# Assessing the Influence of Social Media Age Demographics on Political Approval Ratings

*This study investigates the relationship between social media platform demographics and the relative approval ratings of four candidates for major in 2024 Brazilian elections for the city of Fortaleza, Ceará, namely, Evandro Leitão, André Fernandes, Capitão Wagner, and José Sarto. Using age distribution data from Instagram, Facebook, and the general voter population, we apply a weighted method based on the scalar (dot) product to assess how well each platform's user demographics align with the voter population. By calculating the contributions of each platform's age group to the voter base, we derive relative approval ratings that reflect the influence of Instagram and Facebook on public opinion. These ratings are smoothed using an Exponentially Weighted Moving Average (EWMA) to reduce noise and highlight trends over time. Our findings reveal significant fluctuations in public approval, with André Fernandes gaining substantial support, reaching 38% by early October, while Capitão Wagner's approval declines to 12%. The methodology highlights the impact of social media engagement on public perception, providing insights into how different platforms' user bases interact with political opinions. This approach offers a novel perspective on evaluating the influence of social media on political trends and voter outreach strategies.*

Social media data has become a crucial tool in assessing public opinion due to its real-time nature, vast reach, and the ability to capture diverse perspectives quickly. Unlike traditional polling methods, social media platforms provide an unfiltered glimpse into what people are thinking, feeling, and discussing on a wide range of issues. This data allows analysts to track sentiment shifts, emerging trends, and the intensity of opinions across different demographics. Additionally, social media offers the advantage of being able to analyze the language, tone, and emotional undertones of posts, which provides deeper insights into public sentiment. When used responsibly, social media data can enhance decision-making processes for businesses, governments, and researchers by offering a dynamic and timely reflection of public opinion.

We use social media Instagram and Facebook to track opinion trends related to the candidates for mayor in the 2024 elections for the municipality of Fortaleza CE. The methodology we use to assess public opinion on each social media starts by searching for posts using specific keywords related to the candidates we are analyzing. We then apply AI-based sentiment analysis to these posts to determine whether users generally support or oppose them. Each post is categorized as positive, negative, or neutral. To make sure the opinion reflects more recent trends, we give more weight to newer posts, while older posts gradually have less influence. We use a time-based weighting system, with an exponential decay, to make this adjustment. Over time, this method gives a clear and updated measure of public relative approval of the investigated.

Instagram and Facebook users tend to interact with content differently, and the user demographics on each platform vary, especially in terms of age distribution. Instagram is often more popular among younger users, who tend to engage through visuals like images, videos, and stories, while Facebook has a broader and older user base that interacts more with text-based posts, shared articles, and longer discussions. Because of these differences in user behavior and demographics, opinions captured on each platform might reflect distinct perspectives. The second step of my opinion assessment method involves adjusting the weights of opinions based on the age distribution of the target demographic and the known age distributions of Instagram and Facebook users. Since these platforms have different user bases—Instagram being more popular among younger users and Facebook having a broader, often older audience—I use this

information to assign appropriate weights. By comparing the age distribution of the public I'm interested in with the age distributions of Instagram and Facebook, I adjust the weight of opinions from each platform. For example, if the target demographic is predominantly younger, I give Instagram data more weight, while if the target is older, Facebook's data is weighted more heavily. This ensures that the combined opinion more accurately represents the relevant audience for the policy.

Table 1shows the list of all candidates for mayor in the 2024 elections for the municipality of Fortaleza, Ceará, Brazil.

