life in society presupposes a series of dilemmas, conflicts and consensuses that must be revealed through formal and informal institutional arrangements and aim to give greater predictability to society events. The social dynamic is born from the need to make decisions and has a direct impact on the institutionalization process, for which political activity gains the main role. In democracies such choices take into account the will of the citizens. In this sense, each individual will be able to take advantage of the window of opportunity to express whether they are favorable or unfavorable to a specific government agenda.

However, due to the gigantic territorial scales and the quantitative population, it has become increasingly complicated to take into account the position of each member of society in making any political decision. Therefore, representative democracy is born with the purpose that each citizen can choose a representative through a vote, which in theory will politically represent the will of those who elected him.

The political desire then becomes operationalized by the representative system through a relationship of delegation. Nevertheless, technological advances could make the political process possible through the

channels of network technology that has evolved to the point of becoming what is known today by the internet's digital interaction space. It is precisely with the advent and popularization of the internet that the exchange of information between physical distances could be quickly overcome, since it was possible for information to cross the pacific in a matter of milliseconds and which today already has about 4.3 billion users worldwide (**Datareportal, 2019**). This possibility renewed the hopes of enthusiasts of direct democracy, who saw the internet as a way to overcome the problems of representative democracy (**Norris, 2000**). The internet inaugurates a new way of thinking about politics, as in its environment, there is a typical model of arena with positions and ideas for all sides of the spectrum, combined with a wide range of journalistic information. In this way, it will result in the consequent drop in the information costs of the citizen (**Downs, 1999**). Nevertheless, there is still a lot to be done in this world of revolutionary information technology.

Unlike the classic sense of society, in which the individual does not choose to be part of it or not, as one is born a member and belongs to a certain family group, in relation to the internet, existing social processes have created a diversity of digital social systems, in which it is possible to simulate a complex set of online social interactions, called social networks. In them, it is possible for individuals to choose to join the digital society, have friends, followers, family members, share photos, news, experiences and their daily lives. The social network Orkut was the first to become popular in 2004, created by a Google engineer of the same name. Following the popularity that Orkut had, other social networks such as: MySpace, Twitter e o Facebook. Currently, there are already 3.4 billion active users daily on social networks in general, using these services on average for approximately two hours a day (**Datareportal, 2019**).

As in traditional society, social networks were soon taken over by issues and themes related to what was happening politically at that particular moment. Debates between right and left, defense of candidate "x" or "y", electoral propaganda among other forms of political activity, in addition to the emergence of smartphones, which helped to pave the way for the entry of various segments of political candidates on social networks, mainly on Twitter, a tool highlighted and analyzed during this work. It is not possible to think of politics as something parallel to what happens on social networks currently, especially Twitter. The Microblogging it already has more than 250 million users, and the social network most used politically due to its speed and practicality (**Datareportal, 2019**). Its importance is such that **Jungherr (2014)**, in an analysis of works on the subject, he believed that the election results reflected the behavior predicted on Twitter by its users. Furthermore, recent political moves have once again placed Twitter at the heart of the political debate: Brexit and the 2016 United States of America presidential elections. In the first, there is a huge suspicion that there was an algorithmic manipulation of information via Twitter, aiming to change the result of the referendum that would lead to the withdrawal of the United Kingdom from the European Union. While in the second, the use of Fake News by social networks, including Twitter, would have played an essential role in the election of Donald Trump as President (**Allcott; Gentzkow, 2017**).

In Brazil, the perspective does not change much, the country has 140 million active users on social networks, YouTube, Facebook, Instagram and Twitter are respectively the most used networks by Brazilians, who have an average use of three and a half hours a day. (**Datareportal, 2019**). Within the Chamber of Deputies, of the 513 federal deputies, 460 have Twitter accounts.

Therefore, analyzing how Twitter has impacted the elections is important, as it perceives it to be difficult to explain the functioning of the political system without the direct influence of dialogue on social networks. Therefore, it is sought to understand how Twitter can be helping to change the concept of representation that, due to its dynamism, takes on the aspect of being a growing process of updating. Therefore, this work is guided by the following research question: how has Twitter been used as a new means of fostering political representation in the digital age?

The following assumptions are hypothesized: the use of Twitter as an instrument to strengthen the relationship between candidate and voter has a significant effect on the electoral performance of proponents, and that there is variation in the use of Twitter between pre- and post-election periods, in addition of causing direct reflection in the production of the candidates' image.

To carry out the investigation around the answers to the proposed problem, it was sought to achieve the following objective: to analyze how the frequent use of Twitter by candidates elected to federal deputies in the 2018 elections, improved electoral performance, enabling the expansion of roll call. To reach the

goal, the following specific objectives were outlined: to discuss the meaning and re-meaning of political representation based on social changes and specifically in the context of network relationships; identify and measure the intensity of use of Twitter for the purpose of political-electoral disputes; and finally, to infer the relationship between the exposure of elected candidates through Twitter interactions and electoral performance.

Through the hypothetical-deductive method, we seek to corroborate or disprove the announced hypotheses. The present essay is a quantitative survey that aims to shed the first scientific light on the use of Twitter and the number of votes of candidates for legislative power in Brazilian elections. The investigation was concerned with applying a series of statistical tests (ANN and PLS) to measure the impact of Twitter functions on the voting of candidates elected to the Chamber of Deputies of the Brazilian Parliament. To do so, a preliminary discussion on the dynamics of representation and its challenges was followed.

II. DEMOCRACY AND REPRESENTATION: THE FACES OF REPRESENTATIVE GOVERNMENT

2.1 From democracy to representative government

In ancient Greece it was a great tangle of independent cities or city-states, often surrounded by rural areas. The most famous of these is undoubtedly Athens, which around 507 B.C. adopted the democratic system that would last for two hundred years until the city was taken over by Macedonian rule. (Dahl, 2001). The Athenian government was very complex: at its center, there was an assembly, in which all citizens were authorized to participate and had isegory, isocracy and equality. As a matter of priority, the way to reach rotating public positions was restricted to the drawing of lots, since only then, any citizen would have an equal chance of achieving public duty (Dahl, 2001; Manin, 1997). The exception, it is an ancestor of what is now understood as political representation, was on account of military positions, as it was an extremely important post and demanded experience for the defense and survival of the city. To this end, an election was held among the members of the assembly to choose the best name for the position (Manin, 1997).

