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Detecting compromised accounts caused by phone number recycling on e-commerce platforms: taking Meituan as an example

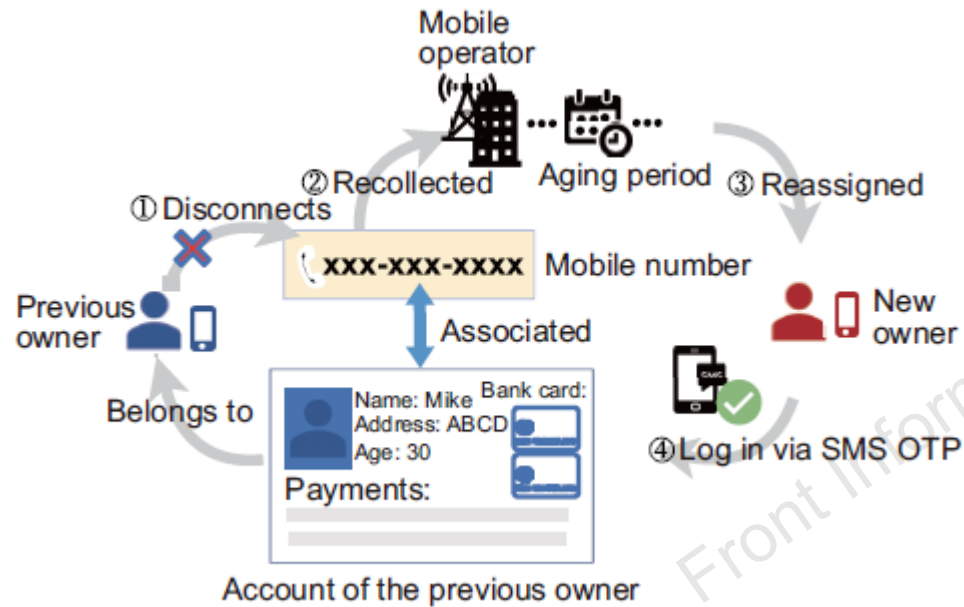
Key words: Phone number recycling; Neural networks; E-commerce; Compromised account detection

