Rumor Detection of COVID-19 Pandemic on Online Social Networks

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2020-10-10

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Outline

- Motivation
- Data Collection and System Design
- Evaluation and Results
- Conclusion

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Motivation

- **Social networks** have penetrated into all aspects of people's daily lives.
- The new coronavirus epidemic (**COVID-19**) 

causes the deep health crisis across the world.
- Messages about the COVID-19 are now largely emerging on social platforms, including some false information or **rumors**.



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Motivation

- Rumors are regarded as some kinds of **public opinion viruses**.
- After being widely spread, rumors can spread panic and pose a potential threat to social stability.
- Therefore, it is an essential task to **detect rumors of the COVID-19** on social networks.

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Our Work

- We extract four types of features: **text features, user-related features, interaction-based features,** and **emotion-based features** to characterize the information related to the COVID-19.

- We design a novel rumor detection model by using **an ensemble learning approach** for the COVID-19 related messages.

- On the Weibo platform, we perform extensive experiments to validate our model.
  - ✓The experiment results show that our model **has a high detection accuracy** for rumor detection.

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Data Collection

- Based on the real data collected from Weibo:

  - User's personal information:
    - including gender, profile, residence, membership level, microblog authentication, number of following, number of fans, number of Weibo or microblogs, etc.

  - Content information of microblog/Weibo:
    - including publish time, publish channel, blog content, number of reposts, number of comments, number of likes, etc.

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System Design

- Construct four types of features:
  - Text features:
    - collected from the content of a microblog or message of COVID-19.
  - User-related features:
    - the basic features of Weibo users.
  - Interaction-based features:
    - reflect the degree of attention during the propagation process.
  - Emotion-based features:
    - reflect the personal emotion of the user and the attitude of the released message.

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System Design

- The XGBoost model:
  - One of the ensemble learning modes
  - Prevent overfitting
  - Deal with missing data effectively
  - Improve the training speed

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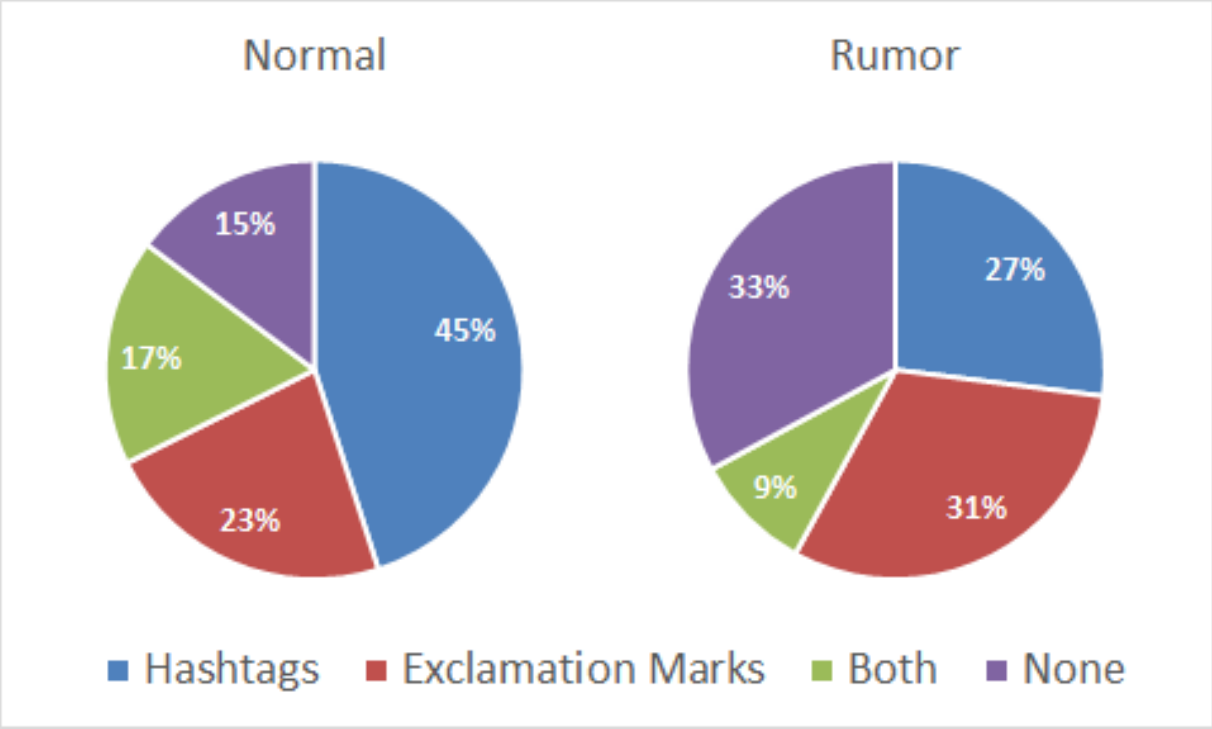
Data Analysis

