Real-Time Detection of Emerging Fraud Trends

Team 42: Yujin Zhang, Jiayi Liu, Hongyi Zhong, Syed Irtiza Mehdi, Demir Degirmenci

Agenda

1 **Introduction**

Team member introduction and project overview.

2 **Data Collection and Cleaning**

Web scraping from different social platform.

3 **Analysis of Social Media Trends**

Fraud Trends on Reddit and Telegram.

4 **Limitations and Future Improvement**

Areas for improvement.

Our Team Members

Yujin Zhang   Jiayi Liu   Hongyi Zhong   Syed Irtiza Mehdi   Demir Degirmenci

Introduction

- **Objective:** Track how fraud discussions evolve using NLP and time series to uncover early warning signals.

- **Platform Exploration:** Assessed Reddit, Telegram, Instagram, Bluesky, and Twitter for fraud monitoring potential.

- **Platform Selection:** Focused on Reddit and Telegram due to richer, actionable, and accessible fraud-related content.

Focus Areas:

- **Identifying unusual posting patterns**

- **Clustering semantically similar posts**

- **Forecasting future keyword volume trends**

- **Evaluating platform-specific strengths**

Data Collection --Multi-Platform Data Collection Strategy

✅ **Used Platforms**

- **Reddit**
  Official API
  Systematic search of 20 subreddits
  → ~2,138 relevant posts

- **Telegram**
  Official API
  Manually identified channels
  → Scraped 8,375+ messages

❌ **Dropped Platforms**

- **Bluesky**
  ✗ Keyword hits sparse
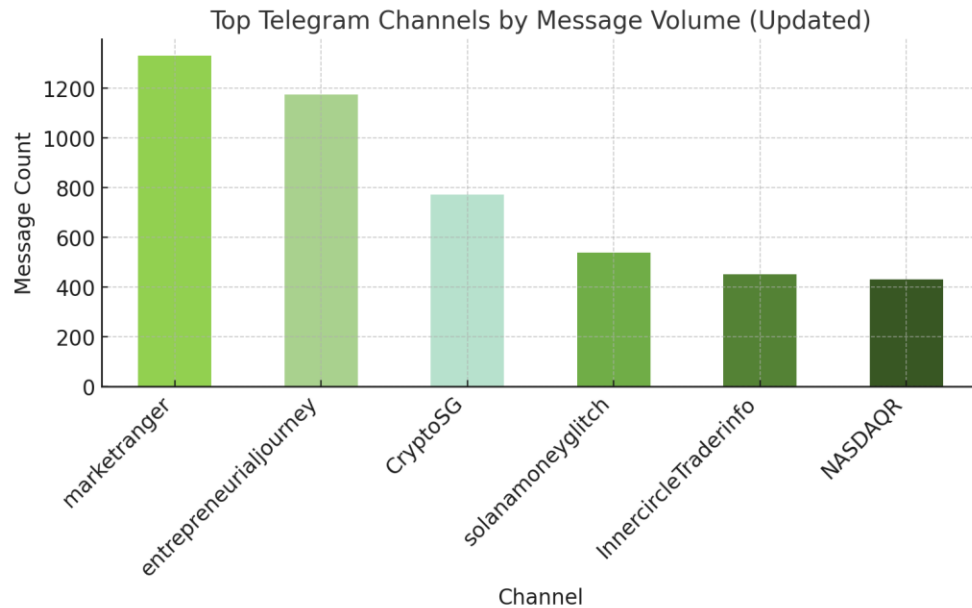 ✗ Hard to extract meaningful content

- **Instagram**
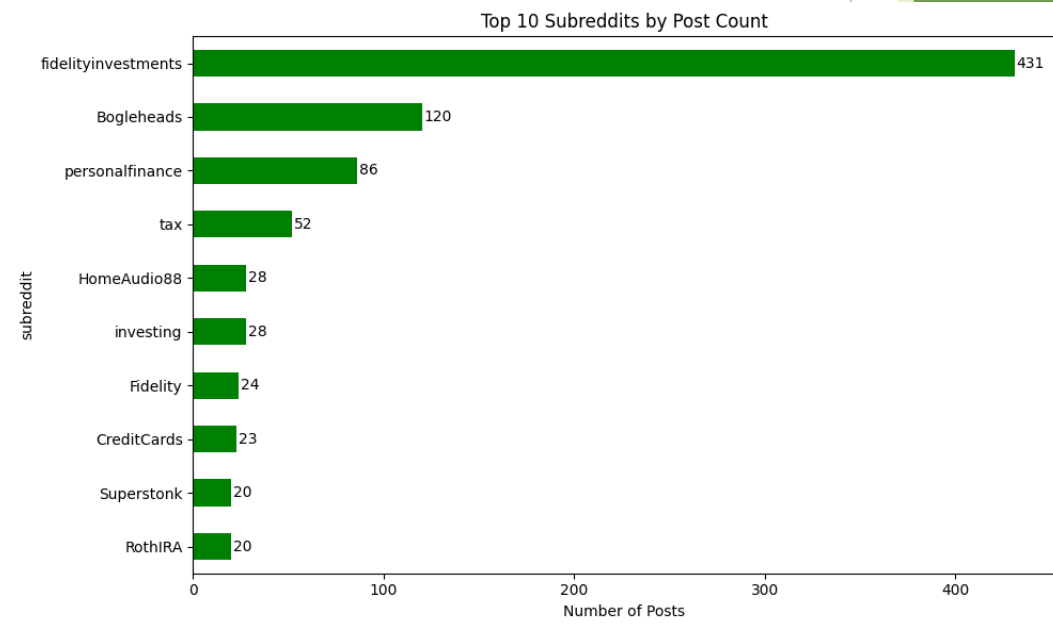 ✗ Limited API access
  ✗ Textual data too minimal for analysis

🌟 *We explored 5 platforms before finalizing the 2 most useful ones.*

Data Collection: What the Process Looked Like

Each of these top Telegram channels was manually identified and scraped. The highest-volume one alone had over 1,200 messages.

Over 1/5 our Reddit posts came from r/fidelityinvestments, indicating it as the most concentrated source of Fidelity discussions.

Data Collection: Final Dataset & Takeaways

Platform	Time Span	Collected	Notes
Reddit	25 days (24/03/2025 – 18/04/2025)	2,138 posts	• Official API • Only the most recent 10 pages of posts can be retrieved • Ran the crawler 3–4 times per day
Telegram	8 months	8,375 messages	API, manually search channel
Bluesky	-	Dropped	Sparse, hard to filter
Instagram	-	Dropped	Not accessible via text

Conclusion:
- Chose quality over convenience
- Learned from failure & iterated
- Ready for next stage: NLP & fraud detection

Data Cleaning: Disambiguating 'Fidelity'

- The word "Fidelity" can refer either to the Fidelity Investments or to general qualities like loyalty and trustworthiness.
- Failing to distinguish them leads to **false positives in fraud detection.**

Telegram

- **Channel selection was performed manually to ensure relevance.**
- **Channels unrelated to business, investment, crypto, or startups were excluded.**