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Motivation

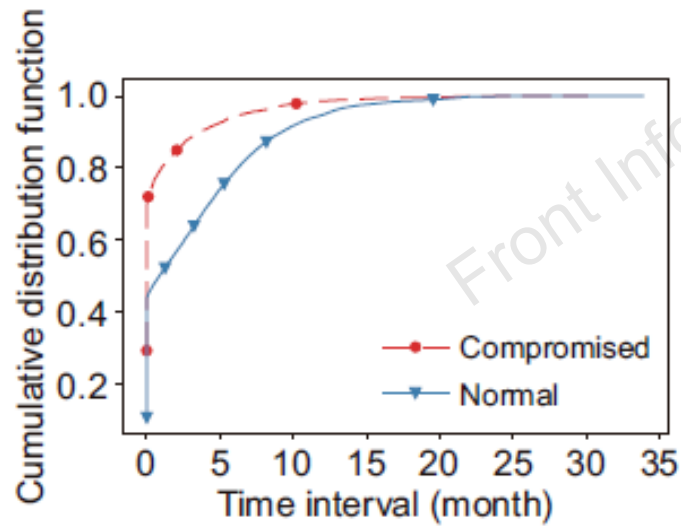


The process of phone number recycling

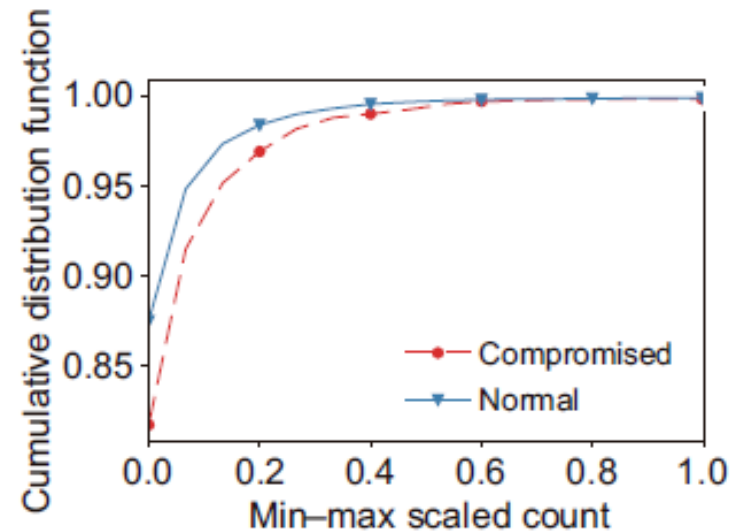
- ❑ **Security Risks of Phone Number Recycling (PNR):** PNR can lead to unauthorized access to accounts, increasing **fraud risk** and causing **monetary loss** as well as **reputation damage**.
- ❑ **Current Solutions:** Existing methods are both **costly and ineffective**. 😞
- ❑ **Need for an Effective Method:** There is an urgent need for **cost-effective** solutions that **use only application data** to identify compromised accounts.

Data-Driven Study

- We have conducted a data-driven study on the compromised accounts and the normal ones from several behavioral patterns.
- We have discovered several distinctive features that would distinguish compromised accounts from normal ones.
- Analysis on card binding related features



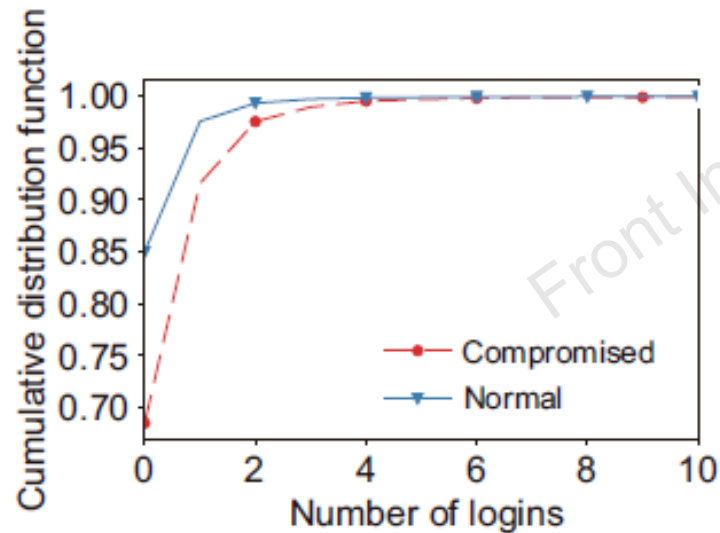
Average time interval of bank card bindings



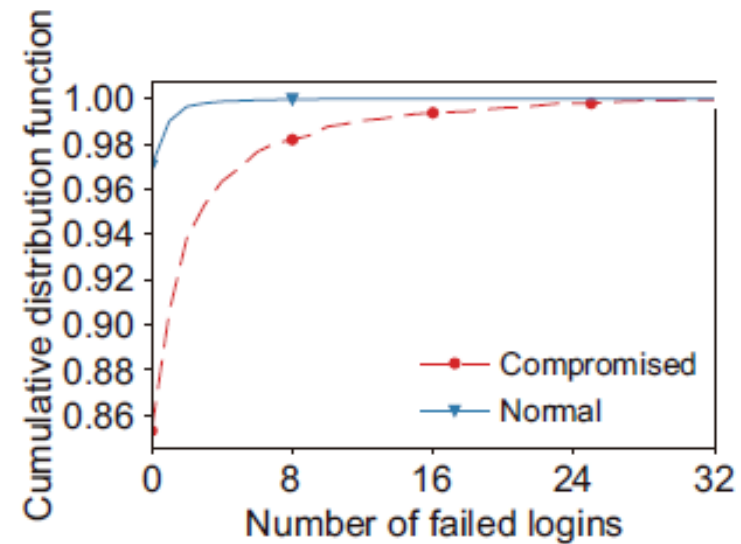
Number of failed bank card binding attempts