The representation appears as a way to encompass the large territorial extension that the great States now had, which would make direct democracy impossible. For Dahl (2012) "[...] representation can be understood as a historical phenomenon and also as an application of the logic of equality to a large-scale political system" (p. 340). The representation also enables the second and third consequences, which are the unrestricted expansion of democracy to national states and the limitation of political participation, respectively. The participation from the perspective of classical theory would enable greater citizen participation, while in modern democracy there would be a reduction in this participation. The fourth and fifth consequences come from the social plurality and the consequent conflict that is generated by them. Dahl (2014) considers that conflict is an inevitable aspect of political life, its existence being necessary and healthy. Before dealing with the last characteristics, it is interesting to note that the change in the general context of democracy – moving from a local exercise to beginning to exist on a national level – contributed too much to the development of a set of institutions that, in general, ended up differentiating the modern democracy of all other existing political systems, thus defined Polyarchy (Dahl, 2000; Pereira, 2014).

Downs (1999) and Olson (1999) are the main representatives of one of the perspectives most approached by Political Science today: rational choice. While the first seeks to understand participation and political phenomena from an economic analysis, the second seeks to understand collective behavior according to US institutions.

Thus, on the basis of this rational logic, Downs seeks to understand electoral behavior and party competition. Therefore, it defines that the ultimate goal of every political party would be to win the elections, requiring the greatest number of votes possible, while each party member is moved by the prestige and power arising from each position. It is perceived that any action carried out with previously planned economic or political purposes will be rational, taking into account the maximization of benefits and minimization of losses (Downs, 1999; Scheffer, 2013).

The dynamics of the parties was explained by Downs emphatically, considers that in a given bipartisan system, the two parties have political views distributed in two extremes, therefore, they will tend to make their discourse more flexible to the center, seeking to offer favors to average voters, aiming to achieve

greater number of votes, while in a multiparty system there are several representations across the political spectrum, thus leaving little room for parties to flex their speeches to attract more voters (**Downs, 1999**).

O'Donnell (1994) understands that the democratic regimes present in South America would have followed a different path from that traced by already consolidated democracies, believing that in addition to formal institutions, it was possible for a democracy to survive surrounded by informal institutions and even by authoritarian practices. From this situation, a kind of delegative democracy emerged (**O'Donnell, 1994**), which would consist of a combination of authoritarian practices and institutions in the model of a polyarchy, a regime in which the conditions listed by Dahl would be present, such as free elections, for example (**Dahl, 2000**).

The main idea of O'Donnell's delegative democracy would be the possibility of a hybridity between the democratic and the authoritarian elements, which would practically balance and impede both the progress towards the consolidation of the democratic regime and the return to the authoritarian regime. (**Daza, 2014; O'Donnell, 1994**).

As noted, the notion of democracy, as will also be seen in the notion of representation, has a mutable and aggregating character and will, as time goes by, modifying its own understanding, embracing some concepts and getting rid of others.

2.2 Political representation as a process

The political representation emerges as a means to overcome democratic obstacles such as the existence of a vast population within a territory and the impossibility of direct democracy (**Dahl, 2012**). Its conceptualization goes through some difficulties, which start from its etymological root. According to the arguments of **Brennan e Hamlin (1999)**, direct democracy is seen as imperfect, while representative democracy and its institutions are seen as superior options. Coming from the Latin word *representare*, which means to become present or manifest, and **Pitkin (2006)** says that its use would be completely linked to inanimate goals. Only with the advent of the 14th century did the word begin to take on the contours that exist today, much in view of the use by the Catholic Church when it was often said that the Pope and cardinals represented the person of Christ and his apostles (**Lagarde apud Pitkin, 2006**).

In the period between the 14th and 17th centuries, the word representation continues to gain political contours during the absolutist period. At that time, the Kings customarily summoned nobles, knights and bourgeois who inhabited lands in their kingdoms to consult them about new tributes, military preparations, among other royal needs, and taking advantage of the trip, these figures brought complaints about their origins to the King, acting as if they were representatives (**Pitkin, 2006**). The author also believes that the English word *represent* gains its political connotation with the advent of leafleting and public debates held before the English Civil War and the rise of the supremacy of Parliament.

The conceptualization of political representation is not a simplest task. **Pitkin (1967)**, in *The concept of representation*, a seminal work on the subject, did a considerable theoretical effort to do so. The author believed that political representation is primarily public, an institutional arrangement that involves groups, interests and people, which operates in a complex large scale of other social arrangements, making political representation not only a single action by a participant, but, a general structure and functioning of the system, the patterns that emerge from a multitude of activities carried out by an indefinite number of individuals, representing in other words, making the absent present present (**Pitkin, 1967 : 221-222**). The representation will depend both on the will of who authorizes the representative, and on the political judgment and inspection by the represented in order to actually exist on his property as a vigilant authorization (**Almeida, 2014**).

The formalist representation is the basic idea of a person representing another through a consensus, but in this case, the institutional model precedes and will initiate the representation. The formalist representation is further subdivided into two other species: the formalist authoritative representation and the formalist accountable representation (**Pitkin, 1967**). The first arises from the Hobbesian ideology and has as its basic premise the notion that the representative is someone who acts as a function of the represented's prior authorization, often bearing the consequences of the performance of the former. (**Loureiro, 2009**). The author herself raises some questions about the possibilities of evaluating the representatives regarding this subtype of formalist representation: "If representing means merely acting with special rights, or acting with someone else bearing the consequences, then there can be no such thing as representing well or badly" (**Pitkin, 1967 : 55**).

While in accountable representation or by liability, after that, **Loureiro (2009)**, which has roots in liberal thought, the essence of the relationship between representative and represented is one of responsiveness, in which during and after the representation relationship, the represented may punish his candidate by withdrawing or returning him to the position previously held. The symbolic representation, together with the descriptive representation are part of the "standing for" representation and has origins in the liberal thought of John Locke. In this type of representation, "stand for" would mean acting for others, in which the represented would maintain a close connection with the representative, especially in the legislative field (**Alkmin, 2013**). As for the symbolic representation, this can take different forms in the most diverse human activities, for example, a cross can represent Christianity, a flag can represent a country, as well as a king or a president can symbolize an entire nation. In short, symbolic representation is constructed through a psychological, emotional and even more irrational than rational perspective, so much so that rituals are often necessary to reaffirm them. (**Pitkin, 1967 : 101-103**). There is actually, according to **Alkmin (2013)**, an inversion of meaning in the symbolic representation, since in this, they must be assumed by the represented, and that, when relationships of this nature are elevated to the extreme, they result in totalitarian and/or fascist experiences like those that occurred after the end of the first wave of democratization (**Pitkin, 1967 : 212**).