Manual channel selection

Reddit

- Data was collected across all subreddits by searching for posts containing the keyword "fidelity".
- 795 Subreddit
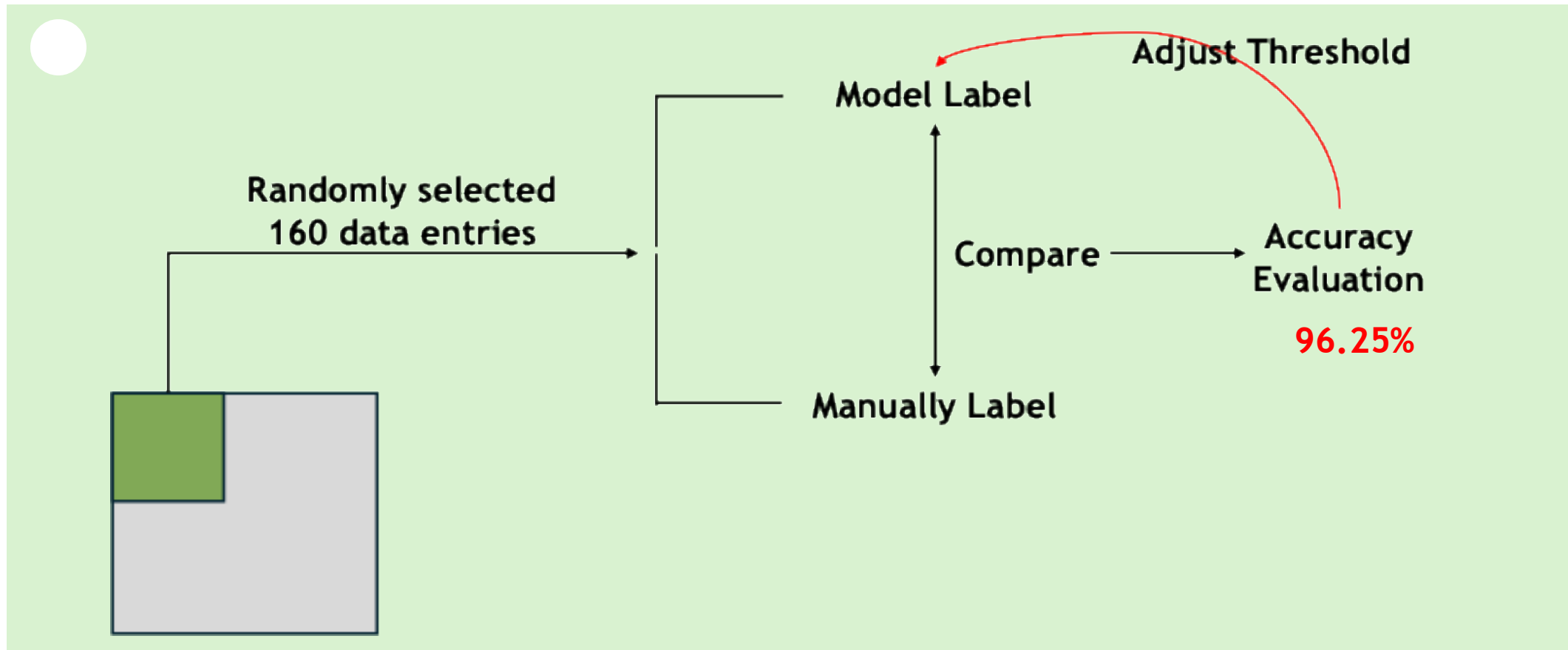- Manual channel filtering was time-consuming and labor-intensive.

Semantic Analysis

Data Cleaning: Semantic Analysis

- Understands the meaning of words and sentences — not just keywords.
- Helps distinguish contextual meanings (e.g., "Fidelity" as a company vs. "fidelity" as loyalty).
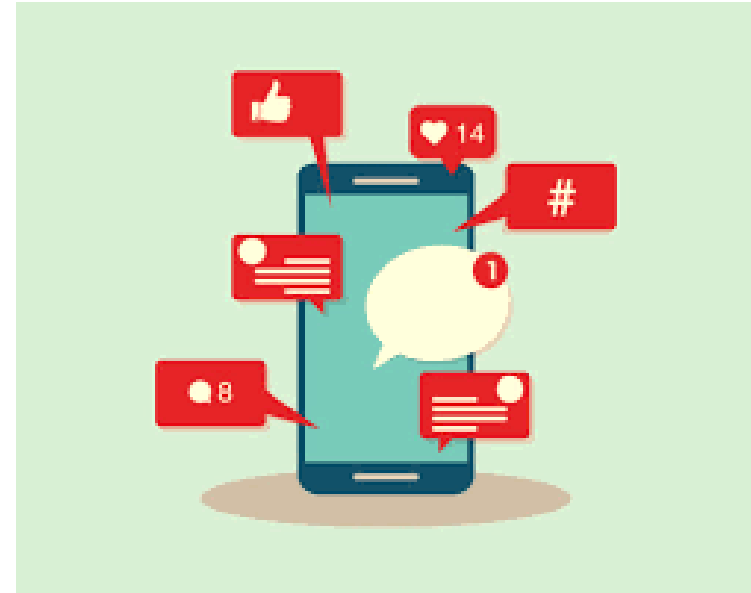- Converts text into semantic vectors (embeddings) and compares them.

Reddit

Characteristics of Social Media Fraud Trends

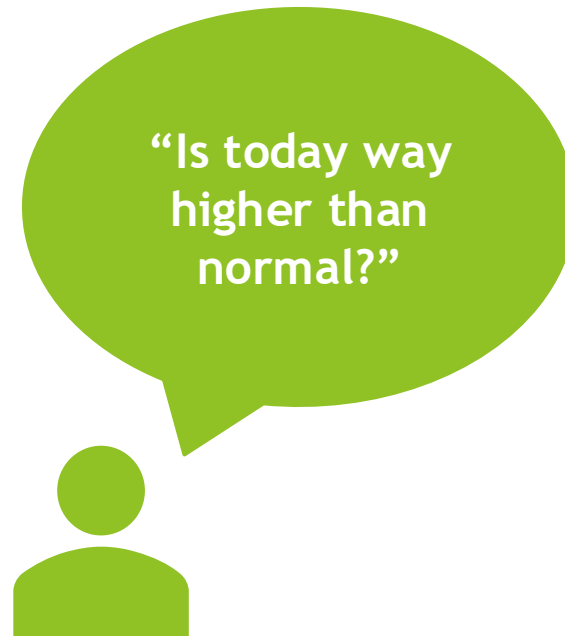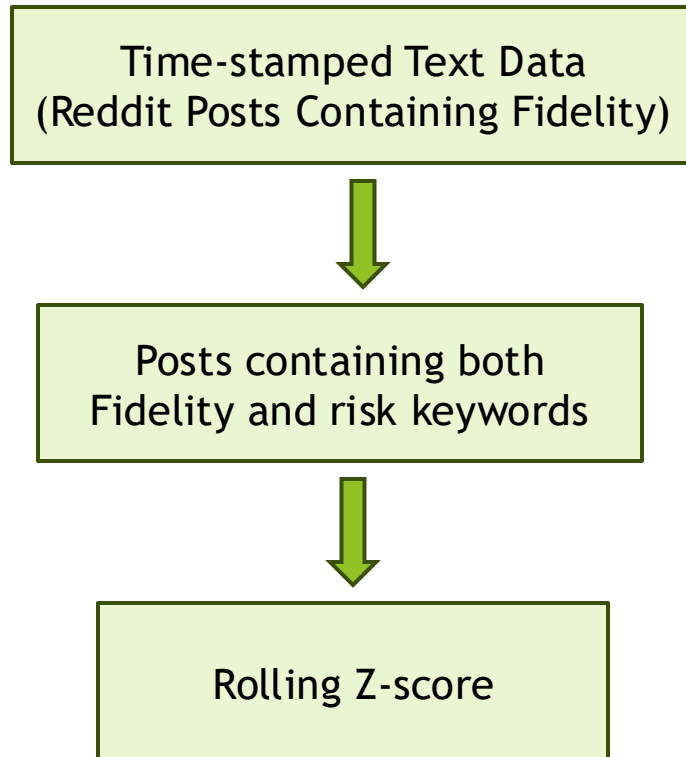Large Volumes within a
Short Time Frame

☐ **Time Series Analysis**

Unusual Repetition

☐ **Clustering**

Reddit: Time Series Analysis

Time-stamped Text Data
(Reddit Posts Containing Fidelity)

↓

Posts containing both Fidelity and risk keywords

↓

**Rolling Z-score**

"Is today way higher than normal?"