Data-Driven Study

- We have conducted a data-driven study on the compromised accounts and the normal ones from several behavioral patterns.
- We have discovered several distinctive features that would distinguish compromised accounts from normal ones.
- Analysis on login related features



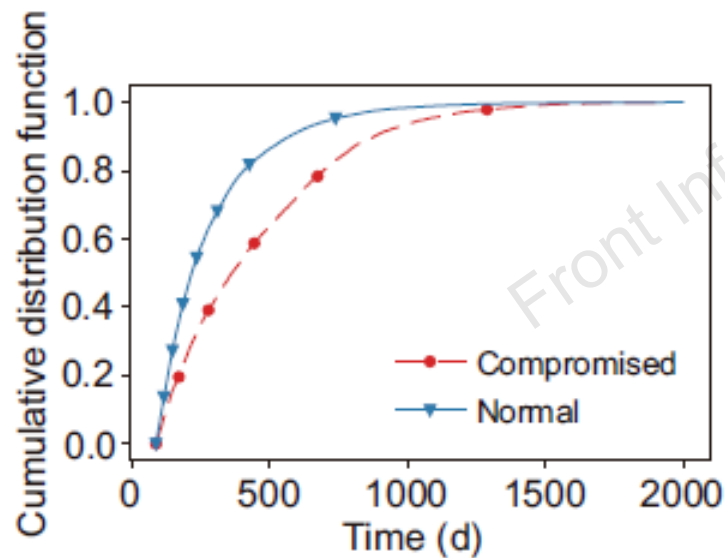
Number of logins on a new device by SMS OTP



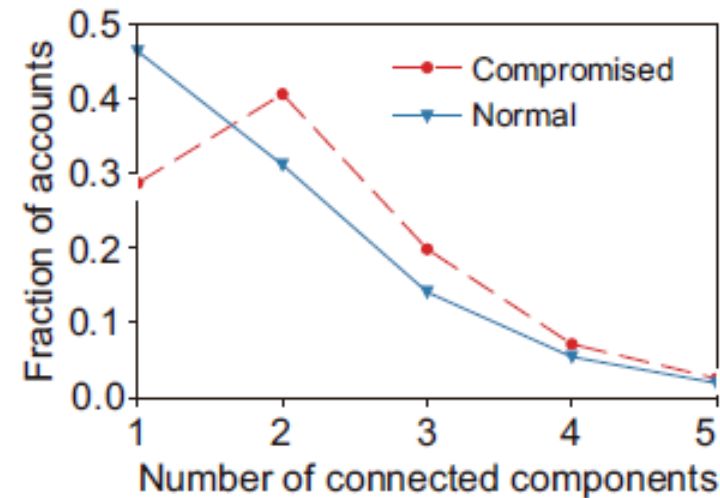
Number of failed logins

Data-Driven Study

- We have conducted a data-driven study on the compromised accounts and the normal ones from several behavioral patterns.
- We have discovered several distinctive features that would distinguish compromised accounts from normal ones.
- Analysis on silent period and behavior sequences related features



