The Comparison of Local and Global Early Fake News Detection Methods

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01

Problem description: Why early detection of Rumors and Fake News is so important?

Problem description

Why should we use fake news and rumor detection methods?

1. To prevent the spread of misinformation and disinformation.
2. To protect people from harm.
3. To promote democracy and civic engagement.

What are the possible benefits of detecting fake news and rumors?

1. Protecting public health.
2. Preventing violence.
3. Ensuring fair elections.

Project description

1. Develop a new method to **quickly spot trending rumors** on social media.
2. Utilize data extracted from platforms like Twitter, enriched with textual content to detect patterns and **focus on key inquiry phrases** such as "Is this true?„
3. Use clustering algorithms to group posts potentially related to the **topic**.
4. Develop a **classifier** to prioritize these clusters based on the likelihood of their association with the disputed fact.
5. The project aims to deliver a model that is able to **efficiently pinpoint social media rumors**, helping fact-checkers, journalists, and online platforms.

02

Literature Review

Topic detection, Fake News Detection,
and Explainability for NLP solutions

Literature Review

Title	Topic	Authors	Description
Topic detection with recursive consensus clustering and semantic enrichment	**Topic Detection**	Vincenzo De Leo, Michelangelo Puliga, Marco Bardazzi, Filippo Capriotti, Andrea Filetti, Alessandro Chessa	Presents opportunities and challenges considering the topic detection in Twitter debates. It suggests a framework with **stable clustering** based on Non-Negative Matrix Factorization (NMF), and **semantical enrichment** of short messages.
Clustering and topic modeling over tweets: A comparison over a health dataset	**Topic Detection**	Juan Antonio Lossio-Ventura, Juandiego Morzan, Hugo Alatrista-Salas, Tina Hernandez-Boussard, Jiang Bian	Introduces a framework for topic detection in Twitter debates. It shows how to evaluate clusterings with the **Calinski-Harabasz index**, and the **Silhouette Coefficient**, and it uses those metrics to compare the efficiency of **various LDA approaches** to topic modeling.
Improving Fake News Detection Using K-means and Support Vector Machine Approaches	**Fake News Detection**	Kasra Majbouri Yazdi, Adel Majbouri Yazdi, Saeid Khodayi, Jingyu Hou, Wanlei Zhou, Saeed Saedy	Describes the importance of **feature selection** in fake news detection. Authors propose a method-based K-means and SVM **outperforming state-of-the-art techniques**.

Literature Review

Title	Topic	Authors	Description
Fake News Detection using Machine Learning with Feature Selection	**Fake News Detection**	Z. Tian. S. Baskiyar	The paper proposes a fake news detection system using **KNN** and utilizing **Genetic and Evolutionary Features Selection**. Additionally, the authors test the viability of the quantum version of KNN (QKNN)
A systematic survey on explainable AI applied to fake news detection	**Explainability**	Athira A.B., S.D. Madhu Kumar, Anu Mary Chacko	The survey covers fake news detection models that use explainable AI (**XAI**) approaches to gain more **insight and a better understanding** of fake news detection. Furthermore, the authors are discussing possible research opportunities in this area.
Towards Machine Learning Explainability in Text Classification for Fake News Detection	**Explainability**	Lukas Kurasinski, Radu-Casian Mihailescu	In this paper, authors perform fake news detection using two **deep learning models**: architecture that combines convolutional neural networks and bidirectional recurrent neural networks (**BiDir-LSTM-CNN**) and bidirectional encoder representation from transformers (**BERT**). Using attention weights text is color-coded to **mark important words** for the models.

03

Dataset Description:

Fake News Corpus

Datasets

- News and fake news: data can be collected online
  Problem: annotation,

- Many different open-source datasets, however, each of them has their own shortcomings.

1. BuzzFeedNews - news published on Facebook; during the US election in 2016; contains only links to Facebook posts containing links.
2. CREDBANK - 60 million tweets; 96 days in 2015; accessible via the AWS cloud for a small fee; labels are not provided for the tweets - only events were identified.