- Text features:



	Pictures	Videos	None
Normal	44%	40%	16%
Rumor	43%	34%	23%

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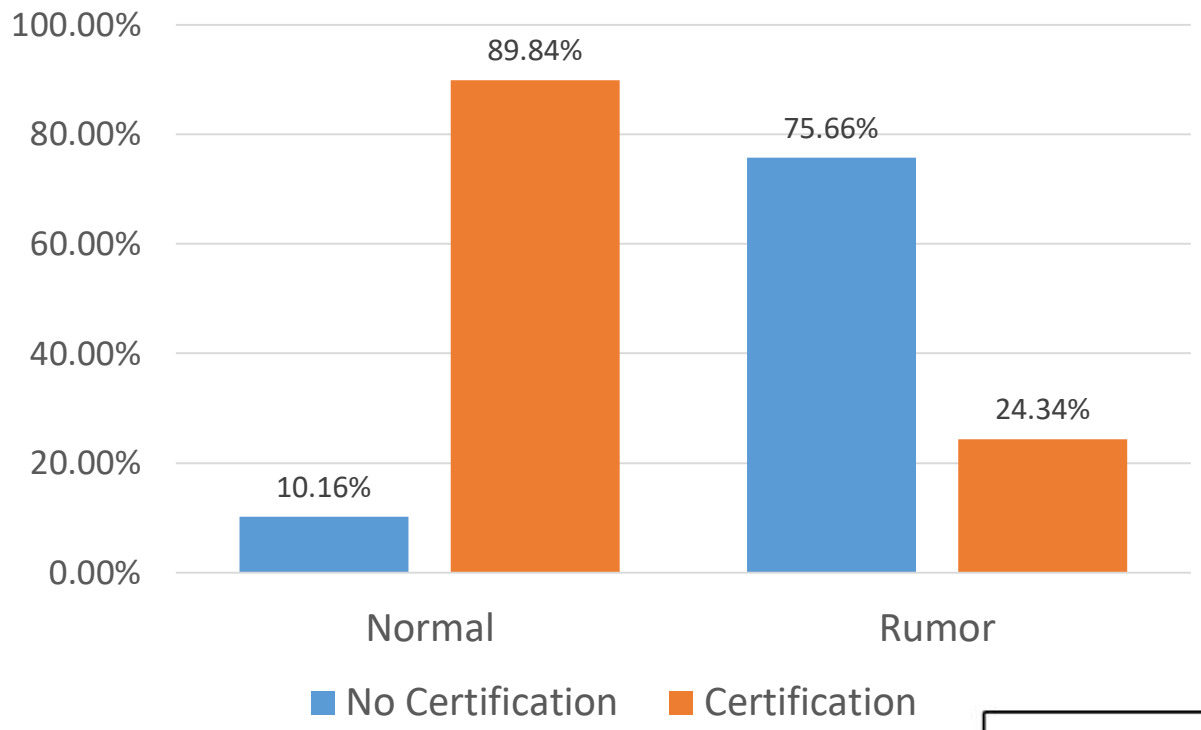
Data Analysis

