Exploring Thematic Coherence in Fake News

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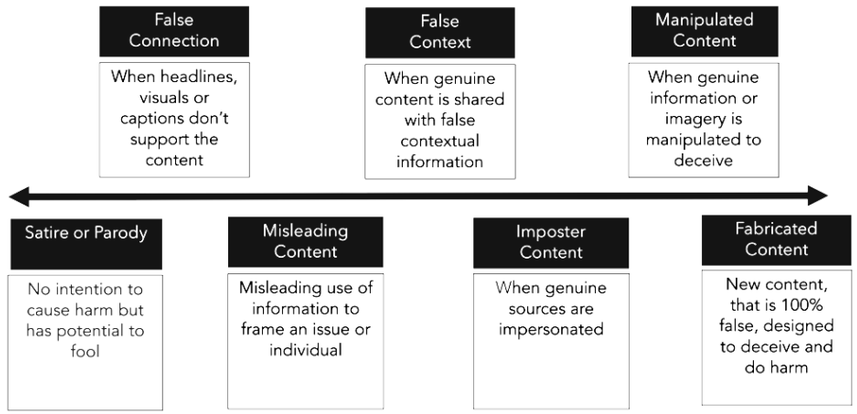
Fake news: definition

Definition: a news item that contains **deliberately** and **verifiably** falsified information.

WHAT

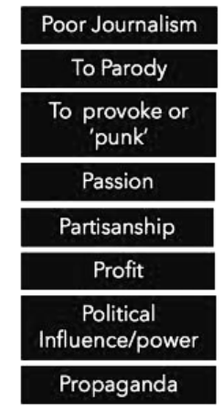
are the types of mis- and dis-information?



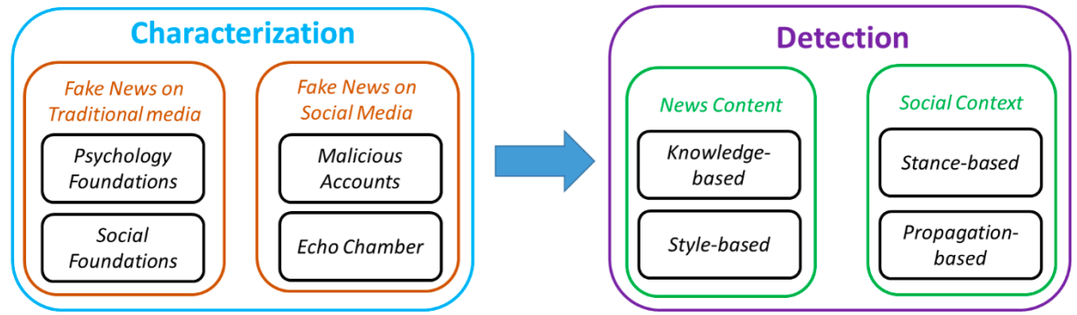
Adapted from Claire Wardle, First Draft News

WHY & HOW

are they shared?



Fake news: characterisation and detection



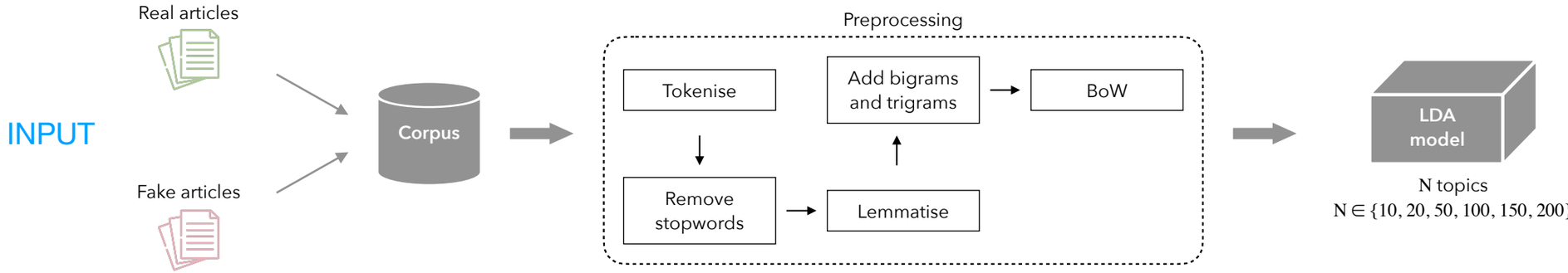
Source: Shu et al. (2017)