*Table 1 – List of candidates for major, for the municipality of Fortaleza, Ceará, Brazil in the 2024 elections.*

| Name | | Party/Federation | Number |
|---|---|---|---|
| **ANDRÉ FERNANDES** | ANDRÉ FERNANDES DE MOURA | PL | 22 |
| **CAPITÃO WAGNER** | WAGNER SOUSA GOMES | UNIÃO | 44 |
| **CHICO MALTA** | FRANCISCO RAIMUNDO MALTA DE ARAUJO | PCB | 21 |
| **EDUARDO GIRÃO** | LUIS EDUARDO GRANGEIRO GIRÃO | NOVO | 30 |
| **EVANDRO LEITÃƒO** | EVANDRO SA BARRETO LEITAO | JUNTOS, FORTALEZA PODE MUITO MAIS | 13 |
| **GEORGE LIMA** | GEORGE LIMA DE ARAÚO | SOLIDARIEDADE | 77 |
| **JOSÉ SARTO** | JOSE SARTO NOGUEIRA MOREIRA | FORTALEZA NÃO PODE PARAR | 12 |
| **TÉCIO NUNES** | TECIO NUNES SALGADO | CONSTRUINDO A NOSSA FORTALEZA | 50 |
| **ZÉ BATISTA** | JOSÉ BATISTA NETO | PSTU | 16 |

In the pools... insert pool results.

The four most important candidates are André Fernandes (PL), Capitão Wagner (UNIÃ0), Evandro Leitão (JUNTOS, FORTALEZA PODE MUITO MAIS) e José Sarto (FORTALEZA NÃO PODE PARAR).
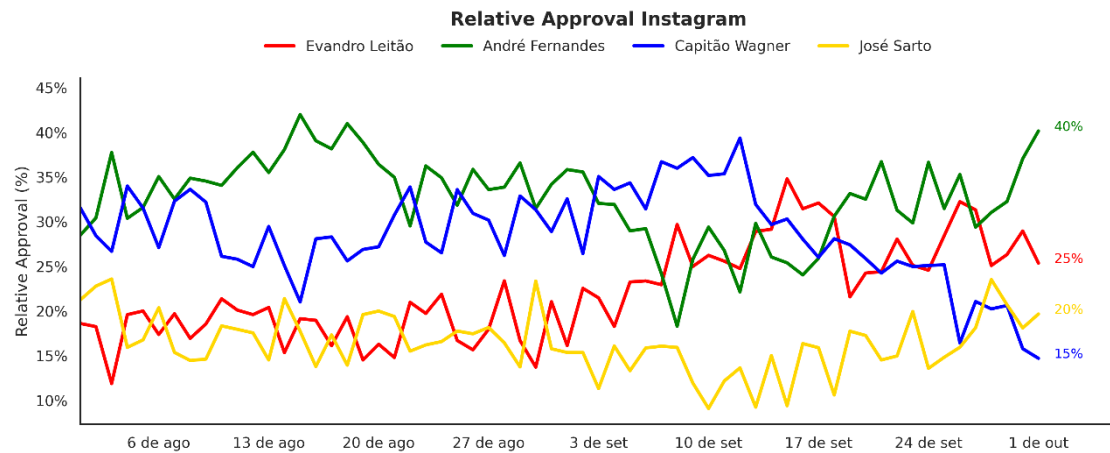
*Figure 1-Relative approval of the main candidates on Instagram over time. The chart shows fluctuating approval ratings for Evandro Leitão (red), André Fernandes (green), Capitão Wagner (blue), and José Sarto (yellow) from early August to early October. Notable trends include Capitão Wagner consistently holding higher approval rates, peaking at 40%, and Evandro Leitão with a steady range around 25%. José Sarto and André Fernandes exhibit fluctuating but generally stable ratings, around 15% and 20%, respectively.*
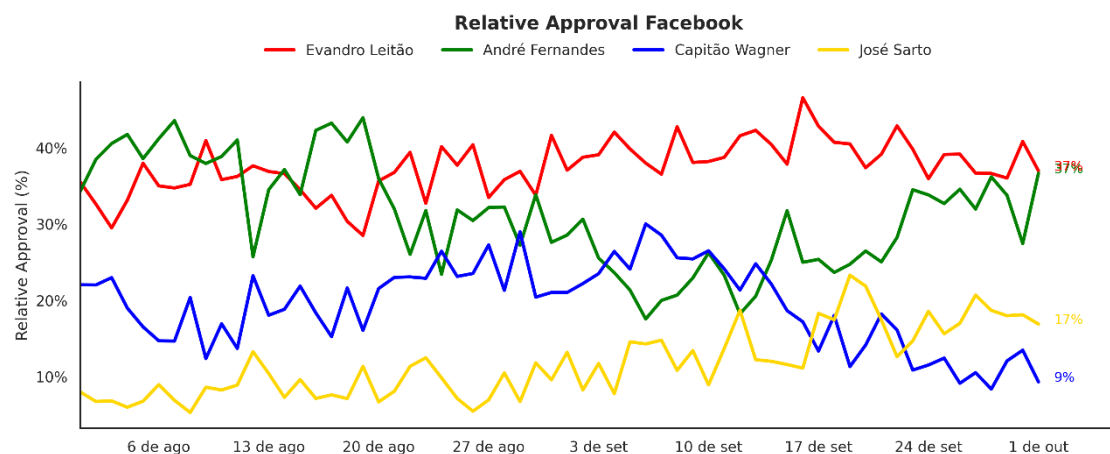