- User-related Features:

		Normal	Rumor
Gender	Female	25.89%	30.73%
	Male	74.11%	69.27%
Weibo	Mean	23164	14903
	Median	12477	4412
Member	0	308	272
	1	3	0
	2	31	14
	3	50	27
	4	65	32
	5	98	57
	6	224	162
	7	117	77
Reputation	Mean	0.96	0.77
	Median	0.99	0.97

$$\text{Reputation} = \frac{number\ of\ fans}{number\ of\ followers + number\ of\ fans}$$



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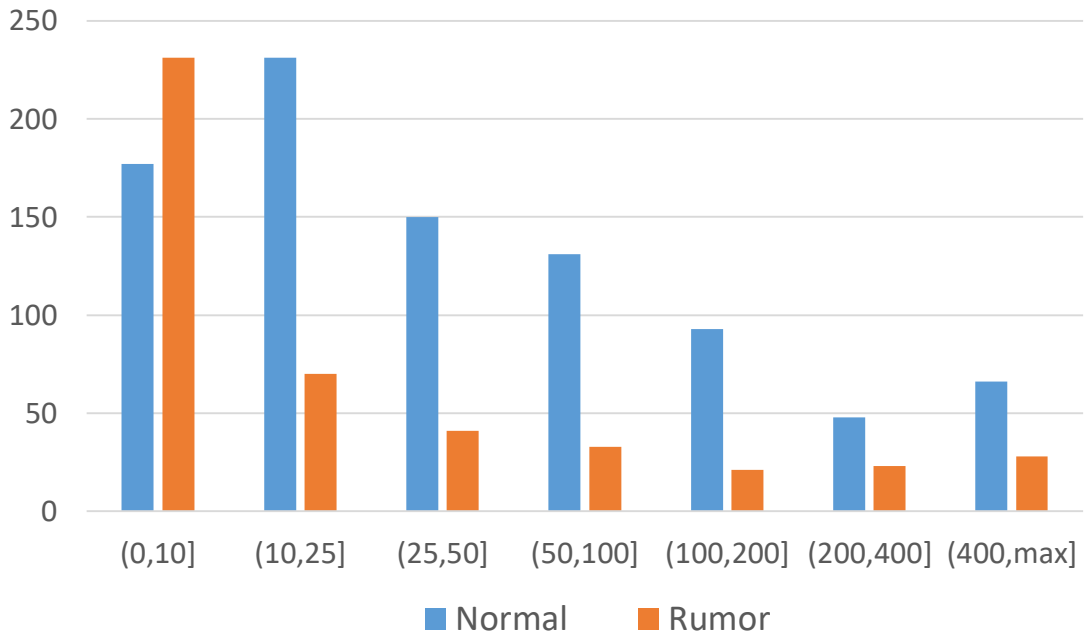
Data Analysis

- Interaction-based Features:

		Normal	Rumor
Reposts	Mean	365	162
	Median	30	2
Comments	Mean	188	117
	Median	29	12
Likes	Mean	1573	1131
	Median	154	19