- Textual content is the most abundant type of information in fake news datasets.
- Style-based features include lexical, syntactic, and latent features such as embeddings.
- Characterisation is key for developing unsupervised fake news detection techniques.
- We focus on characterising fake news in a new way using topic modelling.

Objectives of this study

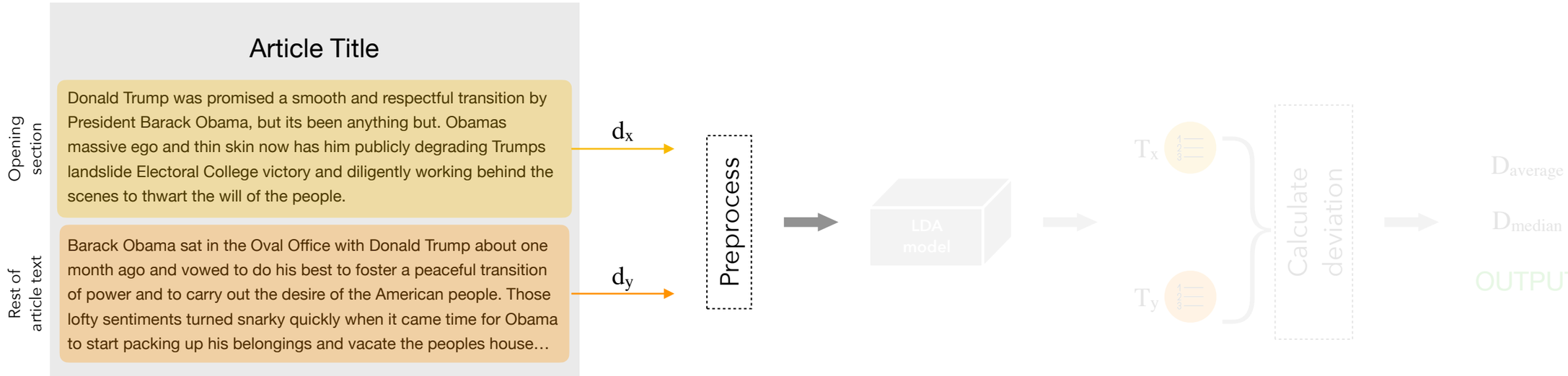
- Assess the importance of internal consistency within articles as a high-level feature to distinguish fake from real news.
- Use latent themes/topics to analyse the coherence of articles.
- Experiment with real-world datasets to demonstrate the efficacy of our proposed approach.