*Figure 2- Relative approval of the main candidates on Facebook over time. The chart shows fluctuating approval ratings for Evandro Leitão (red), André Fernandes (green), Capitão Wagner (blue), and José Sarto (yellow) from early August to early October. Notable trends include Capitão Wagner consistently holding higher approval rates, peaking at 40%, and Evandro Leitão with a steady range around 25%. José Sarto and André Fernandes exhibit fluctuating but generally stable ratings, around 15% and 20%, respectively.*

In this study, we further applied an Exponentially Weighted Moving Average (EWMA) to smooth time series data of vote intention over time. The EWMA technique assigns exponentially decreasing weights to past observations, giving more importance to recent data points, thus reducing noise while preserving trends. Specifically, the smoothing factor $\alpha$ was set based on the number of observations, defined as $\alpha = 2/N + 1$, where $N$ represents a fraction of the total data length. This allowed for responsive yet stable trend estimation, as recent changes in vote intention were captured with greater emphasis, while older data had diminishing influence.

The smoothed values were calculated separately for each candidate using the following recursive formula:

$$EWMA(t) = \alpha \ x(t) \ + \ (1 - \alpha) \ EWMA(t - 1)$$

where $x(t)$ is the current observation. This approach ensured that fluctuations were minimized, while long-term patterns remained visible, providing a clearer understanding of relative approval trends across the observation period.
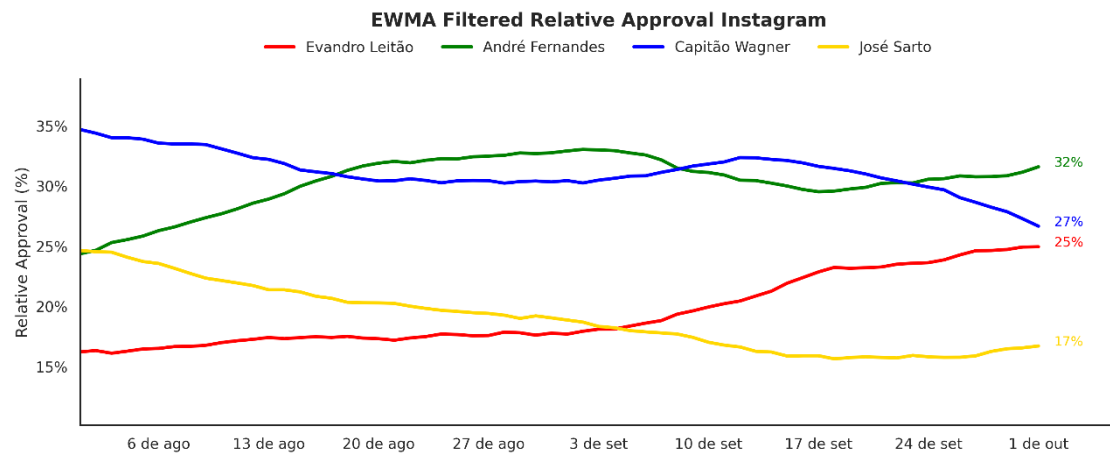