Dataset: FakeNewsCorpus

FakeNewsCorpus

1. 9 million news articles (around 30 GB of data),
2. Contains text, titles, domains, authors, timestamp,
3. 10 classes (9 misinformation types (gossip, fake news, clickbait, etc.)
   + *Credible* class),
4. Scrapping text from more than 1000 different Internet domains.

```
adrian@adrian-komputer:~/Pulpit/news$ head news_cleaned_2018_02_13.csv
,id,domain,type,url,content,scraped_at,inserted_at,updated_at,title,authors,keywords,meta_keywords,meta_description,tags,summary,source
0,2,express.co.uk,rumor,https://www.express.co.uk/news/science/738402/life-an-ILLUSION-reality-does-not-exist-if-you-are-not-looking-at-it,"
Life is an illusion, at least on a quantum level, in a theory which has recently been confirmed by a set of researchers.

They finally have the means to test John Wheeler’s delayed-choice theory and concluded that the physicist was right.

In 1978, Mr Wheeler’s proposed experiment involved a moving object that was given the choice to act like a wave or a particle - the former a
cting as a vibration with a frequency that can distinguish it from other waves and the latter having no frequency that you can determine its
 position in space, unlike a wave - and at what point does it ‘decide’ to act like one or the other.

At the time, the technology was not available to conduct a strong experiment, but scientists have now been able to carry it out.",2018-01-25
 16:17:44.789555,2018-02-02 01:19:41.756632,2018-02-02 01:19:41.756664,Is life an ILLUSION? Researchers prove 'reality doesn't exist if you'
re not looking at it',Sean Martin,,[''],"THE UNIVERSE ceases to exist when we are not looking at it proving that life is an illusion, accord
ing to one study.",,,
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04

Methods Review

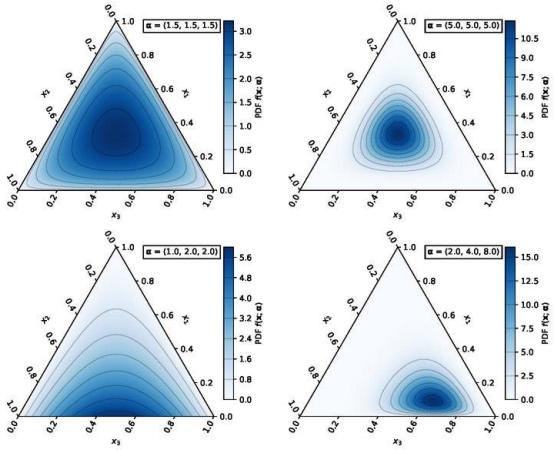
Methods review

topic detection

Latent Semantic Indexing

$$X = U\Sigma V^T$$

Latent Dirichlet Allocation



https://en.wikipedia.org/wiki/Dirichlet_distribution

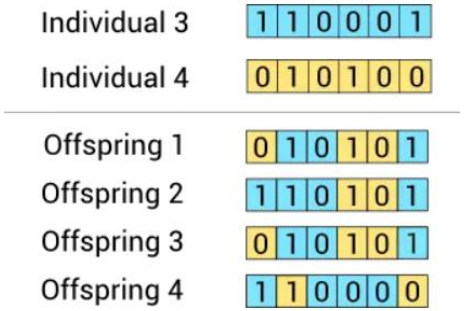
Non - Negative Matrix Factorisation

$$\|\mathbf{V} - \mathbf{WH}\|_F^2$$

Methods review

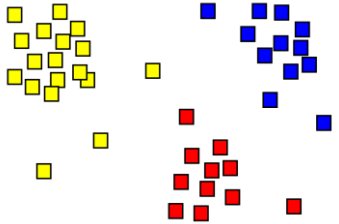
fake news detection

GeFES



https://www.neuraldesigner.com/blog/genetic_algorithms_for_feature_selection/

Clustering
as feature selection



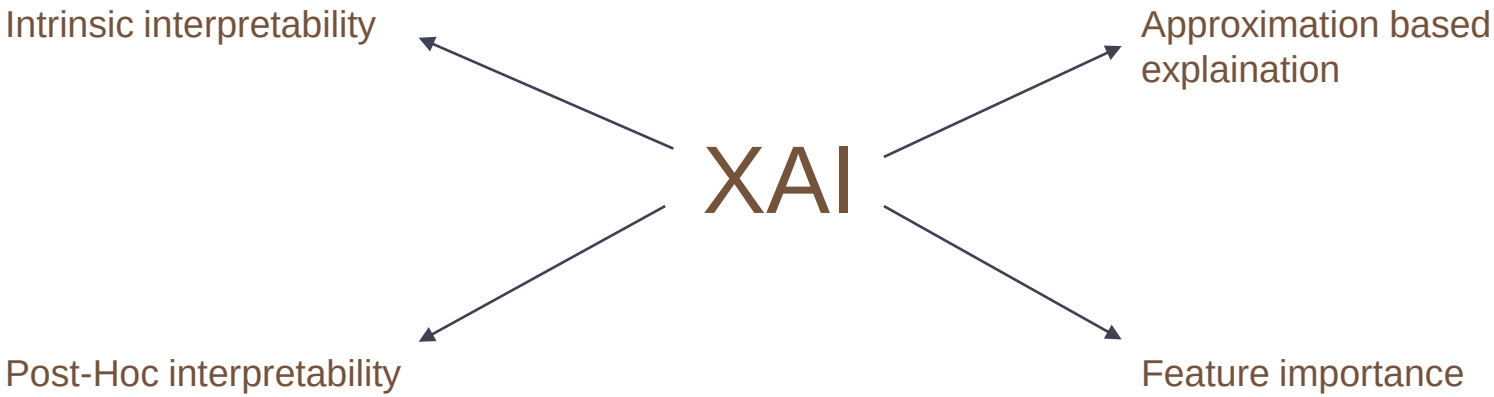
https://en.wikipedia.org/wiki/Cluster_analysis

Models:

- Bert
- Passive agressive
- KNN
- BiDir-LSTM-CNN
- SVM

Methods review

XAI



05

Proposed solution

Proposed solution

1. We will use SOTA topic detection tools, based embeddings, noun chunks, n-grams, named entity recognition, etc.
2. We evaluate the clustering quality with SOTA approaches mentioned in the Literature Review.
3. We prepare a train-test split with regard to particular clusters (ex. 70% - 30%: training – testing).
4. We prepare a few (1-3) SOTA solutions for fake news detection methods.
5. We will train and evaluate them on a global split.
6. We will train and evaluate them on local clusters.
7. We will compare the results of global and local models in terms of performance.
8. We will use eXplainable AI (XAI) methods to discover the most important indicators for global and local methods.

Expected Contributions

1. We will combine SOTA methods for the topic and fake news detection into a novel approach to the early detection of rumors.
2. We will evaluate our local approach, and compare this to current, global solutions.
3. We will explore the differences between the two strategies with the usage of XAI.
4. If the proposed framework proves to be better in terms of performance, it will be faster due to the limitation to a particular topic.
5. The outcomes of our study might lead to further research in the area of local topic modeling.


Thank you for your attention!