Method:
Step 1 – build topic models



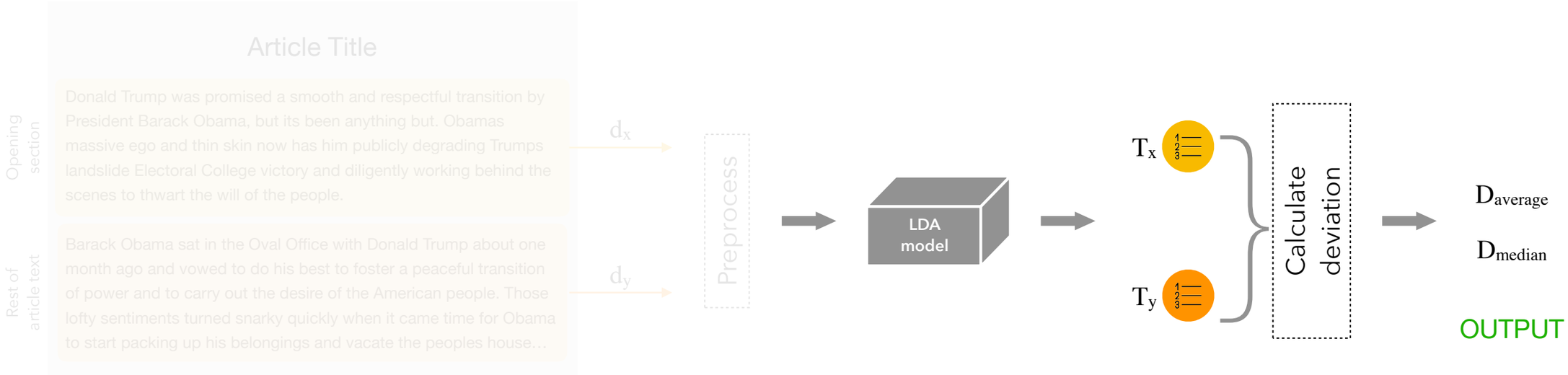
- Create a corpus consisting of entire dataset.
- Preprocess corpus and build LDA model with N topics.

Method:
Step 2 – split articles



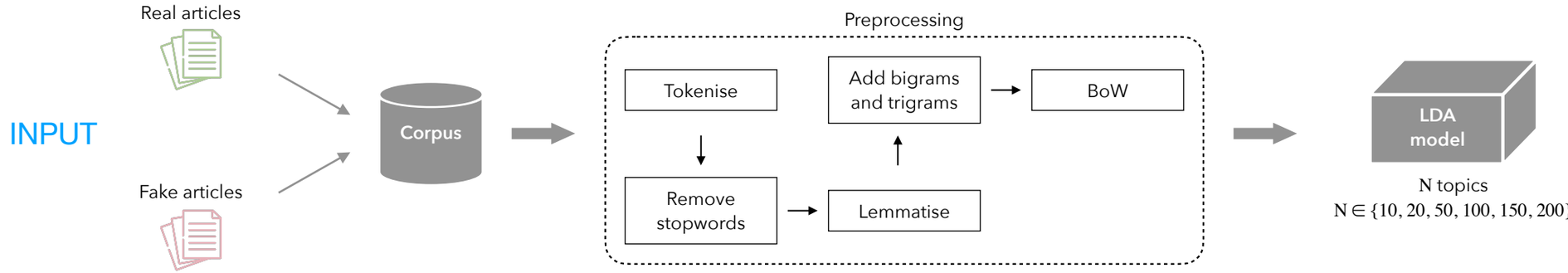
- Split each article into two documents:
  its opening section (first five sentences excl. the title; d_x), and its remainder (d_y).
- Preprocess each document.