Burke (2010) fully believed in the impossibility of the imperative mandate, and proposed another, known contemporarily as the "representative mandate", whose representative would normally know the demands of that place that elected him, but would also be aware that he would be part of a group of representatives of a general policy, underlining that the representatives would make up the representation not only of a place, but of an entire country, therefore, they should discuss and deliberate policies that consider the situation of the country in its entirety, and not only the reality of the place that elected.

Manin (1997) rigorously analyzing the representative governments that existed until then, he realized that there were a series of constants, four conditions that were repeated in all the representative governments analyzed, which he coined as the principles of representative government, also the name of the book that deals with the theme. In this work, the author also analyzes how representation took place during the period under study, leading him to identify three distinct moments: parliamentary, party and public democracy (**Manin, 1997**).

In an empirical and peculiar analysis of the North American context, **Mansbridge (2013)** realized that there would be a diversity of forms of representation, namely: promissory, anticipatory, gyroscopic and substitute representation. The promissory representation consists of the standard representation model. During the campaign, candidates would make promises that would bind them, if elected. The model is based on the social idea of the principal-agent, in which the principal (electors) should necessarily have their agent (elected) under control as representatives of their political desire, generating an imposing accountability (**Mansbridge, 2003**). The failure to fulfill the previously established electoral promises could lead the voter to no longer vote for that referred candidate. Both concepts of democracy and political representation have undergone and are undergoing a series of transformations within them, being also responsive to technological advances in society. Differently from what is believed, the concept of political representation reveals a permanent political process of delimitation of its meaning, opposing the mere formalistic concept of representation, in which this takes place through the existence of a contract that would be the representative linked to the desires of the represented. What happens is: political representation is a concept in a continuous process, with the possibility of adding new meanings and limitations as the generations go by, just as it also happened and occurs with the concept of democracy, previously discussed (**Urbinati, 2005; Almeida, 2014; Rosanvallon, 2009**). The advent of the information age, especially with the rise of social networks, brought a series of consequences to the concept of representation, giving the first notions about digital representation or e-representation (**Ituassu, 2014**).

The emergence of the internet provided a change in the direction of communication between human beings. It opens up the possibility of connecting people geographically distant from each other, exchanging information in virtually real time, getting a new following of virtual friendships.

The internet has made it possible to create a new facet of human life, digital life, in which more and more time is spent connected. Approximately 4.388 billion people already have access to the internet worldwide, reaching a level of 57% worldwide infiltration (**Datareportal, 2019**). One of the main factors

responsible for such a large number of users is social networks, one of the great attractions of the internet, given its ability to connect people through the world wide web and transfer information in a matter of seconds, which takes approximately 3.484 million people to be active users of these services (**Datareportal, 2019**).

With the expansion of the digital world, the interest of political leaders also grows, who already have several ways to interact with the population in digital media. It so happens that social networks provide the candidate with several new ways to interact and foster support for their political platforms, which also has an impact on the concept of representation. **Coleman (2005)** observes that representing is above all a form of communication, therefore, representation is sensitive to the ways of communicating. The author compares radio and television with megaphones, which are forms of communication that only transmit, without receiving interactions and, consequently, not receiving feedback, however, they reach a determined target audience. (**Coleman, 2005**). The internet would have the power to break these boundaries, as it would make it possible to overcome the impossibility of feedback, allowing direct communication between representatives and those represented, even on a permanent basis. Therefore, social networks could precisely achieve what Coleman (2005) called permanent representation, a concept in which the act of politically representing someone would not have a merely electoral intention, which would end soon after the election, but which was renewed in each new form of interaction through digital platforms.

2.3 Twitter: origin, characteristics and political use

The facility to get information is currently excessive, today it is not enough to just consume the news individually, it is necessary to understand and see what other people are talking about that particular subject, in addition, the great political success of social networks is undoubtedly also through the use of twitter. The tool was created in March 2006 – and made available for general North American use in June of the same year – by four Americans: Jack Dorsey, Evan Willians, Biz Stone e Noah Glass. The service only achieved Brazil in 2008, however, only in July 2011 began to be used with a Portuguese language version. Worldwide, Twitter has more than 330 million users, whose highest age group of use is people between 25-34 years, with the predominant majority of men(**Datareportal, 2019**). According to the company, daily more than 134 million daily active users, spending up to approximately 4 minutes on the platform .

The constant basic premise in this social network is the quick exchange of short personal updates, generating dynamic and fast information (**Halavais, 2014**). According to **Stutzman apud Halavais (2014)**, Twitter relied heavily on the organizational structure of IRC, in which through channels, you could talk to other people using commands like “/” or “#”. However, there are understandings that believe that those who would use a digital network would use more, so this diversity of use by the same user would lead developers to share functions, which could justify the adoption of IRC tools by twitter.

Sometimes called a microblog, sometimes treated by a social network, Twitter has a series of specificities that require its explanation to have a complete notion of its features. Microblog would be a reduced and more dynamic version of a blog, a digital space for the individual to share ideas, photos, videos and personal information about a certain thing or person. **Orihuela (2007)** believes that microblog would go beyond this concept, would include beyond the blog itself, a social network and a form of instant communication, since there would be less analytical tendency and a greater need for dynamic conversations.

2.4 Fake news, algorithmic manipulation and polarization: the harmful use of social networks in policy

In the early 2000s, with the growth of the internet, a significant number of independent news sites began to emerge, sites often without fact-checking or serious editorial curation, but with a plethora of viewpoints, which it would make it much easier to find opinions similar to each other, including in the political field, leading to the emergence of echo chambers, or informational bubbles (**Pariser, 2011**).

