

**Team 2:** 

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## Introduction





- Growth of social media.
- Unauthenticated user generated content.



In the US, 62% of adults use social media as their source of daily news [2016, News use across social media platforms].



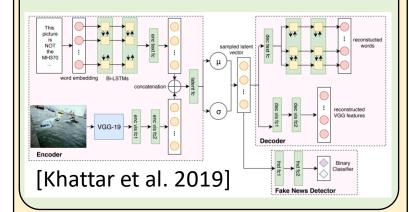
Around **70**% of people can successfully **validate** the authenticity of the news [2017, Automatic detection of fake news].

## Related works



## **Existing Solution**

**MVAE**: Multimodal variational autoencoder for fake news detection



### **Drawbacks**

- Some news do not have visual content.
- Not interpretable features.

### **Proposal**

- A **multi-modal** approach.
- VAE captures **textual** content features.
- LDA captures **topic related** features.
- Together they increase the accuracy of the model.

## Challenges

- The absence of an agreed benchmark dataset.
- **Unclear definition** of the fake news versus real.

### Contribution

Improving the accuracy by concatenating two types of features.

Increasing the interpretability of the model by LDA.

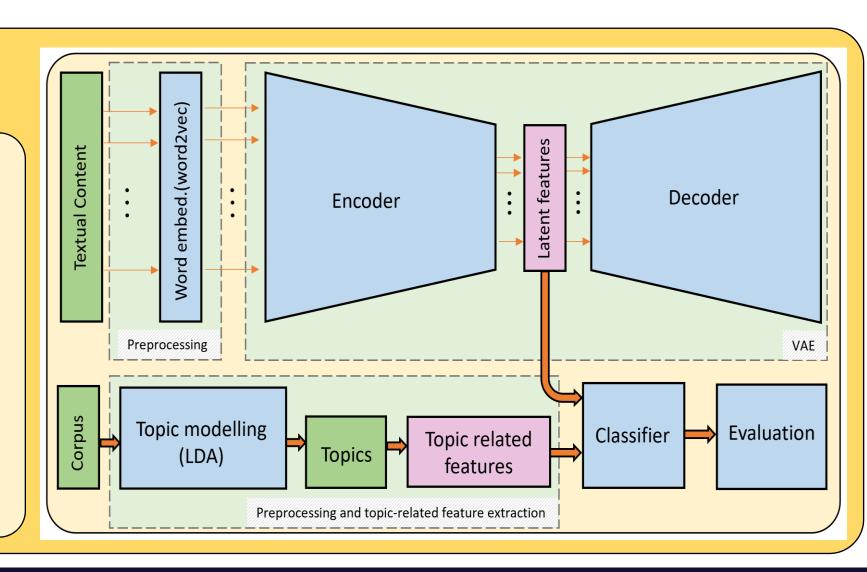
We use **only** textual content.

# Information Flow

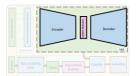


## Main Components

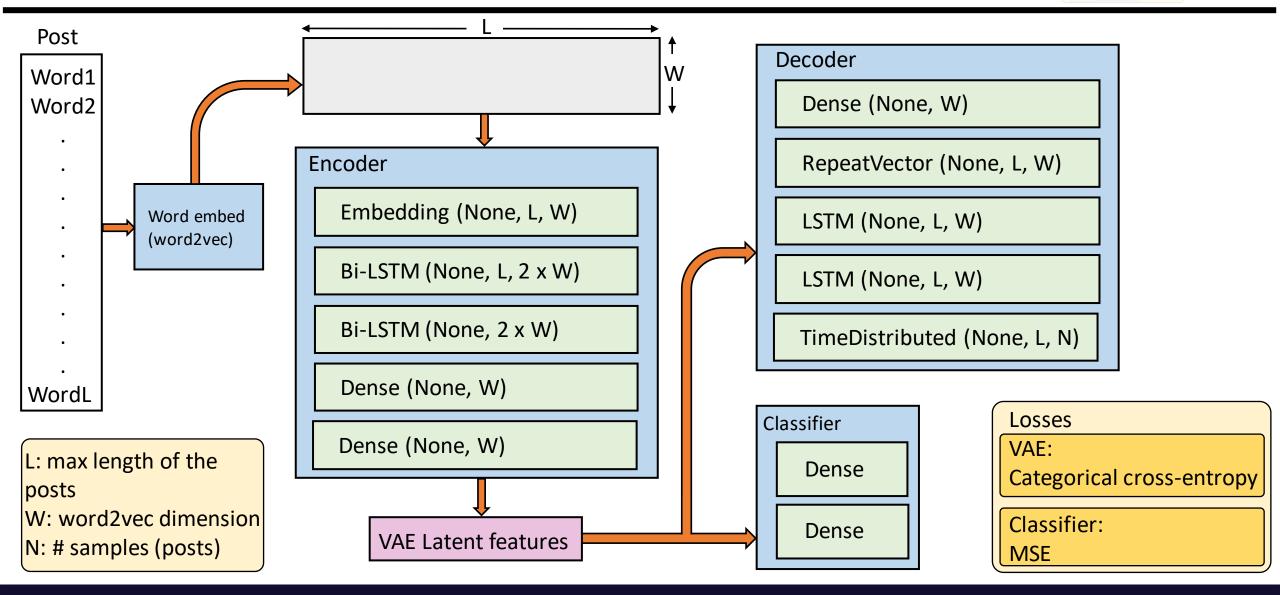
- 1) Preprocessing
- 2) Variational Autoencoder
- 3) Topic Modelling (LDA)
- 4) Classifier
- 5) Evaluation