Measuring Unusual Activity Over Time

- A z-score tells us how unusual today is compared to the recent past.

- It helps us detect social media scam waves, and spot spikes in fraud-related messages that may need attention

Reddit: Time Series Analysis

More Deceptive Risk Keywords Not Detected

- Total Occurrence of Risk Keywords: 18 Times
- 'Glitch' and 'scam' are the most frequently occurring risk keywords
- More deceptive risk keywords did not appear

Frequency of Keywords in Reddit Posts (Related to Fidelity)
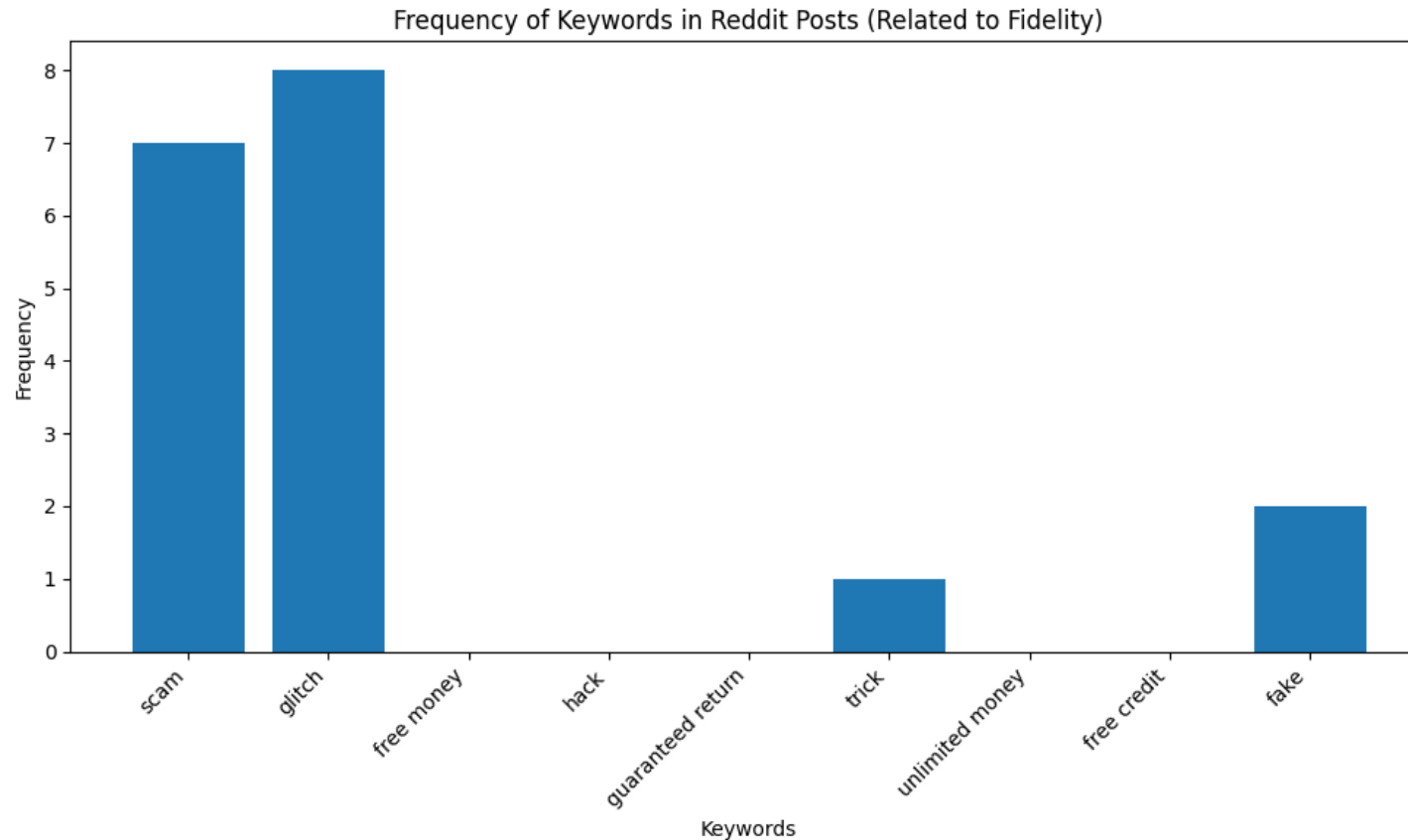
Reddit: Time Series Analysis

No Peaks Detected for Risk Keyword Occurrences

- The frequency of risk keywords appearing is very low.
- Z-score shows early fluctuations, but no other significant anomalies were detected.

Fidelity Daily Mentions with Z-Score Anomaly Detection

Early Z-score Oscillations
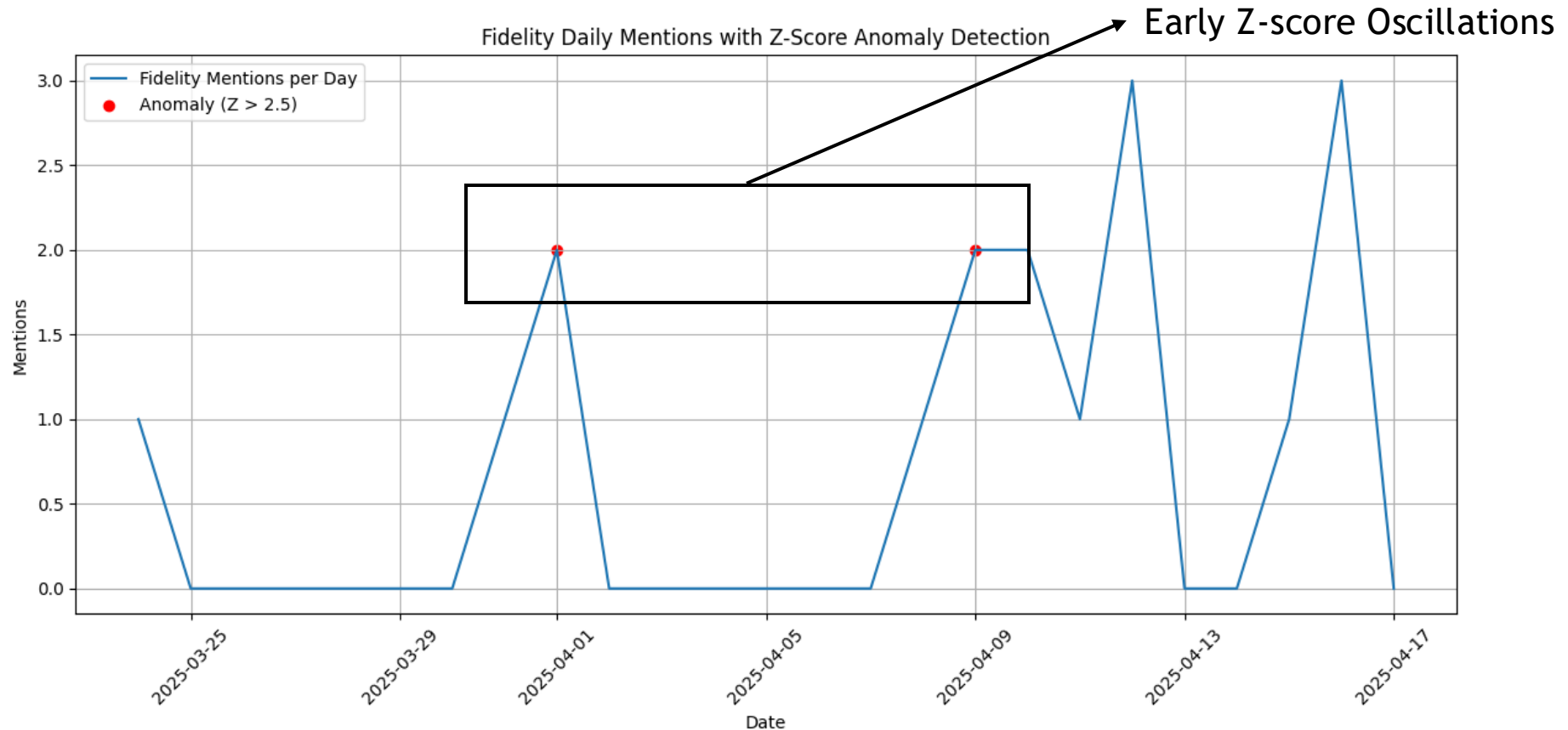
Reddit: Time Series Analysis