With the expansion of new means of communication at the end of the 20th century, one of the main concerns of society begins to spread, the already known, fake news. As shown by **Allcott and Gentzkow (2017)**, fake news, which existed since the beginning of the 19th century with the emergence of the print media, later gained expression with the dominance of radio as the main means of communication. **Allcott and Gentzkow (2017) and Lazer et al (2018)**, conceptualize fake news as false or distorted information that is

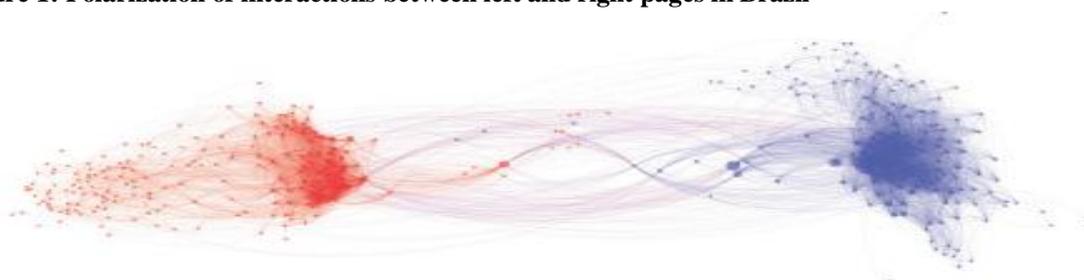
exposed as if it were real news, with the intention of deceiving the reader or exploiting their passions and/or opinions.

The concern about this phenomenon began mainly after the 2016 US presidential election. According to studies of **Higgins et al (2016)**, **Timberg (2016)** and **Rodgers & Bromwich (2016)** during the election period in the United States, Facebook and Twitter recorded more interactions with fake news content than with news in most traditional newspapers. Of these, most portrayed views that confirmed political positions or supported a particular candidate.

In Brazil, this phenomenon has occurred since the 2014 elections, including the vote for the impeachment of the President Dilma Rousseff (PT), when 3 of the 5 most shared news on Facebook were fake (**Silveira, Sanchotene and Lavarda, 2017**). According to the estimative study of the DFNDR Lab, in the first quarter of 2018, there was an increase of 11.97% in false news hits compared to the last quarter of 2017, with more than 90% of them being propagated by social media. With the elections approaching, the second quarter of 2018 registered an increase of 51.7% compared to the first quarter of the year, with easy money (32.5%), celebrities (20.3%) and politics (19, 5%) are the three subjects with the highest detection of misinformation.

During the first half of 2014 to 2016, the interaction pattern of 12 million Brazilians on social networks was analyzed in 500 most relevant pages, and it was found that there is presence and an interaction pattern divided into two large mutually exclusive groups, such as you can see in the Fig.1 (**Ribeiro and Ortellado, 2018; Sorj et al 2018**).

Figure 1: Polarization of interactions between left and right pages in Brazil



Source: SORJ, et al 2018.

As shown in Figure 1, on the left side and in red, there are all the pages of left-wing political parties, together with support for feminism, human rights, LGBT agendas and the black movement. On the other side, blue, right-wing political parties, moral movements, conservatives and liberal economic agendas (**Ribeiro; Ortellado, 2018**). The discrepancy between the groups is remarkable, barely able to point out convergences between those who like the left and right pages, since, as the literature shows, hardly anyone who follows a right page is congruent following a left page, or the contrary. This fact tends to happen due to the influence of the algorithms installed in the systems, which promotes an informational bubble, which positives their pre-convictions. From this polarization, the aim is to specifically inform each of these two groups, what the North American bibliography has conceptualized as hyperpartisan media (**Faris et al, 2017**).

III. METHODOLOGICAL ASPECTS OF THE RESEARCH

Based on the quantitative, statistical and inferential model, we sought to measure the impact of followers and tweets on the performance of roll-call votes of federal deputy candidates in the 2018 elections.

To forward the investigation and to answer the research question, the hypothetical-deductive method was used, in order to find subsidies to corroborate or dispel the hypothesis of the positive impact of the frequent use of tweets on electoral results. The expectation is that the greater the number of tweets and followers of a given candidate, the greater his electoral performance.

The research deals with the empirical-quantitative verification of the impact of Twitter on the electoral success of Federal Deputies elected in the 2018 election.

3.1 Population, sample and exclusion and inclusion criteria

The population in this survey is made up of federal deputies elected in the 2018 general elections and their respective Twitter accounts. Of the 513 elected deputies, 54 do not used the tool, therefore, placed outside the analysis criteria. In general, 457 of the 513 deputies were analyzed, approximately 90% of the total number of representatives.

3.2 Data collection procedure

The data used in the research are primary and secondary origin. The primary data coming from Twitter was extracted using the technique called Web Scraping. This technique consists of extracting information from any website and structuring it in a format that is easy for the machine to interpret, such as formats CSV (Comma-separated values), XML (Extensible Markup Language), JSON (JavaScript Object Notation), etc. To perform the extraction, a program was written in Java that uses a library called Selenium, which provides services for interpreting web pages and extracting information. The program receives, as input, a file containing the characters "ats" (identification) of Twitter profiles and searches the microblog for the information selected in the program's interface. After extraction, the program stores the data in a CSV file that is easily interpreted by the machine, or analyzed by spreadsheet tools. It is also worth mentioning that the collection took place after the election period, as Twitter does not allow for free access to data from past times by API.

The secondary data, on the other hand, come from the Repository of the Brazilian Superior Electoral Court, with the exception of contracted campaign expenses, the number with roll-call votes is ready without further treatment. As for expenses, through the Microsoft Excel software, it was tried to add up all the expenses contracted by the candidates, thus reaching, in the end, a unique number for each candidate.

3.3 Description of variables

To carry out the statistical tests, the dependent variable (DV) is the number of nominal votes obtained by each of the elected deputies. As an independent variable (VI), the following were used: position in the party's ideological spectrum (ID Spectrum); number of Twitter followers per candidate (FollowersC); number of followed by candidate (FollowedC); number of candidate's tweets (tweetsC); contracted expense in campaign (Expense); Followers, followers and tweets from the party of elected candidates (SeguidoresP, SeguidosP and TweetsP), respectively.

The Twitter variables (Followers, Followed and Tweets) were collected directly from each of the candidates' accounts. The number of followers refers to the amount of other users who follow the candidate in the tool and receive their updates. The followed are those accounts that the candidate or party follow and consequently receive their updates. The number of tweets, on the other hand, refers to the number of times the deputy has posted some type of content in his feed, which can be any type of message, from sharing a personal photo or even an obstacle or a discussion with another parliamentary colleague.

