When Tweets Get Viral - STIL 2023

A Deep Learning Approach for the Stance Analysis of Covid-19 Vaccines Tweets of Brazilian Political Elites

Authors: Lorena Barberia, Pedro Schmalz e Norton Trevisan Roman

DCP-USP, EACH-USP

Contents of the Presentation

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Political Background (2020)

- In 2020, The Federal Government opposed lockdowns and restrictions during the pandemic and constantly attacked Covid-19 vaccines;
- Congress, Supreme Court and local elites in the opposition contested its policies regarding lockdown and Covid-19 Vaccination.
- In turn, there was wide politicization around the Lockdown and Vaccination subjects.

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Political Events and Discourse Change (2021)

- April 2021 - Opposition calls a congressional hearing (*CPI da Covid*)
- June 2021 - Covaxin Scandal;
- These events led to important discourse changes in the government over the subject of Covid-19 vaccines.

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Motivation

- Brazilian Congress operated remotely during most of 2020 and 2021;
- Increased usage of social media by political candidates and politicians;
- We aimed to understand how politicians positioned themselves in what concerns Covid-19 vaccines, on social media.

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Research Questions

- How did Brazilian Mayoral Candidates drive the COVID-19 vaccine agenda on X (former Twitter)?
- Did the Data Drift phenomenon affect the model's results, given the changes in the politicians positions and discourses between 2020 and 2021?

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Research Design

- Barberia, Schmalz et al. (2022) analyzed Covid-19 Vaccines and Vaccination tweets (now posts) from mayoral candidates (local elites) posted from 2020 to 2021 on X (former Twitter).
- This training dataset is now used to train BERTimbau with three different datasets to predict Covid-19 Stances: one for 2020, one for 2021 and one with posts from both years.

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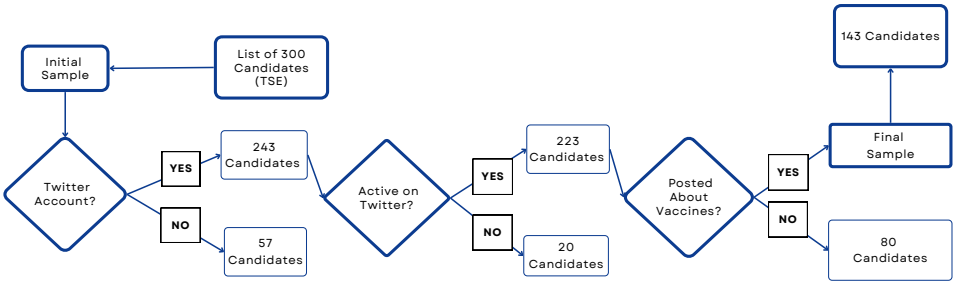
Building the Corpus



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Building the Corpus - Keywords and Annotation

- We have chosen a keyword search as our primary corpus selection strategy.
- A training data set was created by manually annotating vaccine-related tweets.
- Annotation - **Relation to Covid-19 Vaccines** and **Stance** towards them.

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Corpus Expansion and Model

- To expand the time period of our analysis, we added tweets from the same individuals for 2021.
- To classify tweets, we used the Brazilian Portuguese pre-trained model, *BERTimbau*[1], which is based on BERT[2].

[1] Souza, Nogueira, and Lotufo 2020.
[2] Devlin et al. 2019.

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Corpus Distribution

Table: Distribution of Classes

Class	2020	2021	Combined
Favorable	1,319	2,682	4,001
Neutral	82	2,085	2,167
Unfavorable	188	64	252
Total	1,589	4,831	6,420

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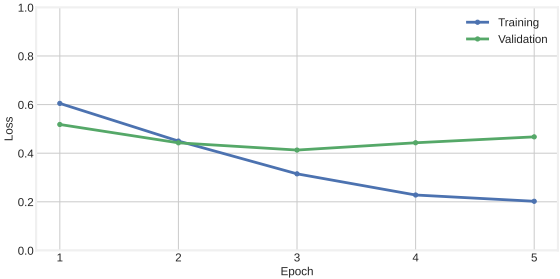
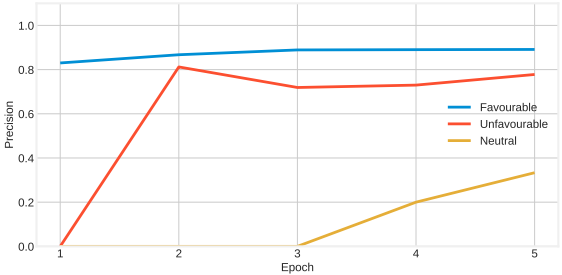
Validation Results (2020)