No New Types of Fraud, But the Same Old Story

|	
Potential Scams When Making Charitable Contributions from a Fidelity IRA	**r/fidelityinvestments** · 9 days ago turtlerunner99 **ACH Security** I recently wanted to make a charitable contribution (actually a QCD) from my Fidelity IRA. I went on line to the charity and there was a place to enter my account and routing numbers. How is this secure? Couldn't someone go to a charity I don't want to donate to and enter my account and routing numbers? Couldn't someone set up a fake charity and enter account and routing numbers without authorization?
Phone Scam	• $5,000 stolen via fraudulent wire transfer during phone setup. • Received spoofed texts and calls claiming to be from "Fidelity", referencing past charges. • Scammer instructed the user to dial ##21#, unknowingly forwarding calls and texts. • This likely enabled the scammer to reset the account password using intercepted codes. • Fidelity attempted to call, but their call was redirected to the scammer, who posed as "Fidelity Fraud Department."

Reddit: Clustering

Clustering is a method of grouping similar data points together based on shared patterns or features.
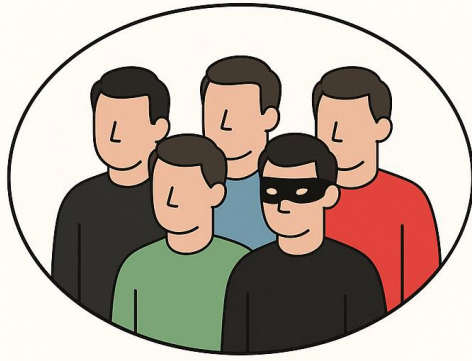
Scammer

Once a new scam method emerges, it often attracts many copycats
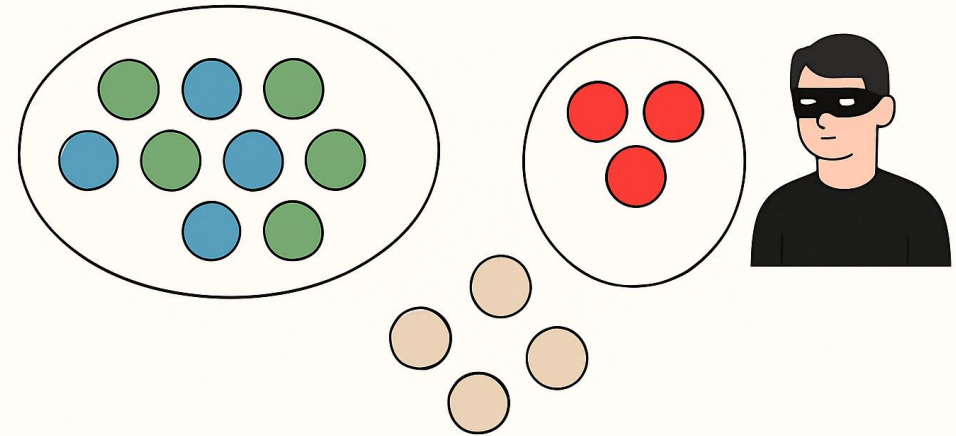
Scammers often use multiple accounts—or even bots—to flood platforms with similar posts to lure in consumers

Reddit: Clustering

Time-stamped Text Data
(Reddit Posts Containing Fidelity)