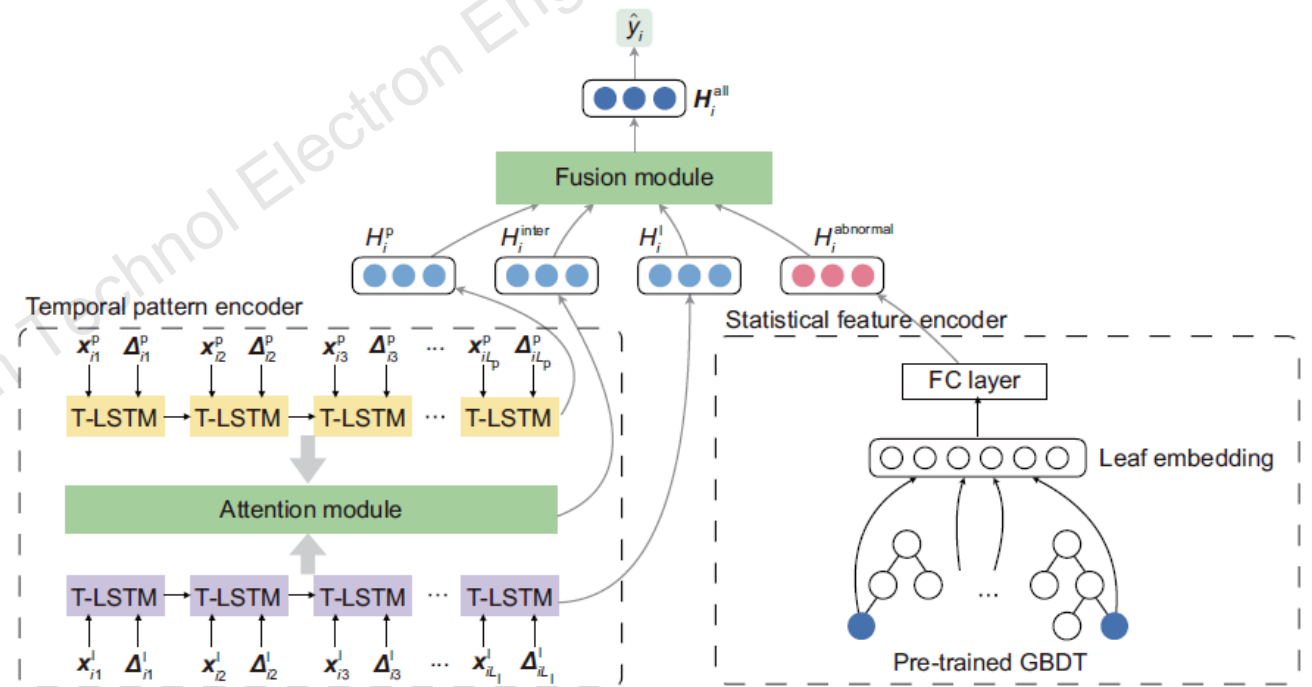
The maximum length of silent periods



Number of connected components in an account's behavior sequences

Method

- We propose an approach named **TSF** to detect compromised accounts due to PNR.
- The **temporal pattern encoder** is designed to capture behavioral evolutionary interaction.
- The **statistical feature encoder** is employed to capture significant operation features.

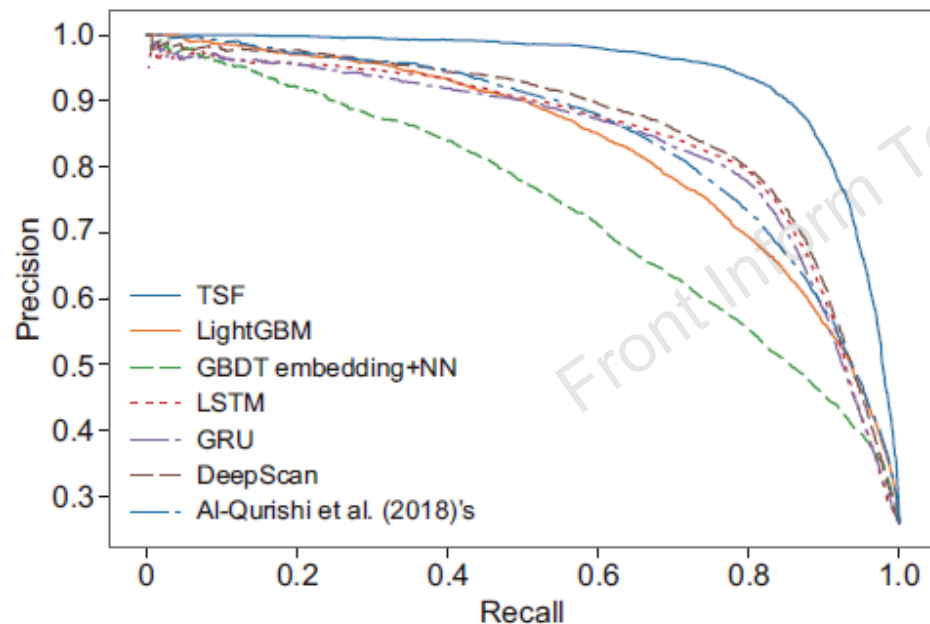


Overview of the TSF model

Major Results

Table 1 Statistics of the Meituan dataset

Type	Number of accounts	Average payment per account	Average login per account	Number of payment records	Number of login records
Compromised	32 388	166	55	5 368 566	1 815 494
Normal	91 575	315	48	28 863 693	4 687 487