# Technical Component 1: VAE



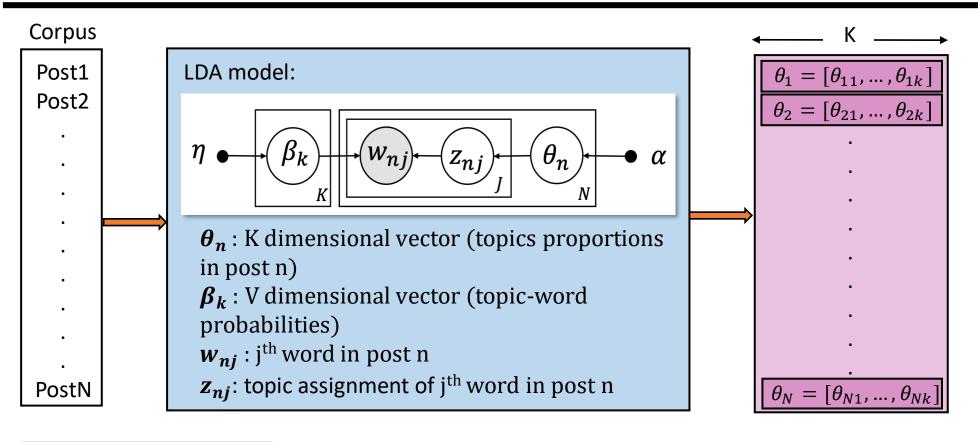




# Technical Component 2: LDA







K: # topics

V: # words in the corpus

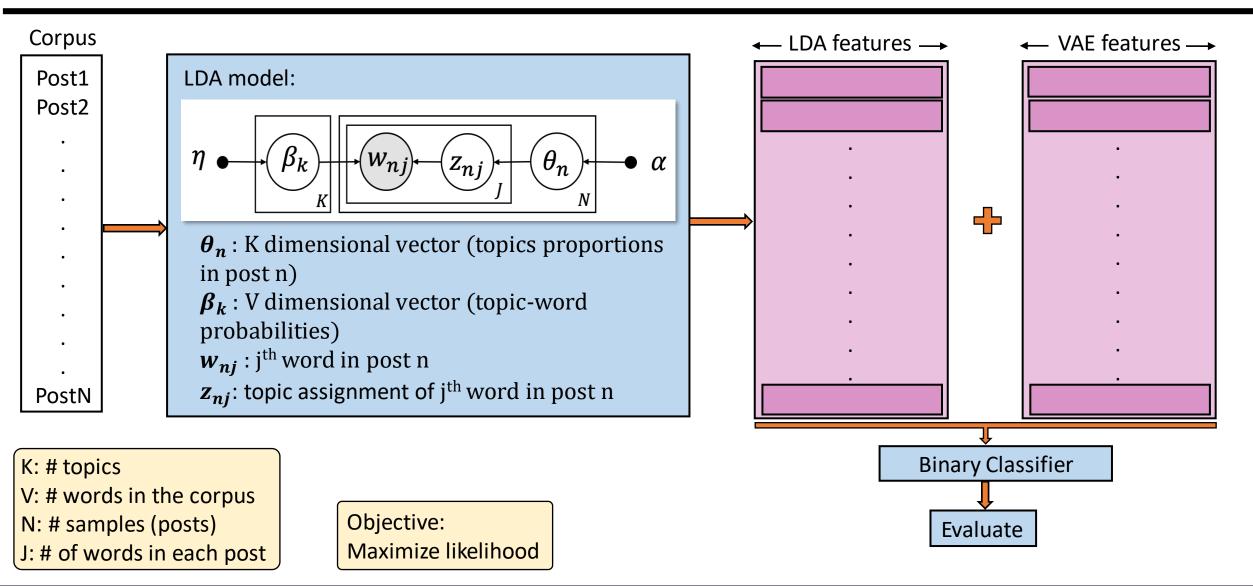
N: # samples (posts)