↓

Use SentenceTransformer to convert posts into embeddings

↓

Calculate the cosine similarity between pairs of embedding vectors

↓

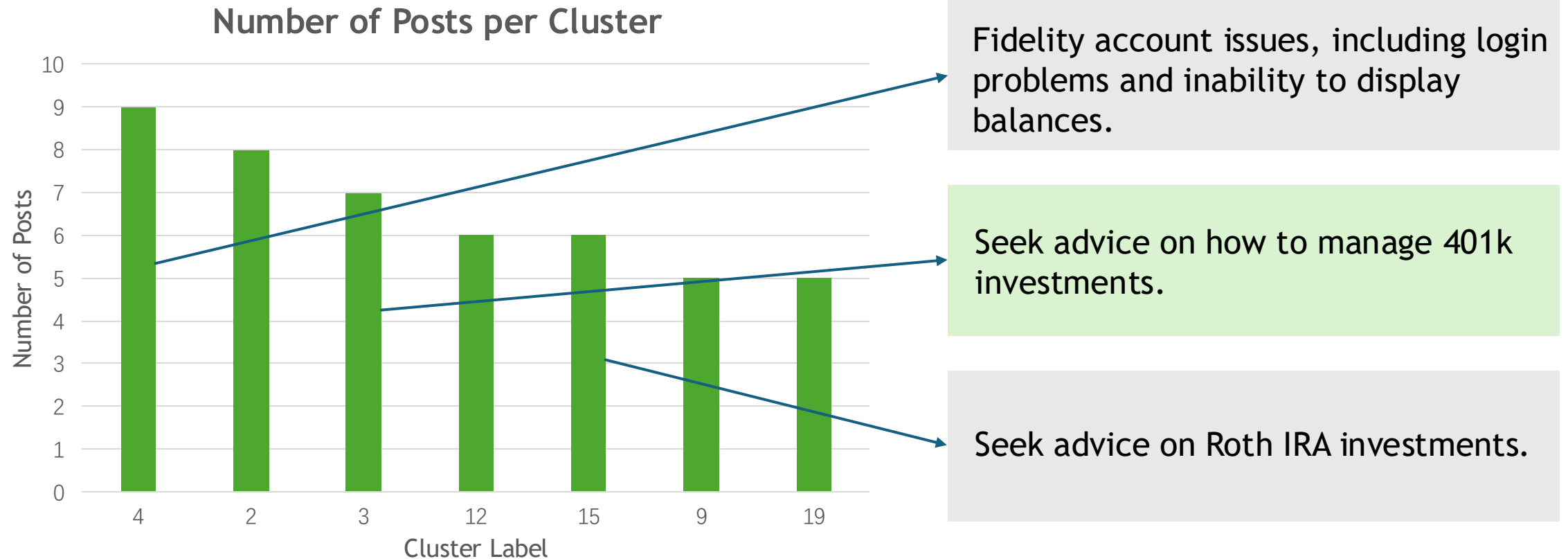Use DBSCAN for clustering and filter clusters (> 5 posts)
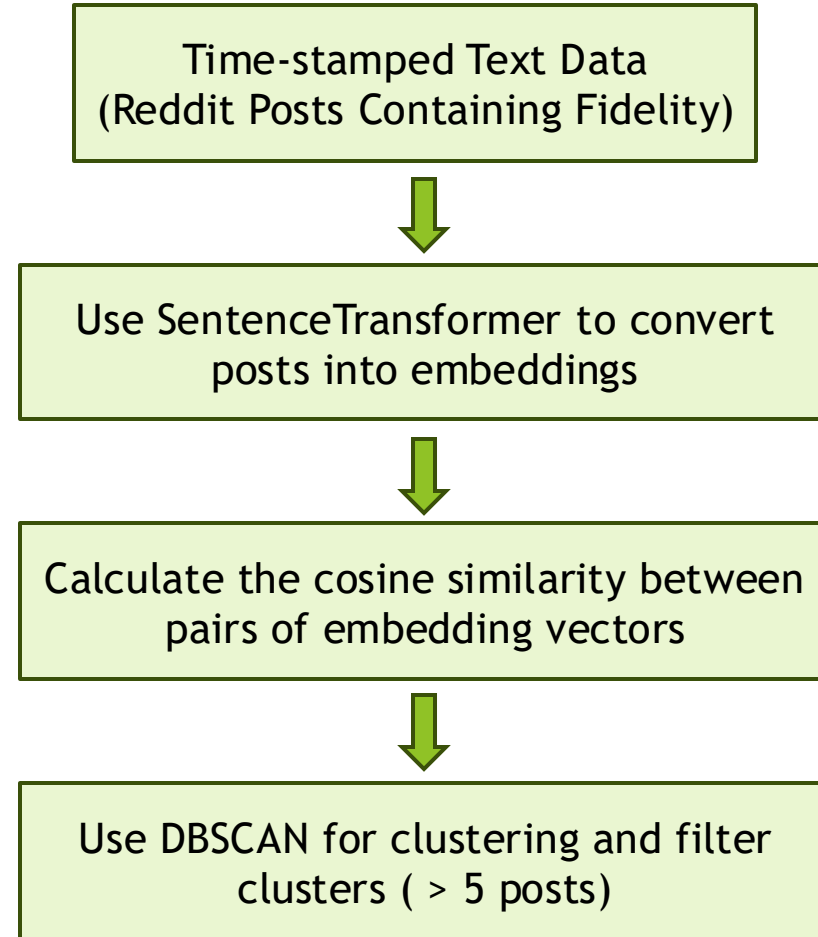
Reddit: Clustering

➢ 1011 noise points (unassigned to any cluster)
➢ 8 Clusters with more than 5 post ➡ May signal suspicious activity

Number of Posts per Cluster

Fidelity account issues, including login problems and inability to display balances.

Seek advice on how to manage 401k investments.

Seek advice on Roth IRA investments.

Telegram for Industry Analysis

▶ Only had access to public channel information

▶ Channels scrapped for keywords such as: glitch, scam, free money & hack

▶ 8,375 messages were identified:

```
Total number of messages: 8375

Risk Keyword Frequency:
         Risk Keyword  Frequency
0                scam        855
1               glitch       102
2           free money        84
3                 hack       116
4    guaranteed return         2
5                trick         4
6       unlimited money         0
7          free credit         5
8                 fake        55

'Company Keyword Frequency: 91
```
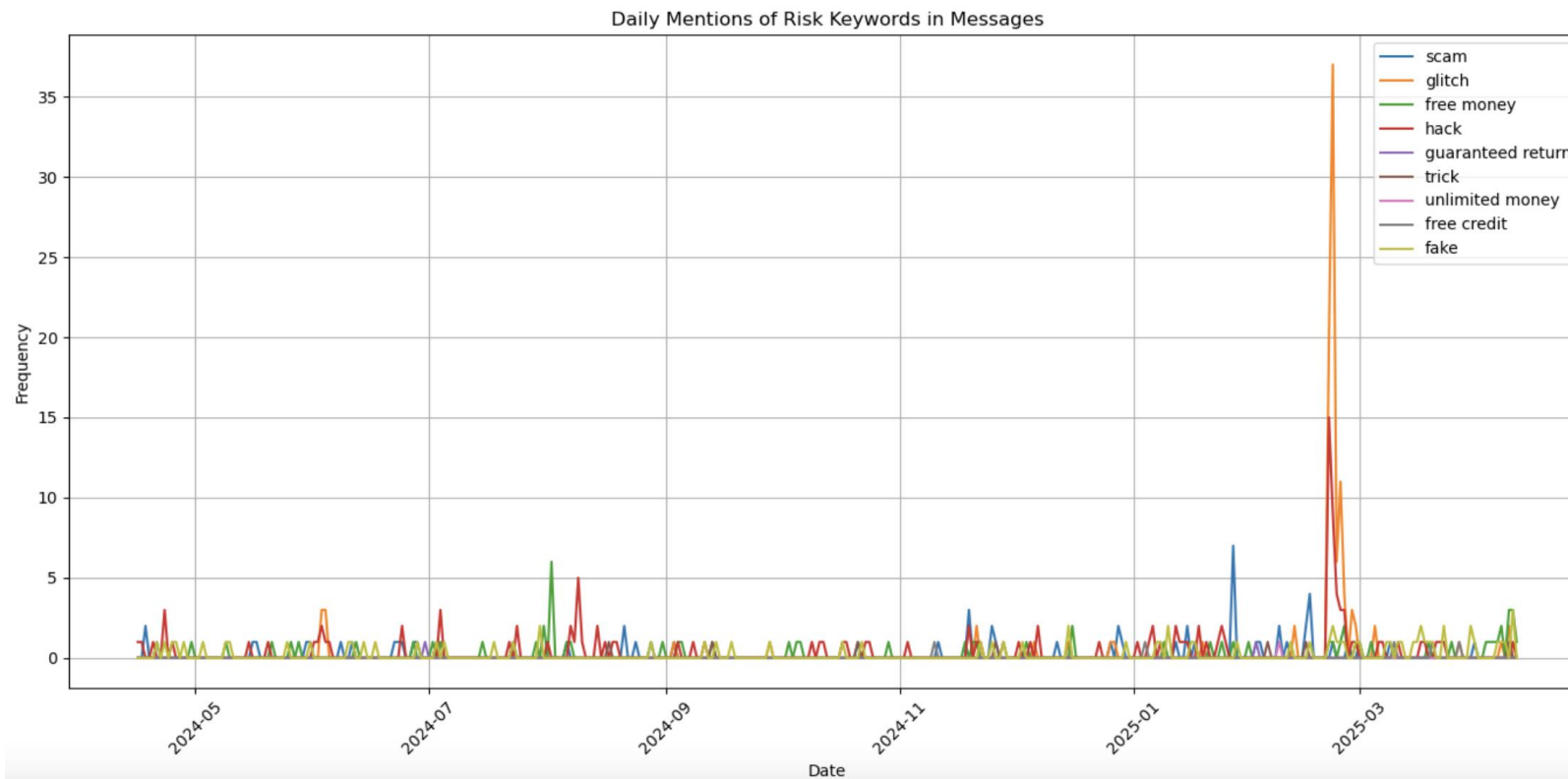
Telegram for Industry Analysis