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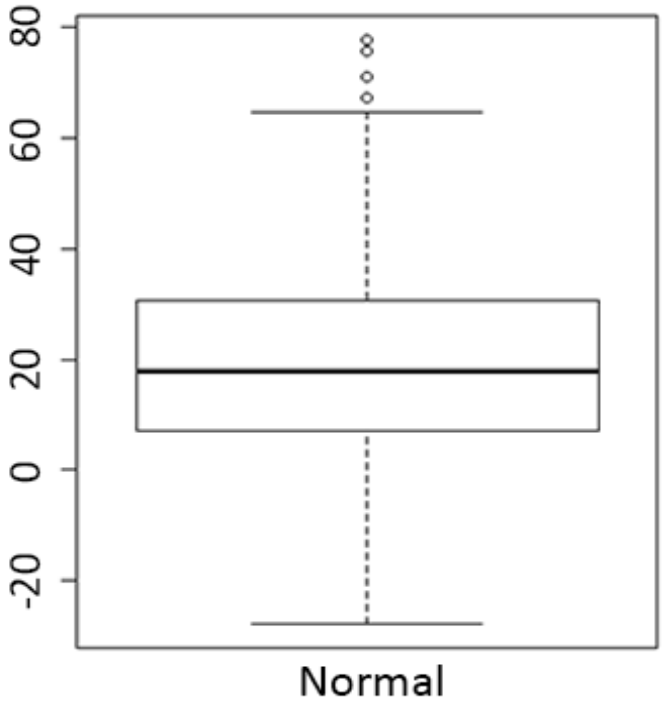
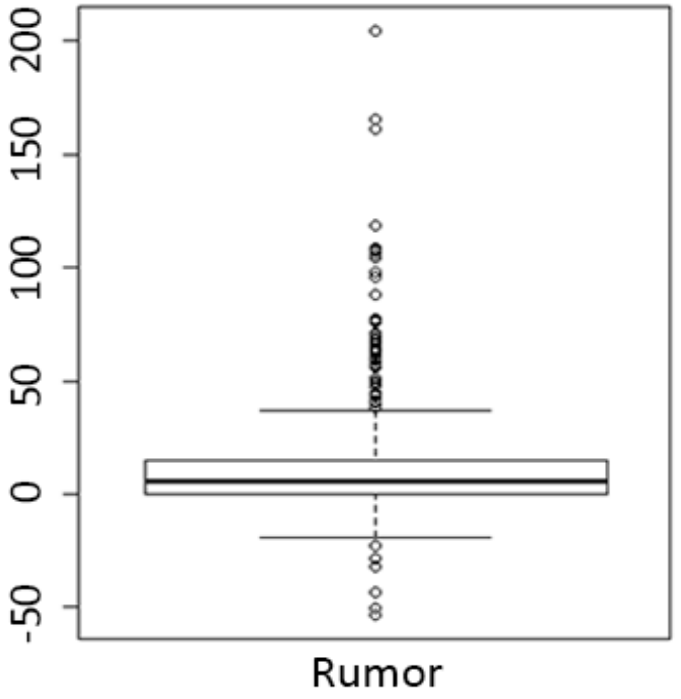
Data Analysis

- Emotion-based Features:





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Performance Metric

- The most common evaluation indicators for classification models are accuracy, precision, recall, F1 value, and AUC value:

Model	Accuracy	Precision	Recall	F1	AUC
Text Characteristics	0.70	0.67	0.54	0.60	0.78
User-related Features	0.87	0.85	0.83	0.84	0.91
Interaction-based Features	0.80	0.94	0.55	0.69	0.84
Emotion-based Features	0.69	0.61	0.64	0.63	0.71
Our Detection Model	**0.91**	**0.94**	**0.85**	**0.89**	**0.96**