(a) Avg. Training and Validation Loss



(b) Avg. Precision per Class

Figure: Validation Metrics (2020)

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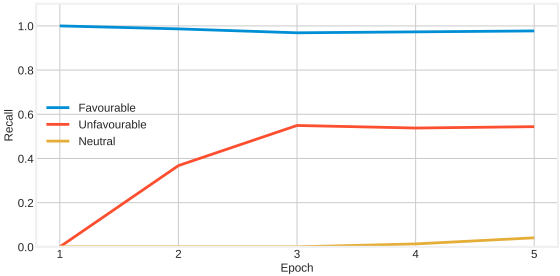
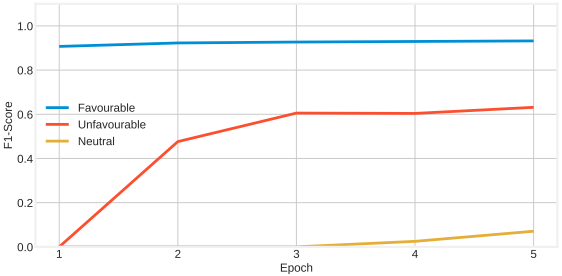
Validation Results (2020)



(a) Avg. Recall per Class



(b) Avg. F1-Score per Class

Figure: Validation Metrics (2020)

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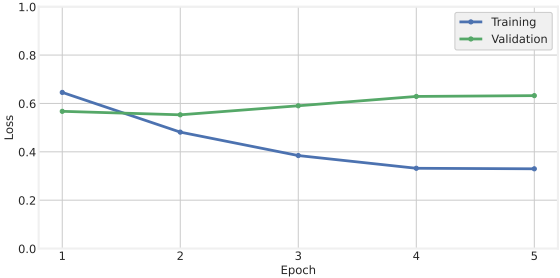
Validation Results (2021)



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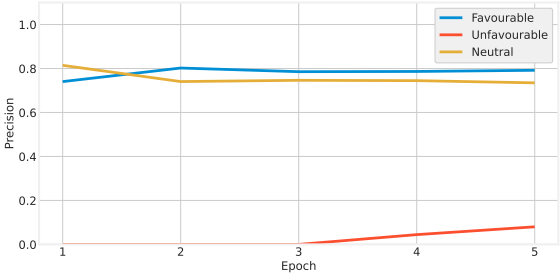

(b) Precision per Class

Figure: Validation Metrics (2021)

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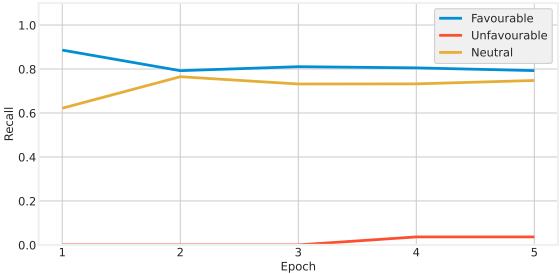
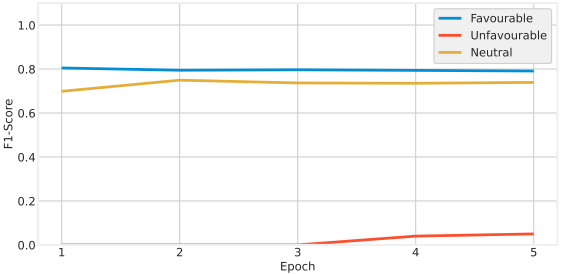
Validation Results (2021)



(a) Recall per Class



(b) F1-Score per Class

Figure: Validation Metrics (2021)