▶ When matching Risk keywords and Fidelity we returned 0 results

▶ One unnerving trend was realized through keyword analysis:

Daily Mentions of Risk Keywords in Messages

Telegram for Industry Analysis

▶ "Glitch" spiked, most relating to video games

▶ Third largest spike corresponded to "Solana Money Glitch", a cryptocurrency "glitch"

Date	Sender ID	Message	Channel	fidelity_flag
2025-02-21 2	2106209134	these is real glitch shit	solanamoneyglitch	FALSE
2025-02-21 2	2106209134	have to hold and believe in the glitch!!	solanamoneyglitch	FALSE
2025-02-21 2	2106209134	this is the real	solanamoneyglitch	FALSE
2025-02-21 2	2106209134	20 mill is preprogrammed just trust the team and the glitch!!	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üü¢	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	131354669	live on pumpfun:	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	131354669	bybit infinity money glitch ⬚üí£	solanamoneyglitch	FALSE
2025-02-21 2	8135790512	no need for money glitch and automatic burns	solanamoneyglitch	FALSE
2025-02-21 2	8024543055	can someone look at my wallet? ive holded for over 30 mins, but without any rewards solana money glitch	solanamoneyglitch	FALSE

Telegram for Industry Analysis

▶ One channel produced mostly noisy data

▶ When filtering out certain channels for noise:

Daily Mentions of Risk Keywords in Messages
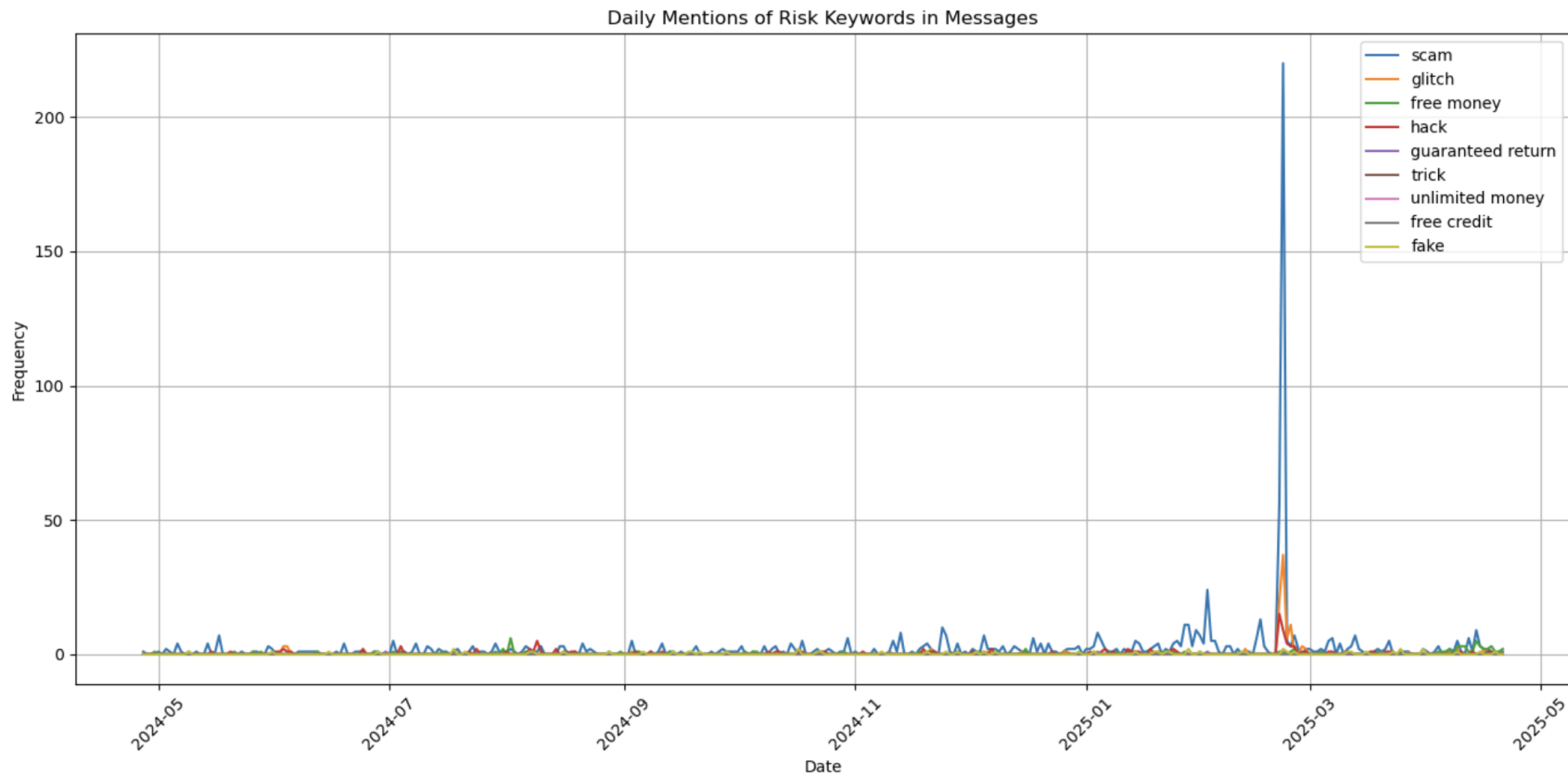
Telegram for Industry Analysis

▶ When further filtering for noisy data, we discovered actual fraud related posts:

Date	Sender ID	Message	Channel	fidelity_flag
2025-02-22 2	756201229	damn you mean scam?	solanamoneyglitch	FALSE
2025-02-22 2	6828071499	i have never seen so much garbage in a chat without it being cleaned, i only read shit and scam	solanamoneyglitch	FALSE
2025-02-22 2	7817603625	excalty cause its scam	solanamoneyglitch	FALSE
2025-02-22 2	975901521	that‚Äôs a scam airdrop ⬚üòÇ	solanamoneyglitch	FALSE
2025-02-22 2	975901521	that‚Äôs a scam token mate that got airdroped	solanamoneyglitch	FALSE
2025-02-22 2	7298004204	you‚Äôre selling a scam coin⬚üòÇ it‚Äôs not this one.	solanamoneyglitch	FALSE
2025-02-22 2	879351130	check pm bro	solanamoneyglitch	FALSE
2025-02-22 1	7069327379	it‚Äôs a scam	solanamoneyglitch	FALSE
2025-02-22 1	7069327379	yo the amount of effort you just went through whoever you are in order to scam people is fickkng ridiculous	solanamoneyglitch	FALSE
2025-02-22 1	7069327379	yo the amount of effort you just went through whoever you are in order to scam people is fickkng ridiculous	solanamoneyglitch	FALSE
2025-02-22 1	7130357808	this is a scam coin the other is okay	solanamoneyglitch	FALSE
2025-02-22 1	7069327379	infinite works like clockwork is this a scam?	solanamoneyglitch	FALSE
2025-02-22 1	1081717185	other one got airdropped , probably a scam	solanamoneyglitch	FALSE
2025-02-22 1	6951113890	not a scam i was in both. out of img for now	solanamoneyglitch	FALSE
2025-02-22 1	6329425370	is this a scam	solanamoneyglitch	FALSE
2025-02-22 1	7056448486	guys is the scam stop bying it	solanamoneyglitch	FALSE
2025-02-22 1	7056448486	it‚Äôs a scam	solanamoneyglitch	FALSE
2025-02-22 1	7056448486	guys it‚Äôs is scam	solanamoneyglitch	FALSE
2025-02-22 1	6030897065	keep a eye out for $srp later today. solana reward program. fresh copy of img/smg. enter early so u can scam other people to and get fat rewards for holding this shit. join the ponzi early this time!	solanamoneyglitch	FALSE
2025-02-22 1	6030897065	keep a eye out for $srp later today. solana reward program. fresh copy of img/smg. enter early so u can scam other people to and get fat rewards for holding this shit. join the ponzi early this time!	solanamoneyglitch	FALSE
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2025-02-22 1	6030897065	keep a eye out for $srp later today. solana reward program. fresh copy of img/smg. enter early so u can scam other people to and get fat rewards for holding this shit. join the ponzi early this time!	solanamoneyglitch	FALSE