Since the number of votes for a given candidate to be elected differs from state to state of the federation, it was decided to transform all variables involving absolute numbers on Twitter (both candidates and parties) into rates, for comparison purposes, leading into account the total number of valid votes for each state. To do so, the following formula was used:

$$\frac{\text{Twitter variable}}{\text{Scope votes}} * 100$$

To codify each party within its ideological spectrum, the idea present in the work of **Marques, Aquino e Miola (2014)** that adapted the conceptualizations regarding the ideological positioning of the parties from the text of **Tarouco e Madeira (2012)**. A classificação consiste num índice que leva em consideração uma série de questionamentos que resultam numa escala entre 1 e 7, no qual quanto mais próximo de um, mais o partido está à esquerda do espectro político, e quanto mais próximo de 7, mais próximo da direita. It is noteworthy that, according to the authors, there are no Brazilian political parties at the extremes (1 and 7) of the ideological spectrum.

The expense variable comes from the literature on the use of Twitter as an electoral prediction tool (Jungheer, 2014). However, in his work, the author uses Germany as a reference, in which there is a need for prior disclosure of each candidate's campaign budgets. As there is no similar previous institute in Brazil, it was decided to use the data declared by the Brazilian Superior Electoral Court regarding the contracted campaign expenses. It is also worth mentioning that in this variable, only the expense contracted by the candidate was taken into account, other payments made and declared were not included in the general and individual sum of each candidate. The total sum was performed using Excel software, present in the Microsoft Office package.

3.4 Box plot, Neural Artificial Net and desirability

The data are exposed in descriptive form, using the Box Plot technique, and Artificial Neural Network (ANN). For the ANN analysis, the number of votes stands out for the Output. All analyzes were processed using JMP® Pro 13.

The use of ANN is a test developed in the field of computer science and data science, which simulates the performance of a human neuron, and its use in Political Science is increasingly common, as it is a comprehensive test regarding to accepted data and has considerable robustness in its results. There are a number of works in the international literature in the field of Political Science research that make use of this research technique (Anastasopoulos; Badani, et al., 2017; Iyyer; Enns, et al., 2014; Khashman; Khashman, 2016; Richards, 2003; Borisyuk, et al. 2005).

For ANN optimization, data were randomly divided into two sets, a data group for training and another for validation (retraction ratio of 0.33) and a four-layer feed-forward neural network (one layer input, two hidden layers and an output layer) was developed. The ANN model was trained until the Root Mean Square Error (RMSE) was minimized and the R² was maximized, as recommended by Sebayang et al. (2017). The estimate of nominal votes by RNA was maximized through the Desirability technique and the importance of each input variable (Variable Importance: Independent Resampled Inputs) in the ANN was determined.

3.5 Partial Least Squares (PSL)

Descriptive data are exposed using the Box Plot technique, and multivariate analyzes using the Partial Least Squares (PSL) technique. For the multivariate regression developed, the SAS® University Edition (2015) was used.

The PLS regression equations were estimated considering the Nonlinear Iterative Partial Least Squares (NIPALS) algorithm. All variables accepted in the models showed a significant effect of up to 0.15 of probability of error, that is, the variables that did not reach the level of significance did not enter the models.

IV. THE IMPACT OF TWITTER ON THE ELECTORAL PERFORMANCE OF CANDIDATES FOR FEDERAL DEPUTY IN THE 2018 ELECTIONS IN BRAZIL

As the data are non-parametric, Spearman's correlation was chosen to know the correlation coefficients between the variables in the research. The results vary on a scale between (-1 and 1), and the closer to the extremes, the greater the correlation between the variables, whether negative or positive. It is noteworthy that the variable referring to the political spectrum and campaign expenses were removed from this first test, leaving only the variables referring to Twitter, in absolute terms, without the transformation into rate. The table below shows the result of Spearman's correlation test.

Table 1 – Spearman's correlation table

| Correlação de Spearman | | Votos nom inais do candidato | Seguidores C | SeguidosC | TweetsC | Seguidores P | SeguidosP | TweetsP |
|------------------------------|---------------------------|------------------------------|--------------|-----------|---------|--------------|-----------|---------|
| Votos nom inais do candidato | Coeficiente de Correlação | 1,000 | 0,202** | 0,091 | 0,161** | 0,053 | 0,074 | 0,125** |
| | Sig. (2 extremidades) | | 0,000 | 0,051 | 0,001 | 0,259 | 0,113 | 0,007 |
| Seguidores_C | Coeficiente de Correlação | 0,202** | 1,000 | 0,464** | 0,689** | 0,351** | 0,126** | 0,230** |
| | Sig. (2 extremidades) | 0,000 | | 0,000 | 0,000 | 0,000 | 0,007 | 0,000 |
| Seguidos_C | Coeficiente de Correlação | 0,091 | 0,464** | 1,000 | 0,631** | 0,265** | 0,249** | 0,234** |
| | Sig. (2 extremidades) | 0,051 | 0,000 | | 0,000 | 0,000 | 0,000 | 0,000 |
| Tweets_C | Coeficiente de Correlação | 0,161** | 0,689** | 0,631** | 1,000 | 0,263** | 0,291** | 0,260** |
| | Sig. (2 extremidades) | 0,001 | 0,000 | 0,000 | | 0,000 | 0,000 | 0,000 |
| Seguidores_P | Coeficiente de Correlação | 0,053 | 0,351** | 0,265** | 0,263** | 1,000 | 0,514** | 0,716** |
| | Sig. (2 extremidades) | 0,259 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 |
| Seguidos_P | Coeficiente de Correlação | 0,074 | 0,126** | 0,249** | 0,291** | 0,514** | 1,000 | 0,589** |
| | Sig. (2 extremidades) | 0,113 | 0,007 | 0,000 | 0,000 | 0,000 | | 0,000 |
| Tweets_P | Coeficiente de Correlação | 0,125** | 0,230** | 0,234** | 0,260** | 0,716** | 0,589** | 1,000 |
| | Sig. (2 extremidades) | 0,007 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | |

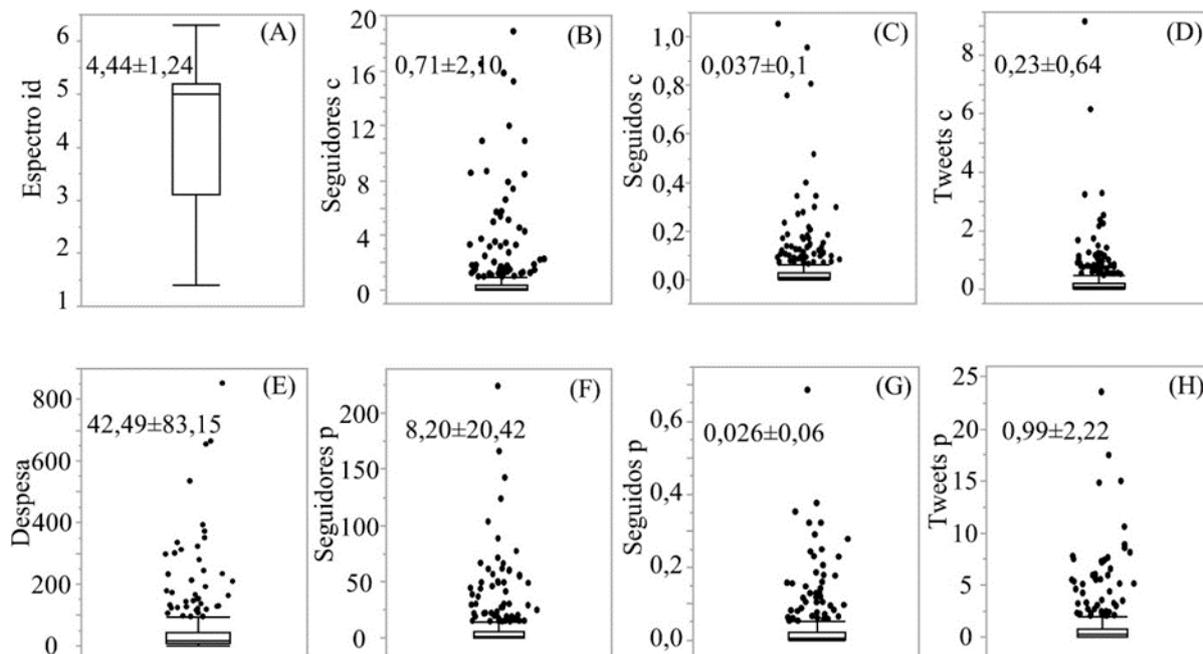
Source: Authors' elaboration through the Software SPSS.

The result presented has interesting outputs, which are partially in agreement with what is proposed by the hypotheses of this work. As variáveis: seguidores e tweets do candidato, bem como os tweets do partido estão positiva e levemente correlacionados, com o valor nominal dos votos de cada candidato, além de todos apresentarem significância estatística a 0,01. Another interesting result, even noticeable by common sense, concerns the number of followers both from parties and candidates, depending on the number of tweets: there is a correlation of 0.716 (high) and 0.689 (average), respectively.

Although correlation does not imply causation, in relation to the perspective of digital representation or E-representation (Ituassu, 2014), it can be said that Manin (2013), during reconsideration of his theory, he was correct in saying that parties still had some value in the context of public democracy. The parties, as well as candidates, can perform a variety of functions through Twitter, including: fostering support for their candidates, publicizing events in which their candidates may appear, among other possibilities (Kreiss 2014; Parmelee; Bichard, 2012; Stromer-Galley, 2014).

For a general notion of the data, it is necessary to pay a little attention to the results of the Box Plot graphs, which show information about the grouping and dispersion of the input variables:

Figure 2 - Box Plot with the variables: rate of followers, followed and tweets, of candidates (c) and parties (p), and expenses on electoral campaigns of federal deputies elected in 2018.



Source: Elaboration of the authors through the Software JMP Pro 13.

It is noteworthy that there is a large presence of outliers in the analyzed data, which ends up causing an increase in the standard deviation of almost all variables, with the exception of the Ideological Spectrum. The numbers inside each of the graphs represent its mean and standard deviation respectively. There is also an interesting point to be noted: the low average indices, for example, occur in the variables referring to both the party and the candidate.

Regarding the PLS multivariate regression, of the eight proposed independent variables, only four demonstrated a significant effect of up to 0.15 of error probability, that is, half of what was proposed did not reach the expected significance level and were excluded from the model. The proposal of the PLS is to assemble the statistical model through stages, starting with the variable Expense, being added immediately afterwards Candidate's followers, Candidate's Tweets and Party's followers, respectively. The summary of operations and their values can be better viewed through the table below:

Table 2 - PLS regression models to estimate the number of votes of deputies as a function of the rate of followers, followed and tweets, candidates (c) and parties (p), and campaign expenses

| Variables in the model | Equações | R ² | C (p) | Pr > F |
|--|---|----------------|-------------|--------|
| Expense | 117380 -241.06409 Expense | 0.0315 | 29.298 6 | 0.0001 |
| Followers c, Expense | 111757 +12378 Followers c -315.75541 Expense | 0.0816 | 6.3858 | 0.0001 |
| Followers c, Tweets c, Expense | 113367 +14332 Followers c -20515 Tweets c -276.52264 Expense | 0.0924 | 3.0026 | 0.0206 |
| Followers c, Tweets c, Followed p, Expense | 115382 +14303 Followers c -17532 Tweets c -152170 Seguidos p -246.80180 Expense | 0.0978 | 2.2948 | 0.0995 |

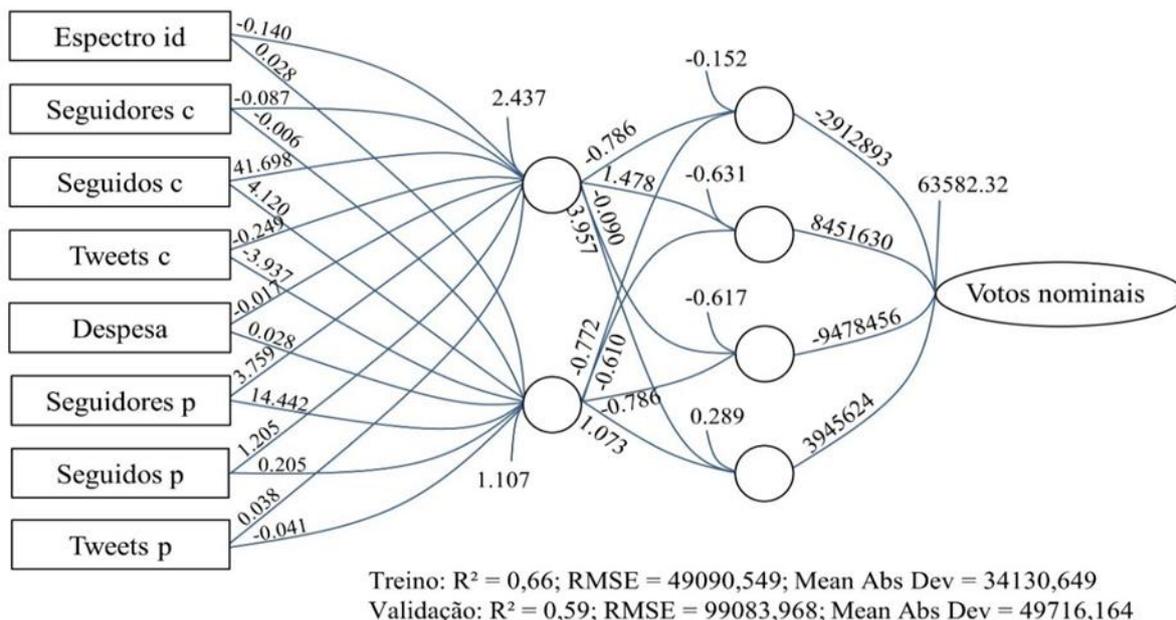
Source: author's elaboration through the software SAS.