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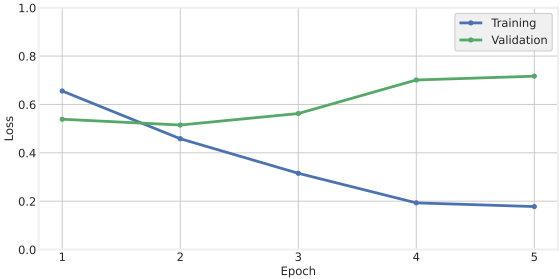
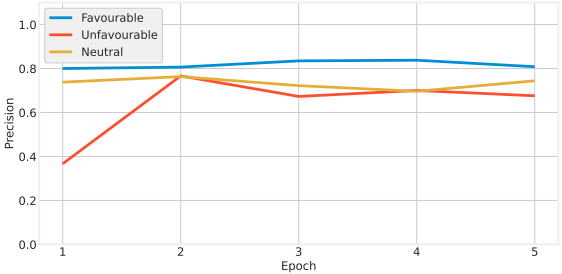
Validation Results (2020 and 2021)



(a) Training and Validation Loss



(b) Precision per Class

Figure: Validation Metrics (2020 and 2021)

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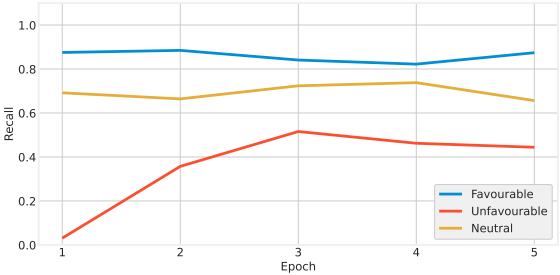
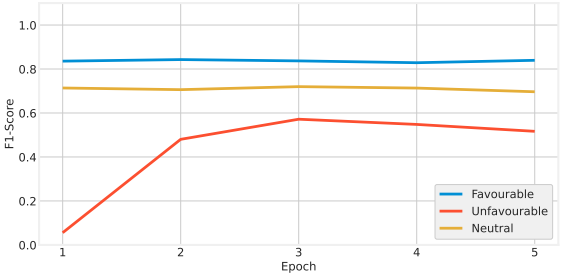
Validation Results (2020 and 2021)



(a) Recall per Class



(b) F1-Score per Class

Figure: Validation Metrics (2020 and 2021)

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Epoch 2 Results*

Table: Average of Folds' Validation Results (Epoch 2)

Data Set	Train Loss	Val. Loss	Val. Accuracy	F1-Micro	F1-Macro
2020	0.45 (0.43:0.46)	0.44 (0.40:0.49)	0.86 (0.84:0.88)	0.86 (0.84:0.88)	0.51 (0.44:0.57)
2021	0.48 (0.48:0.49)	0.55 (0.53:0.58)	0.77 (0.76:0.78)	0.77 (0.76:0.78)	0.67 (0.66:0.69)
Both	0.46 (0.45:0.47)	0.52 (0.50:0.53)	0.79 (0.78:0.80)	0.79 (0.78:0.80)	0.67 (0.65:0.69)

*Notes: 95% Confidence Intervals in Brackets.

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Conclusions

- Important changes between 2020 and 2021 made the classification task more difficult;
- The imbalance in the data set affected the results on the unfavorable class for 2021 and in the neutral class for 2020;
- Using both years, the model performs relatively well. However, there will be an underestimation of unfavorable tweets.

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Next Steps

- Compare the results obtained by the BERTimbau model with other models (e.g. SVMs, RNNs, CNNs) or other different portuguese pre-trained BERTs - e.g. BERTabaporu, Albertina (PT-Br), etc.;
- Expand the annotation to include sentiment analysis;
- Minimize the impact of class imbalance on the classification task.
- Use the model to classify tweets from other political elites (e.g. Congresspersons).

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Important Links

- Tweet Corpus - `https://github.com/PedroSchmalz/covid19-tweets-brazilian-mayoral-candidates.git`
- Replication Files - `https://github.com/PedroSchmalz/when-tweets-get-viral-replication-files.git`
- Contact - `https://www.linkedin.com/in/pedro-schmalz/`

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Thank you for you attention!

Any questions?

pedrosantanaschmalz@usp.br

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