Telegram - Prophet Forecast Plot

Actual vs. Forecast over time

A spike signal:

▶ A new scam circulating
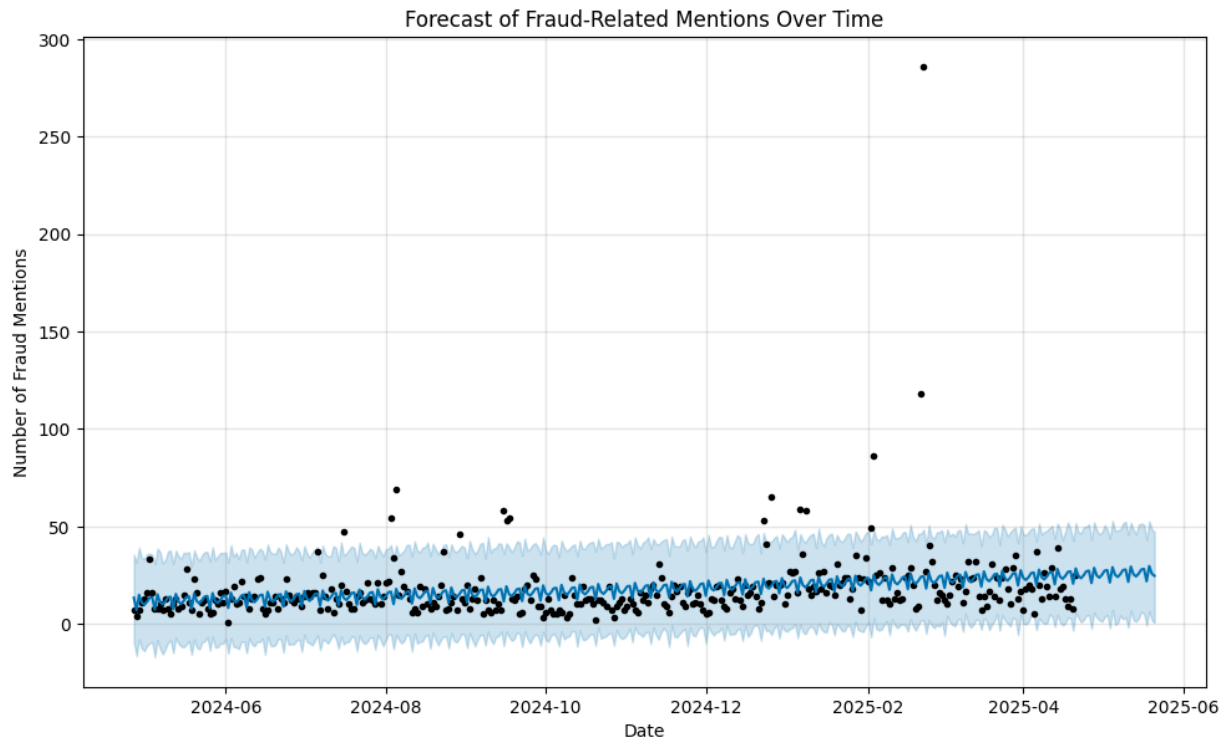
▶ Brand impersonation

▶ Security risks emerging online

### We can:

▶ Alert teams early

▶ Act before issues go viral

Telegram - Prophet Forecast Plot
Actual vs. Forecast over time

Forecast of Fraud-Related Mentions Over Time

- ▶ Black dots = real messages we've seen each day.

- ▶ Blue line = the expected number of messages going forward.

- ▶ Shaded area = uncertainty — how much that number might go up or down.

Telegram - Prophet Forecast Plot

Forecast of Fraud-Related Mentions Over Time
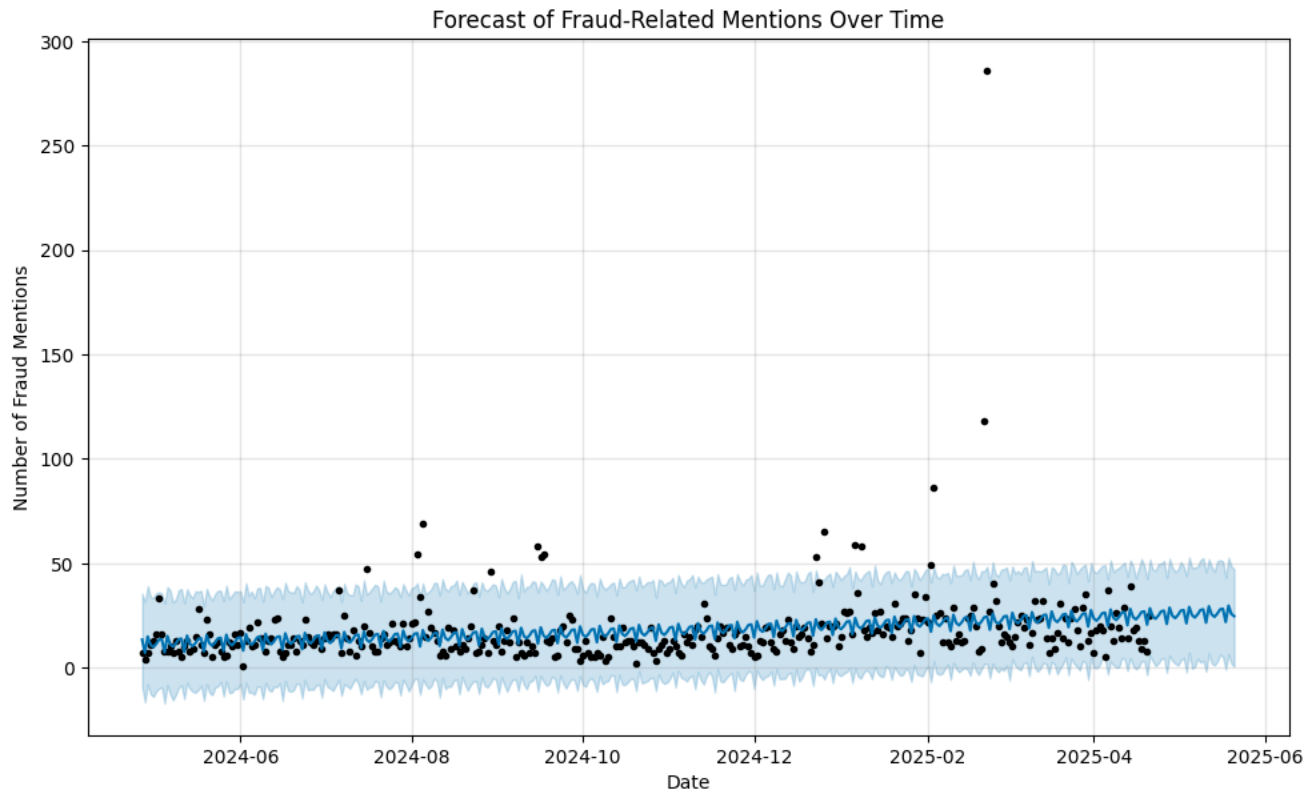
- A gradual upward trend in daily fraud-related mentions from mid-2024 through early 2025.