None of the regression models through the PLS allowed satisfactory estimates of the nominal value of the votes of elected deputies, as it has an R² close to 10%, despite being a multifaceted social phenomenon such as voting. For the purposes of this research, despite its low, yet significant predictive power, multivariate regression using the PLS was disregarded as a predictive model of the nominal value of votes.

The results from the topology of the Artificial Neural Network – ANN proved to be very promising for the hypotheses proposed by the research. The neural networks are forms of artificial intelligence that every day are gaining new followers, not only in computer science, but also in other related areas, such as Political Science (ANASTASOPOULOS; BADANI, et al., 2017).

The proposed model consists in the eight variables in the input layer, processed by two neurons in the first hidden layer and four more in the second hidden layer. Altogether, the model only needed to be trained ten times, which demonstrates some consistency between the data and the results found through the outputs. As will be seen below, despite the small number of training sessions, ANN was a little complex, but the explanations and data are explained below for a better understanding.

Figure 3 - Diagram of the artificial neural network to estimate the number of votes of deputies as a function of the ideological spectrum, rate of followers, followed and tweets, candidates (c) and parties (p), and campaign expenses



Source: author's elaboration through the Software JMP Pro 13.

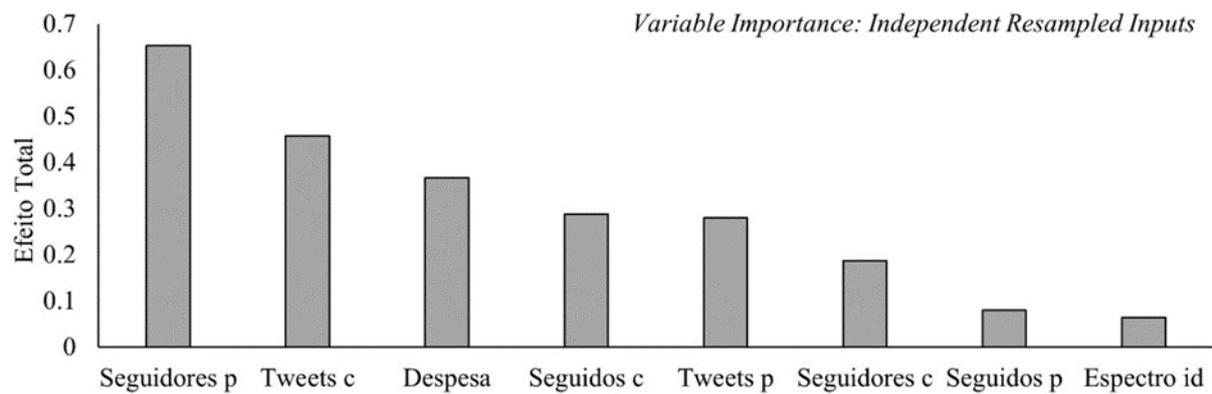
The values of the lines joining the neurons are the weights of the connections, in which the positive connections represent excitatory signals and the negative connections are inhibiting signals.

The model has a training R^2 of 0.66 and 0.59 validation, also having a Root Mean Square Error of 49090.549 and 99083.968, respectively. It is noteworthy that among the trained models, the model presented was the one that most maximized the R^2 and minimized the RMSE. The values that come out of each one of the input variables refer to the weight of each one in that respective neuron, which can be positive or negative.

The effects of the input variables on the output variable are positive when the connection weights of the hidden-input layers are positive (excitatory) and the hidden-output layers are also positive, or when the connection weights of the hidden-input layers are negative and of the negative hidden-output layers. In turn, the effects are negative (inhibitory) when the connection weights of the hidden-input layers are positive and the hidden-output layers are negative, or when the connection weights of the hidden-input layers are negative and the hidden-output layers are positive (Anastasopoulos; Badani et al., 2017).

The importance of each variable within the model can be seen in the graph below, it should be noted that it does not take into account the excitatory or inhibitory effect of each one, it only points out its importance.

Graphic 1 - Importance of each variable in estimating the number of votes from the artificial neural network



Source: Elaboration of the authors through the Software JMP Pro 13.

As will be shown with the Desirability data, all variables proposed in the input layer will positively influence (excitingly) the output variable, which is the nominal vote of elected deputies, which only changes its impact factor.

Once again, the parties are shown to contribute to the candidate's good performance (0.653), since the number of party followers proved to be the most influential among the proposed variables (**Manin, 2013; Gayo-Avello, 2013**). However, right after that, each candidate's tweets appear (0.457), showing that the face value of votes can be influenced by the number of times the candidate has posted certain content on their Social Network. Specifically at this point, a qualitative analysis would prove interesting and adequate, including for the purpose of exploring the use or not of Fake News and other related issues (**Parmelee; Bichard, 2012; Allcott; Gentzkow, 2017; Parmelee, 2013; Marques, Aquino; Miola, 2014; Aharony, 2012**).

Right after that, the expense variable (0.367) appears, confirming that there is an influence on the number of votes depending on the campaign budget/expense (**Jungherr, 2014**). However, it is interesting to note that two other variables that do not involve direct financial expenditure performed better within the proposed model, which may indicate a more prolific and less costly area for better electoral performance.