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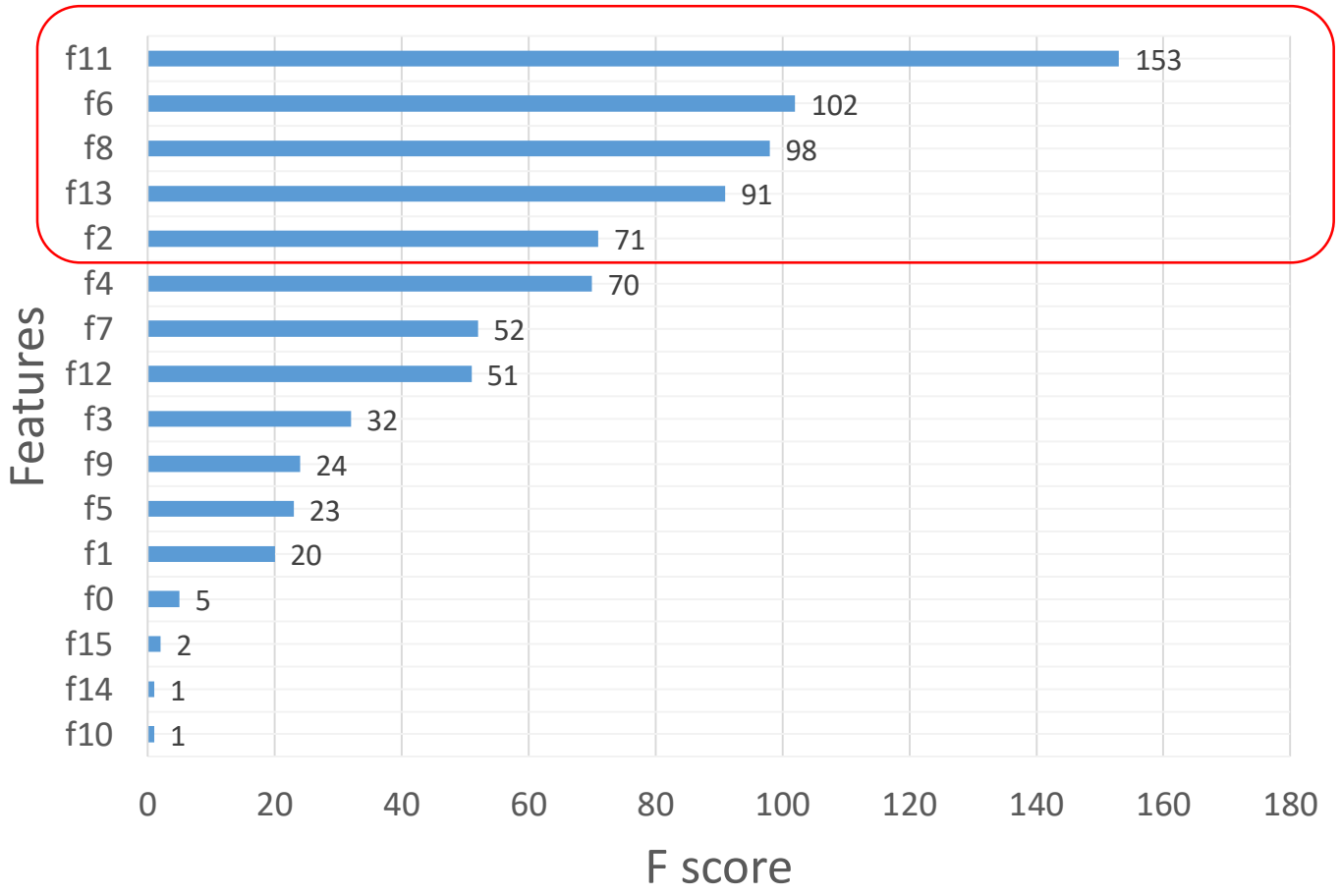
Feature Importance



f0:	Gender	f1:	Member
f2:	**Certification**	f3:	Following
f4:	Fans	f5:	Weibo
f6:	**Reputation**	f7:	Time
f8:	**Emotion**	f9:	Hashtags
f10:	Exclamation Marks	**f11:**	**Reposts**
f12:	Comments	**f13:**	**Likes**
f14:	Pictures	f15:	Videos

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Conclusion

- We design a rumor detection model for COVID-19 related messages on social networks：
  - We deploy the XGBoost ensemble learning algorithm to construct a new rumor detection model;
  - **Our model combining 16 features in four dimensions can achieve 91% accuracy**.

- We find that the top five features that have the greatest impact on the accuracy of rumor detection are the number of reposts, reputation, emotion, number of likes, and Weibo certification.

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Thank You !