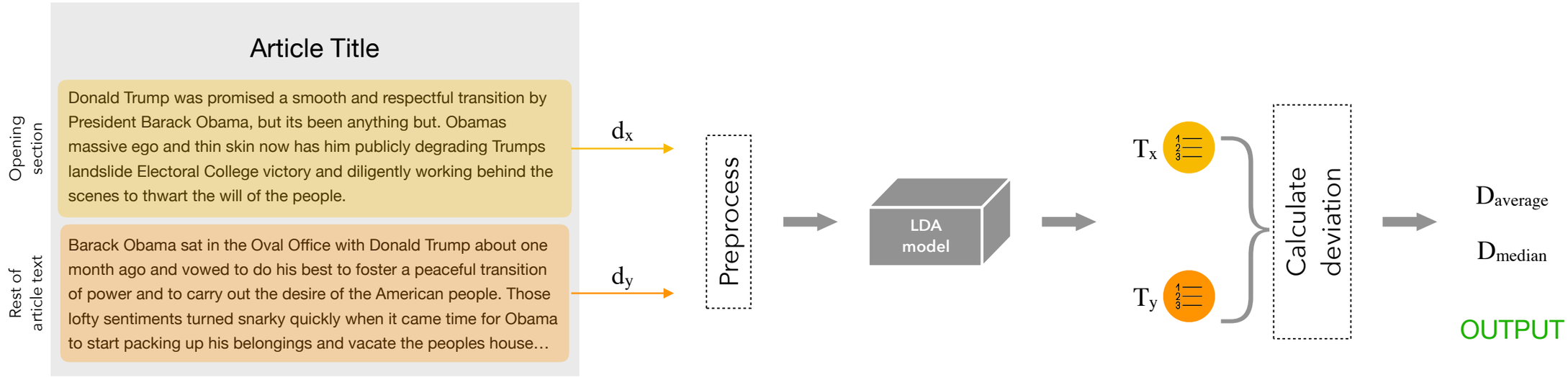
Method:
Step 3 – extract topics and calculate deviation



- Use LDA model to extract N topics from both documents.
- Calculate the deviation between their topic distributions (T_x and T_y) using distance metrics. Find mean and median deviation across all values of N.

Method: all steps





Experimental evaluation

- Datasets*:
  - FakeNewsAMT & Celebrity: 641 articles
  - BuzzFeed Political: 243 articles
  - BuzzFeed Webis: 1,545 articles
  - George McIntyre: 5,547 articles
  - ISOT Lab: 36,147 articles
  - POLIT False-n-Legit: 256 articles
  - Syrian Violations Documentation Center: 664 articles
- Distance metrics:
  - Chebyshev (Chessboard) distance
  - Euclidean distance
  - Squared Euclidean distance

- Parameters:
  - Length of article opening: 5 sentences
  - Number of topics: 10, 20, 50, 100, 150, 200

- We evaluate the differences in coherence/deviation between fake and real articles using the T-test at 5% significant level.

* Articles remaining after preprocessing dataset.

Results and observations: coherence

	Fake	Real	Fake	Real
Dataset	Mean D_{Ch}(f)	Mean D_{Ch}(r)	Median D_{Ch}(f)	Median D_{Ch}(r)
AMT+C	0.2568	0.2379	0.2438	0.2285
BuzzFeed-Political	0.2373	0.2149	0.2345	0.2068
BuzzFeed-Web	0.2966	0.2812	0.2863	0.2637
GMI	0.4580	0.4241	0.4579	0.4222
ISOT	0.3372	0.2971	0.3369	0.2989
POLIT	0.2439	0.1939	0.2416	0.1894
SVDC	0.2975	0.2517	0.2934	0.2435

- Real news articles are more coherent (i.e., show less deviation) than fake ones.
- In other words, there is a greater shift in the topics the body of a fake article discusses, from its opening section.

Results and observations: statistical test

Dataset	p-value (D_{Ch})	p-value (D_E)	p-value (D_{SE})
AMT+C	0.144	0.126	0.116
BuzzFeed-Political	0.0450	0.0147	0.0287
BuzzFeed-Web	0.209	0.209	0.207
GMI	0.0480	0.00535	0.0106
ISOT	0.00319	0.000490	0.000727
POLIT	0.000660	0.0000792	0.0000664
SVDC	0.000684	0.0000112	0.0000789

- Our results show statistical significance in most datasets.
- This suggests that it may be possible to stylistically characterise fake news using the transition of topics within its text.

Conclusion

In this work, we:

- investigated the coherence of topics discussed in fake and real articles in seven cross-domain datasets.
- proposed a new method for characterising fake news using only textual data.
- empirically demonstrated that fake articles are thematically less coherent than real ones.

Future work: investigate how these characteristics can be utilised to develop unsupervised models for fake news detection.

Thank you

If you have any questions or would like to give some feedback, please write to me:

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