The number of followed by the candidate (0,288) and the number of tweets by the party (0.28) have practically the same importance in the model, followed by the number of followers of the candidate on Twitter (0,187). Finally, there are those followed by the party (0.08) and the ideological spectrum (0.064). These last two have a very low importance for the model, despite positively influencing the output referring to nominal votes.

Table 3 – Maximization (Desirability) of the number of votes of deputies as a function of the rate of followers, followed and tweets

| | Fatores | Maximização |
|---------------|----------------|-------------|
| <i>Inputs</i> | Espectro id | 1,886 |
| | Seguidores c | 14,015 |
| | Seguidos c | 0,006 |
| | Tweets c | 3,951 |
| | Seguidores p | 150,095 |
| | Seguidos p | 0,310 |
| | Tweets p | 2,692 |
| | Despesa | 7,314 |
| <i>Output</i> | Votos nominais | 131.228,480 |

Source: author's elaboration through the software JMP Pro 13.

Considering the Maximization or Desirability test, it is possible to have a notion of how much each variable is necessary to reach a certain result proposed by the output, in the case of this work, the nominal value

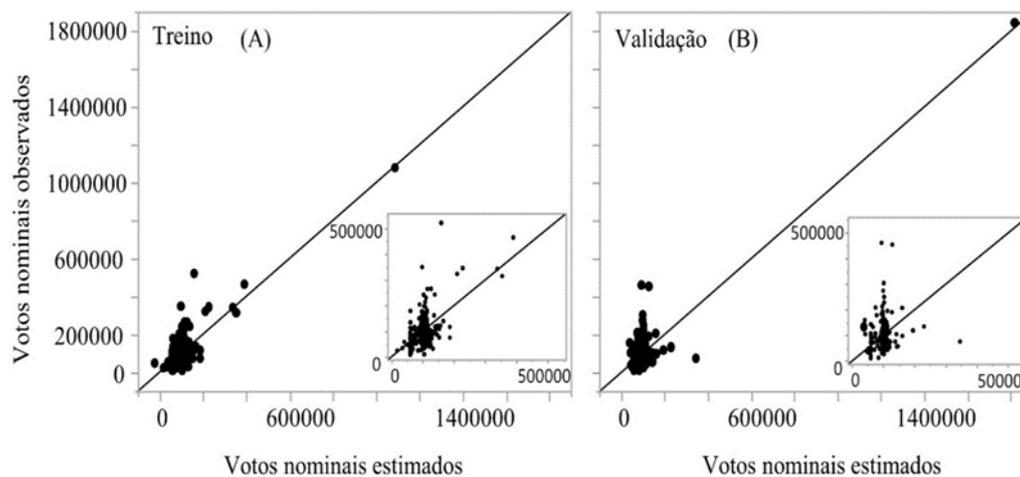
of votes. In the present case, the quantities shown in the image are necessary for a given candidate to obtain around 131,000 nominal votes, taking into account the ANN. It is noteworthy that the numbers presented were calculated as a rate, taking into account the valid voting of each state. Once again, the variables: candidate's followers and party's followers emerged as the factors within the model that most have the power to maximize nominal votes, followed by the value of contracted expenses.

It should be taken into account that other variables could bring greater explanatory power to ANN, such as: number of followers, followed and tweets from unelected candidates, time of use of the tool, candidate's age, average of tweets per week, among others brought by literature (Jungherr, 2014).

In short, once again, RNA demonstrates that there is an importance in Twitter's functions for better performance for elected candidates, which corroborates what was proposed in the initial hypothesis of this work.

The following figure demonstrates the robustness and potential of the artificial neural model used, as it demonstrates a tendency for the estimated values to follow a positive linear correlation with the observed values, as shown in the graphs below:

Figure 4 – Plot of nominal votes observed versus estimated in the Training (A) and Validation (B) phase of the ANN



Source: author's elaboration through the Software JMP Pro 13.

In general, the efficiency of the Artificial Neural Network indicates that the variables contained in the input layer (inputs) are fully capable of describing at least 50% of the variation in nominal votes (output), as it has two R^2 above 50%.

In general, the statistical tests partially confirm the hypothesis that Twitter has, regardless of a positive or negative relationship, the ability to change the number of nominal votes of an elected candidate, depending on the observed statistical model. As it is a highly multifaceted phenomenon such as voting, the results of this research should be considered sparingly, giving clues to new investigations, different data and different approaches to further strengthen the study of the impact of Twitter.

V. CONCLUSION

The internet has made great advances in social life possible. It is possible to transact a lot of information at an amazing speed. Along with it, social networks also emerged, which each day gain more space and supporters in contemporary society. Twitter was born with the promise of being a microblogging tool that would allow a quick transaction of interactions about facts that happened in real time. It was not long before this tool came to be seen as an efficient means to enhance the strategies of political actors in representative democracy. This implies considering the impacts on electoral preferences and choices as it encompasses a significant number of citizens present in the public debate.

Statistical tests on the roll-call vote of elected deputies yielded interesting results. In rough terms, Spearman's correlation showed that there is a slight correlation between the variables referring to the candidate's

followers, candidate's tweets and party's tweets, which in a way will be confirmed with the Artificial Neural Network. The PLS, despite being neglected by this research, presented an R^2 of approximately 10%, which should be seen with some parsimony because it is a multifaceted social phenomenon such as voting.

The Artificial Neural Network - ANN, with 4 layers, two of which are hidden, proved to be very interesting and promising considering the variables worked in this investigation. With a training R^2 of approximately 62% and a validation R^2 of 52%, the model can explain about 50% of the variation in roll-call voting. The Desirability test or Maximization showed that all variables presented as independent have an excitatory (positive) condition together with the dependent variable, in this case, the nominal vote of deputies.

Within the RNA, the model considered as the most impacting variables, respectively, the number of party followers, candidate's tweets, expenditure, followed by the candidate, party tweets, candidate's followers, followed by the party and political spectrum according to the ranking of **Tarouco and Madeira (2014)**.

The results of statistical tests show the importance that Twitter has for voting for a particular elected candidate. As it is a simple and free tool, the political use before, during and after Twitter can prove to be a powerful ally for future incumbents. Tests still show that political parties matter and are able to rally support for their candidates through their Twitter. It is interesting to note that the expense variable is only in third place of importance within the variation of the roll-call vote brought by ANN, which may prove to be a more economical way to carry out a political campaign.

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