Precision–recall curves of TSF and the baselines for the Meituan dataset

Detection results

- The proposed TSF outperforms all the baseline models, with a 3.89%–4.95% AUC increase and a 16.55%–50.49% recall increase for the Meituan dataset.
- The ensemble models outperform the sequential models with higher AUC performance.

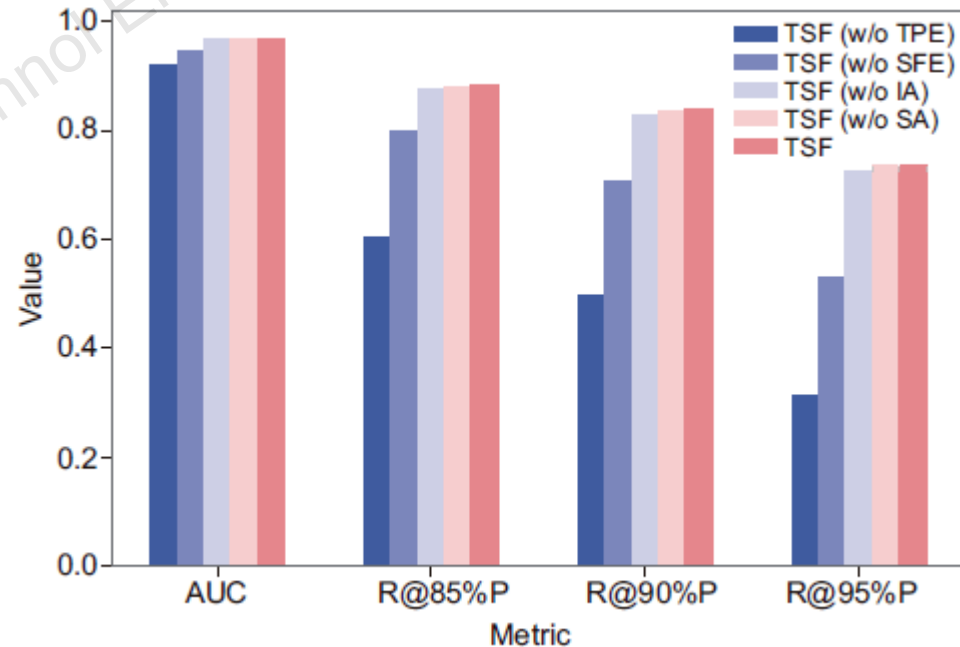
Major Results

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Ablation study

- All modules of our model contribute to the task of detecting compromised accounts via PNR for the Meituan dataset.
- Removing the temporal pattern encoder has the most severe impact on the performance of our model.



Ablation study for the Meituan dataset

Conclusions

- We focused on the problem of detecting compromised accounts via PNR, a widely prevalent problem in e-commerce platforms. We analyzed and observed that the compromised accounts and the normal ones have distinctive behaviors and evolution patterns.
- We proposed the TSF model to detect the compromised accounts from the normal ones. TSF considers behavioral evolutionary interaction and significant operation features of all accounts.
- Extensive experiments on two real-world datasets demonstrated that our model significantly outperforms some carefully selected baselines.

Future Work

- We will build the association graphs between accounts and entities (such as devices and IP addresses) and utilize graph neural networks to identify the compromised accounts.
- We expand our approach to distinguishing more fine-grained types like lost, stolen, and other abnormally lost numbers for compromised accounts.
- We will continue to develop more comprehensive strategies like data augmentation and transfer learning techniques, for further addressing class imbalance challenges.

Author Information



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