*Figure 3-EWMA-filtered relative approval of the main candidates on Instagram over time. The chart displays smoothed approval ratings for Evandro Leitão (red), André Fernandes (green), Capitão Wagner (blue), and José Sarto (yellow) from early August to early October. Capitão Wagner's approval starts high but declines to 27%, while André Fernandes overtakes him with a rise to 32%. Evandro Leitão shows a steady increase, reaching 25%, and José Sarto's approval consistently decreases, ending at 17%*
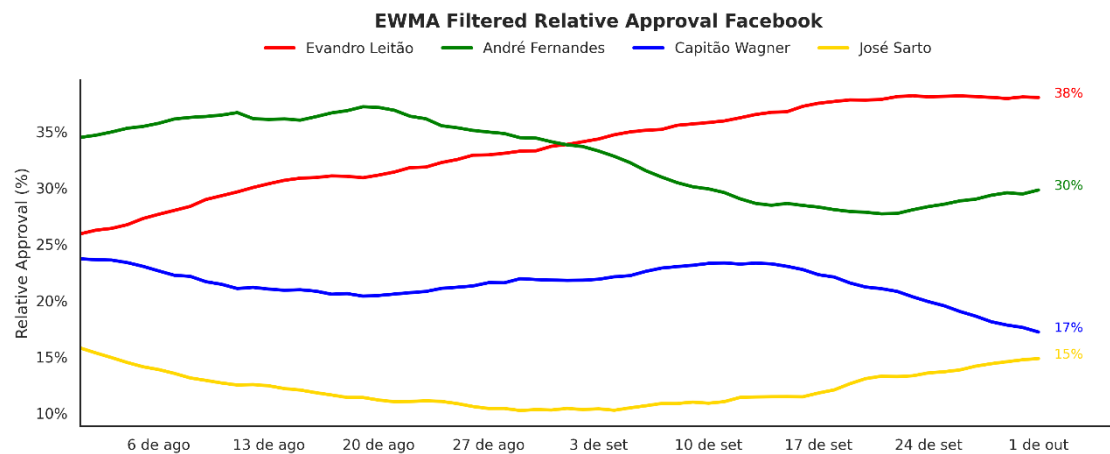