J: # of words in each post

Objective function: Maximize likelihood

# Technical Component 3: Classification





# Experimental Settings



#### **Datasets Characteristics:**

Dataset	ISOT	Twitter
# training samples	34684	12211
# test samples	8672	1448
Max length of posts	45	28
Original data	Fake/Real	Training/Test
Other	Stratified	No label on test

#### Settings:

#### LDA configuration:

Max # words: 10000

# iteration: 1000

# topics: 2, 4, 8, 10, 16, 32, 64

VAE configuration:

Epoch: 30 - 50

Latent dim = [2, 4, 8, 10, 16, 32, 64]

word2vec = [2, 4, 8, 10, 16, 32, 64]

**Environment:** 

UCONN UCHC Server, Python 3

#### Classifiers:

Naïve Bayes, SVM, MLP, Logistic Regression, KNN, Random Forest

**Dimensionality Reduction:** 

PCA, tSNE

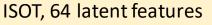
Feature Selection:

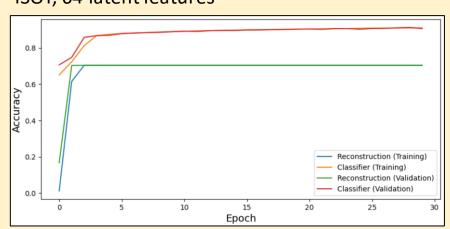
Kbest (chi<sup>2</sup>, Gini index)

Baseline:

