Final project:
Analysis of ideological polarization on social networks based on the spread of disinformation content

Data Processing
Master in Telecommunication Eng.

13 de octubre de 2025

Descripción general

The expansion of disinformation on social networks has transformed the way individuals access information and shape their opinions. Numerous studies indicate that the spread of false or manipulated content not only affects the perception of reality, but can also amplify **ideological polarization** by reinforcing preexisting beliefs within homogeneous communities.

This project aims to examine the relationship between the spread of disinformation and the structure of polarized communities on social networks (e.g., Twitter/X or Facebook). The central hypothesis is that specific patterns of disinformation function as catalysts of polarization, deepening the divide between social and political groups.

The project is conceived as an open applied exercise, in which each team of 3 or 4 members may select the most suitable database and analytical approach, within the methodological boundaries and components defined below.

The project has a **maximum score of 3 points**, broken down as:

- **Basic project:** 2.25 points

- **Extension:** 0.75 points

The submission deadline is December 10, 2025, at 23:59.

Specific Objectives

- Identify posts with potentially disinformative content using machine learning techniques and language models.

- Analyze the relationship between the diffusion of disinformation and users' ideological polarization.

- Explore sentiment analysis and stance detection models as complementary tools for ideological characterization.

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- Compare different text vector representations and supervised modeling strategies.

Suggested Datasets

Each group may use any dataset related to disinformation, opinion, or polarization on social networks to develop the project. Some datasets that may be suitable are suggested below.

- POLITiCES 2023: Analysis of political discourse on Twitter

- PHEME: Rumour and Stance Classification Dataset

If you are unsure whether your chosen dataset fits the project, please consult the instructor for confirmation.

Basic Project

Although the project is open-ended in nature, to obtain the minimum passing grade, the following stages must be included.

1. Exploratory Analysis of the Dataset

Before applying language processing techniques, each team must carry out a brief exploratory analysis of their dataset that includes:

- General description of the dataset (number of instances, variables, data types, missing values).

- Basic statistics and simple visualizations (class distribution, text lengths, etc.).

- Preliminary text analysis (most frequent words, word cloud, examples by class).

- Formulation of initial hypotheses about possible relationships between disinformation and polarization.

2. Text Vector Representation

Compare three representation strategies:

- **TF-IDF:** representation based on term frequency and inverse document frequency.

- **Word2Vec:** representation of documents as the average of the embeddings of the words they contain.

- **Contextual embeddings:** obtained through Transformer-type models (e.g., BERT, RoBERTa).

3. Modeling and evaluation

Train and evaluate predictive classification or regression models using at least two of the following strategies:

- A **neural network** implemented in **PyTorch**.

- At least one other **Scikit-learn** algorithm (for example, K-NN, SVM, Random Forest, Logistic Regression, etc.).

In addition, the performance of these strategies must be compared with that of a **pre-trained Transformer** model fine-tuned using the **Hugging Face Transformers** library.

In all cases, adequate validation of the models must be performed, including explicit separation into training, validation and test sets.

4. Comparative evaluation

Teams are expected to:

- Evaluate the models using appropriate metrics (accuracy, F1, ROC-AUC, etc.).

- Analyze performance differences across vector representations and model architectures.

- Interpret the results in relation to the initial hypothesis regarding disinformation and polarization.

Extension Project

The extension work is fully open-ended, and you should expand on the basic project in any direction you find appropriate. For example:

- **Thematical analysis of disinformation:** Apply topic modeling or clustering methods on contextualized embeddings to detect recurring disinformation themes.

- **Generative modeling for disinformation analysis:** Explore the ability of LLMs to generate synthetic posts that mimic disinformative or polarized content. Compare outputs from fine-tuned models and prompting-based generation (e.g., LLama). Analyze whether generated text exhibits patterns observed in real data.

- **Lexicon & URL-domain baseline for disinformation cues:** Build a simple rule-based baseline using keyword/hashtag lists and linked URL domains (e.g., known fact-checkers vs. low-credibility sites), and compare its performance against the models you created in the basic project.

- **Correlational analysis of polarization:** Investigate how exposure to disinformation or rumour-related content relates to stronger emotional expression, more negative or disagreeing language, and other linguistic signs of polarization in social media discussions.

Take this list as a mere suggestion; you may choose any other topic as long as it fits within the course's scope.

In the extension work, originality in the choice will be valued. If you have any doubts about the suitability of your chosen extension, consult the instructor. In any case, keep in mind that the extension work constitutes 0.75 points of the final grade. Avoid undertaking overly ambitious extension projects that could compromise the project's timely delivery.

If you have any doubts about the appropriateness of any extension work, consult the instructor.

Project Submission

The project submission will use GitHub as a collaboration and version control tool. The submission must include the following elements:

- Fully functional and documented code.

- A `README.md` file (or a GitHub Pages site) serving as the **project report**, which should include:

  - A description of the problem and the dataset.
  - An explanation of the methodologies used.
  - Experimental results and discussion.
  - Conclusions.

- All files or scripts necessary to reproduce the results.

The submission will be made through Aula Global: one student from each group must upload the link to the shared repository. It is important that the repository be public to allow the instructors to review and reproduce the work. Documentation pages may not be edited after the submission deadline; the evaluation will be based on the last commit made before the due date.

Without exception, the documentation must adhere to the principle of proper authorship acknowledgment. If you use external code snippets or any material from outside sources, you must clearly specify this in the report.

Evaluation

The project will be evaluated on the basis of the submitted documentation as well as an individual presentation to be held the week of 16 December. The evaluation will be made according to the following criteria:

- Basic Project (2.25 points)

  - Methodology (0.75)
  - Quality of documentation (0.3)
  - Code quality (0.3)

- Presentation quality (0.5)
- Responses to comments on the presentation (0.4)

- Extension (0.75 points)
  - Originality (0.25)
  - Quality of the work (0.5)