*Figure 4-EWMA-filtered relative approval of the candidates on Facebook over time. The chart displays smoothed approval ratings for Evandro Leitão (red), André Fernandes (green), Capitão Wagner (blue), and José Sarto (yellow) from early August to early October. Capitão Wagner's approval starts high but declines to 27%, while André Fernandes overtakes him with a rise to 32%. Evandro Leitão shows a steady increase, reaching 25%, and José Sarto's approval consistently decreases, ending at 17%.*
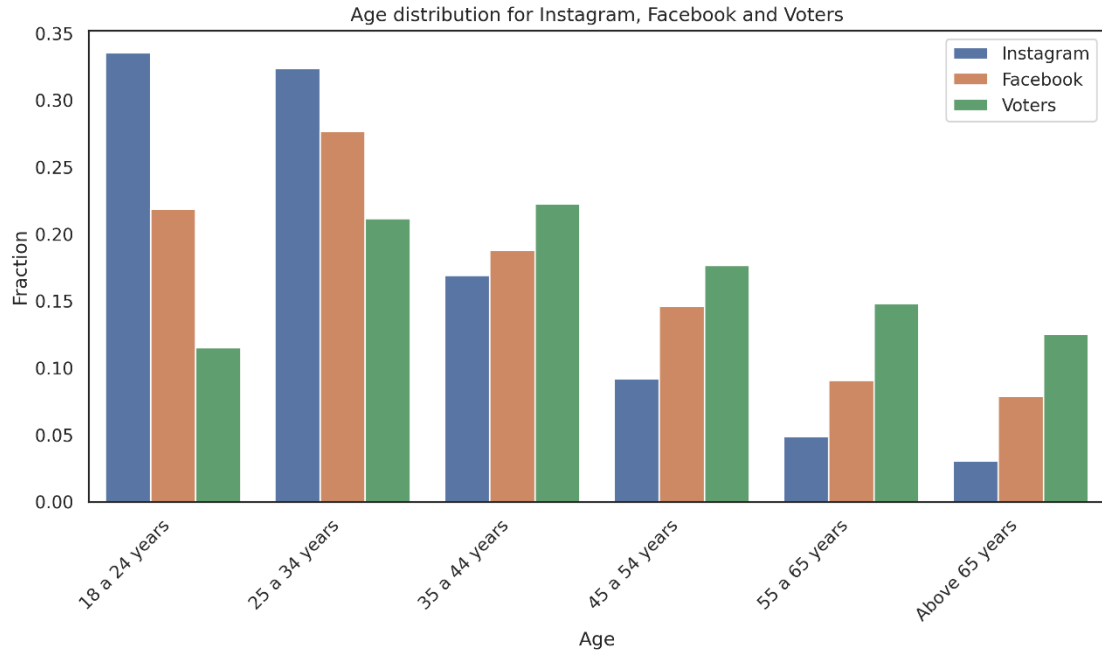
*Figure 5-Age distribution comparison for Instagram, Facebook, and voters. The bar chart shows the fraction of each age group using Instagram (blue), Facebook (orange), and the age distribution of voters (green). Instagram has a higher proportion of younger users (18-24 and 25-34 years), while voters are more evenly distributed across age groups, with a noticeable concentration in the older demographics (45-54 and above 65 years). Facebook usage is more balanced, with significant representation across all age groups but slightly lower among younger users compared to Instagram.*

To assess the relative influence of Facebook and Instagram age demographics on the voter population, we employed a scalar product (dot product) approach to measure the alignment between the age distributions of each social media platform and that of the voters. Age distribution data for Facebook, Instagram, and voters were normalized to represent the fraction of the population in various age groups, creating probability distributions for Facebook (\( \mathbf{age\_F} \)), Instagram (\( \mathbf{age\_I} \)), and voters (\( \mathbf{age\_voters} \)).

To quantify the similarity between each social media platform's age distribution and the voter age distribution, we computed the dot product for each pair of distributions:

$$
a = age\_I \cdot age\_voters
$$

$$
b = age\_F \cdot age\_voters
$$

where $a$ represents the alignment between Facebook and the voters' age distribution, and $b$ represents the alignment between Instagram and the voters' age distribution.

The dot product measures the degree of overlap between two probability distributions, with higher values indicating greater similarity between the platform's user base and the voter population.

Next, we normalized the contributions of Facebook and Instagram to the voter age distribution by calculating the relative weights \( cf \) for Facebook and \( ci \) for Instagram, as follows:

$$c_i \ = \ \frac{a}{a+b}$$

$$c_f \ = \ \frac{b}{a+b}$$

These weights represent the relative influence of Facebook and Instagram on the voter population, and sum to 1, ensuring that the total contribution is distributed between the two platforms.