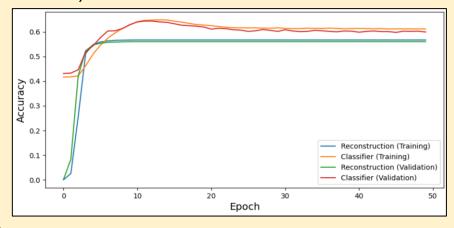
Results on two feature sets alone

#### Convergence:





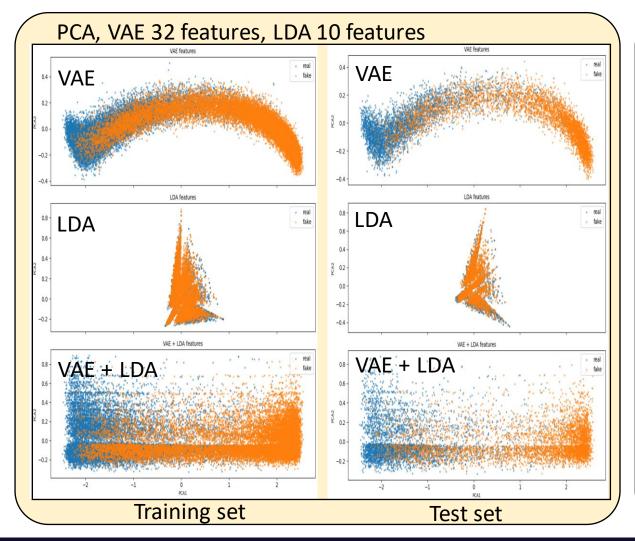
#### Twitter, 32 latent features

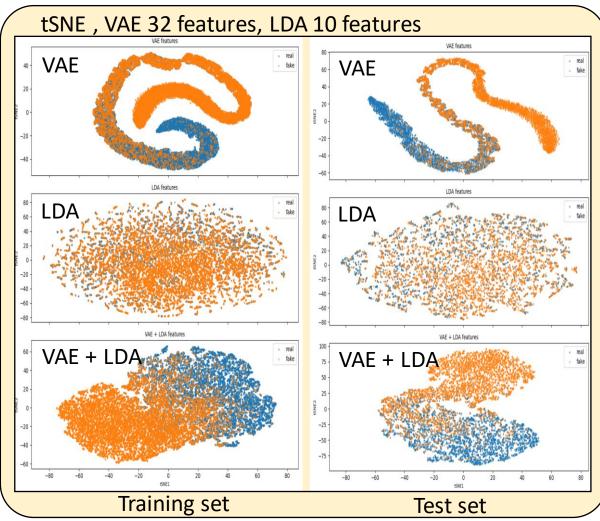


# Results





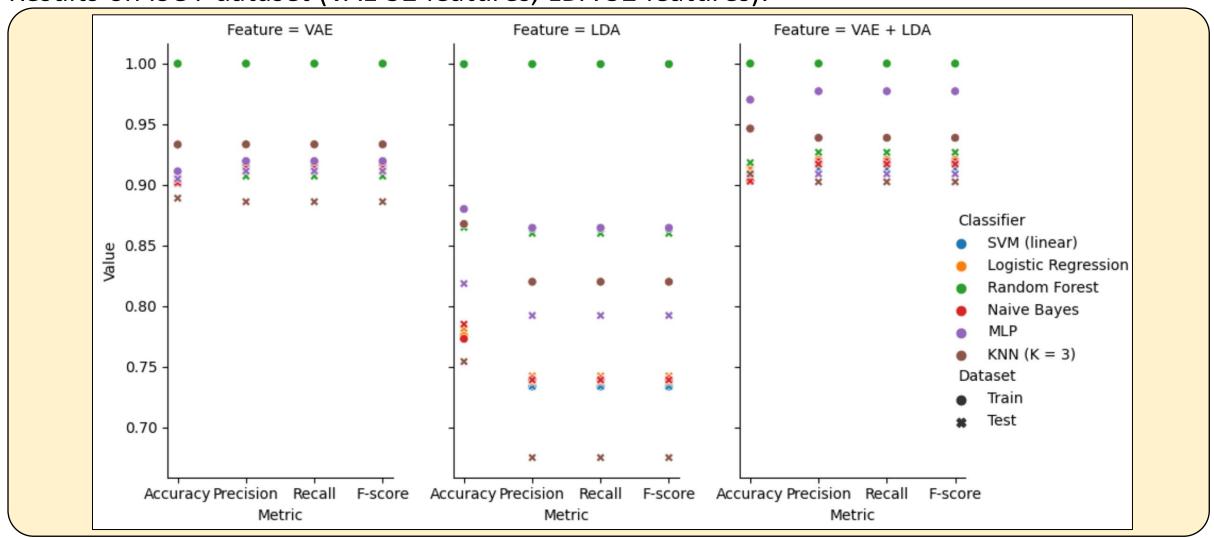




# Results



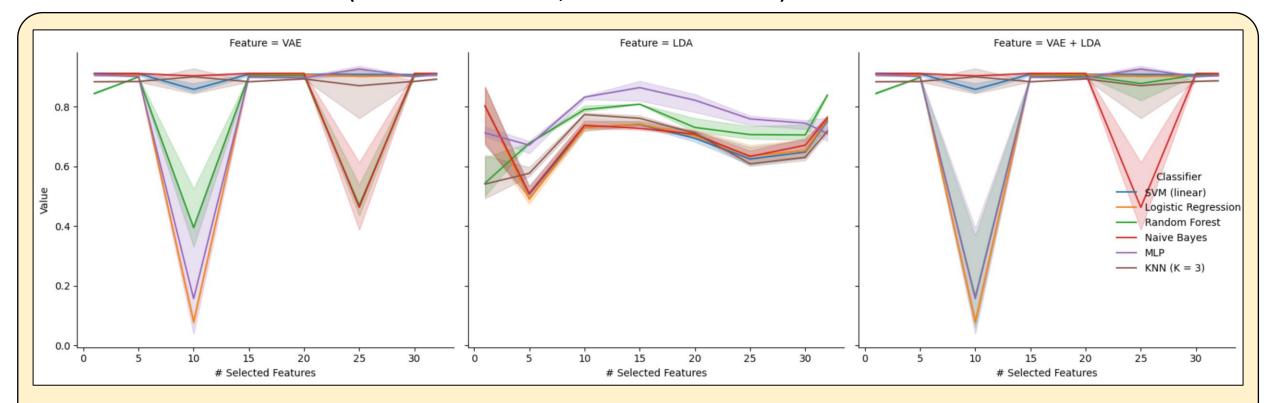
### Results on ISOT dataset (VAE 32 features, LDA 32 features):



# Results



### Results on ISOT dataset (VAE 32 features, LDA 32 features):



#### Feature selection:

- Univariate feature selection
- Chi<sup>2</sup>

- Dataset: Test data
- Metric: Accuracy

## Discussion



### Advantages:

- Our model improves the interpretability of the model.
- Multimodal approach that incorporates two types of features which increases the accuracy.
- Requires **only textual** content.

### Disadvantages:

- Computationally expensive, especially with large data.
- LDA and VAE results are different in different runs, so multiple training might be required.
- Dependent on the text preprocessing.

## Conclusion and Future Work



### **Future Work:**

- Tunning other hyper-parameters in the VAE including the layers configuration.
- Apply multivariate feature selection algorithms.
- Include other types of features, such as publishers.
- Try other types of preprocessing.

### **Conclusion:**

- Our model improves the accuracy of previous model.
- We increase the interpretability by adding LDA component.
- Multimodal approach that incorporates two types of features.
- Requires only textual content.

# References



- Jeffrey Gottfried and Elisa Shearer. News use across social media platforms 2016.
- Ver onica Perez-Rosas, Bennett Kleinberg, Alexandra Lefevre, and Rada Mihalcea. Automatic detection of fake news.arXiv preprintarXiv:1708.07104, 2017
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- David M Blei, Andrew Y Ng, and Michael I Jordan. Latent Dirichlet allocation. the Journal of machine Learning research, 3:993–1022, 2003.
- Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning. MIT Press, 2016. http://www.deeplearningbook.org.



Thank you! Questions?