The resulting weights $c_f$ and $c_i$ provide a measure of how closely the age demographics of each platform match those of the voter population. Higher values $c_f$ or $c_i$ indicate greater alignment of the platform's user base with the voter population, offering insights into the potential impact of social media platforms on voter outreach strategies. We obtain $c_i \ = \ 0.489$ and $c_f \ = \ 0.511$. The resulting combined traces are shown in Figures 6 and 7.
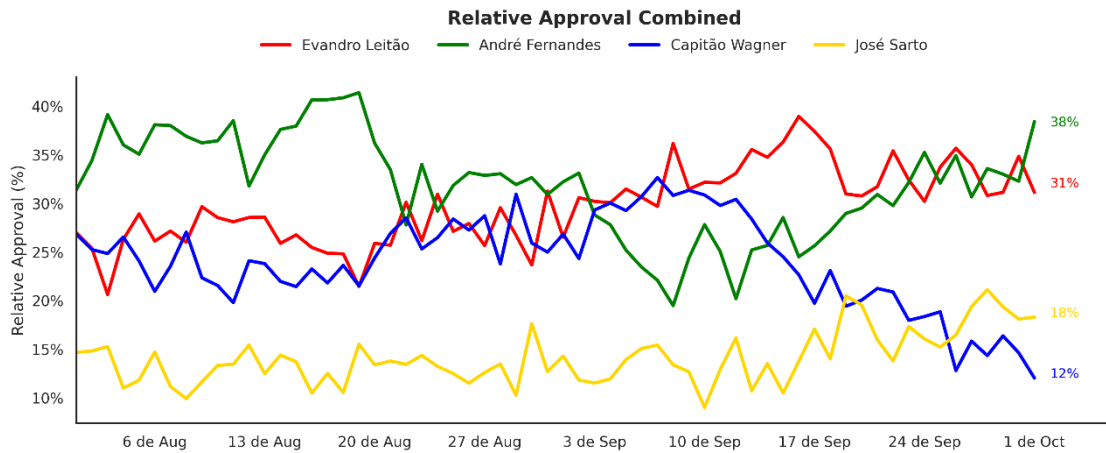


*Figure 6- Combined Instagram-Facebook Relative Approval of the candidates over time. The chart illustrates the approval ratings for Evandro Leitão (red), André Fernandes (green), Capitão Wagner (blue), and José Sarto (yellow) from early August to early October. André Fernandes experiences a rise in approval, peaking at 38%, while Evandro Leitão shows a steady increase to 31%. Capitão Wagner's approval drops to 12%, and José Sarto maintains a relatively stable trend, ending at 18%*

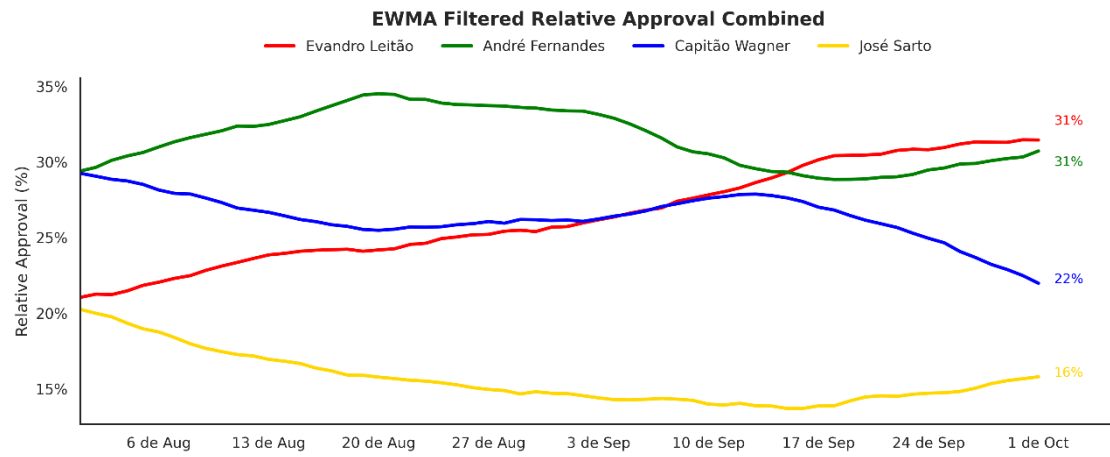**EWMA Filtered Relative Approval Combined**

*Figure 7- Combined Instagram-Facebook EWMA Filtered Relative Approval of the candidates over time. The chart illustrates the approval ratings for Evandro Leitão (red), André Fernandes (green), Capitão Wagner (blue), and José Sarto (yellow) from early August to early October. André Fernandes experiences a rise in approval, peaking at 38%, while Evandro Leitão shows a steady increase to 31%. Capitão Wagner's approval drops to 12%, and José Sarto maintains a relatively stable trend, ending at 18%*