- Almost every day—about 95 days out of 100—to fall inside this blue-shaded zone. Only the rare "dot" outside is truly unusual.

Telegram - Prophet Forecast Plot

Forecast of Fraud-Related Mentions Over Time
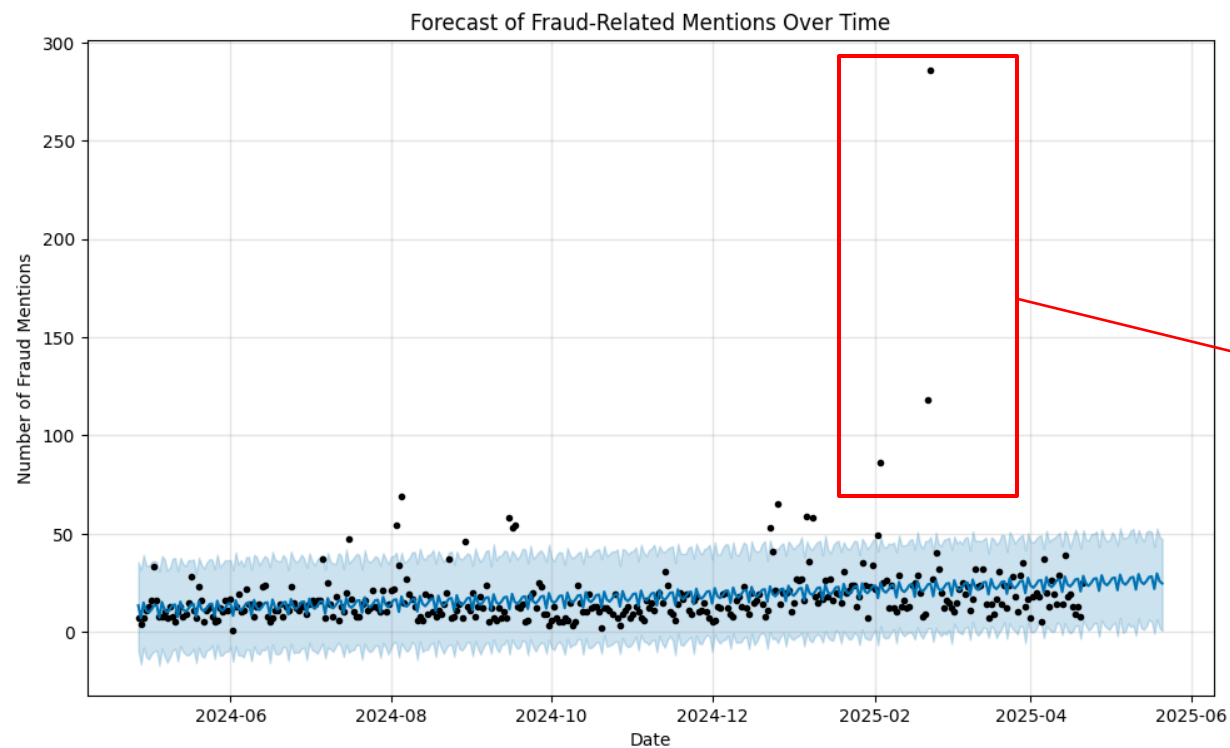
Outlier spikes:

- 2025-02-03
- 2025-02-21
- 2025-02-22

Telegram – Outlier Spikes

Date	Total Mentions	Top Message Examples (count)	Top Channels (count)	Key Themes
2025-02-22	400	1. "Keep a eye out for $SRP later today. Solana Reward Program. Free rewards for holding this shit. Join the ponzi early this time!" (79)	solanamoneyglitch (362)	• Solana "Reward Program" Ponzi spam • Engagement-bot callouts • Scripted reposts
		2. "Keep a eye out for $SRP later today. Solana Reward Program. Free rewards so u can scam other people too. Join the ponzi early this time!" (63)	CryptoSG (9)	
		3. "NEED MORE PEOPLE ENGAGING COMMENT $SMG 👇 LETS FUCKING GO" (30)	entrepreneurialjourney (6)	
2025-02-21	154	1. "SCAM SCAM SCAM…SCAM" (23)	CryptoSG (6)	• "SCAM" flood to trigger moderation • Anti-scam warnings • "Money Glitch" promos
		2. "/Do_not_buy_this_scam_pvp" (16)	calls_from_satoshi (5)	
		3. "Bybit Infinity Money Glitch 🟣 sensor based on $IMG $BIMG…" (12)	indicatorsmt5mt4Signal (5)	
2025-02-03	98	1. "Keep your investment coming guys we are open ✅✅✅ 🔢 💯💯" (4)	marketranger (54)	• General investment hype • Automated short-sell signals • Market-making spam
		2. "🟣 SHORT Crypto Close 25% position BUY #DOGE Price 0.24575000…not investment advice." (2)	entrepreneurialjourney (20)	
		3. "🟣 SHORT Crypto Close 25% position BUY #XLM Price 0.32740000…not investment advice." (2)	fxtradergoatofficials (8)	

Telegram - Breaking Down the Forecast
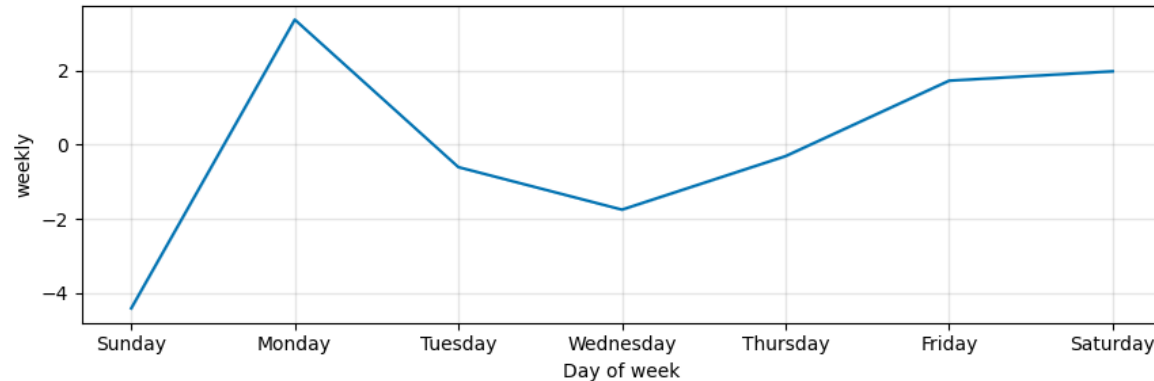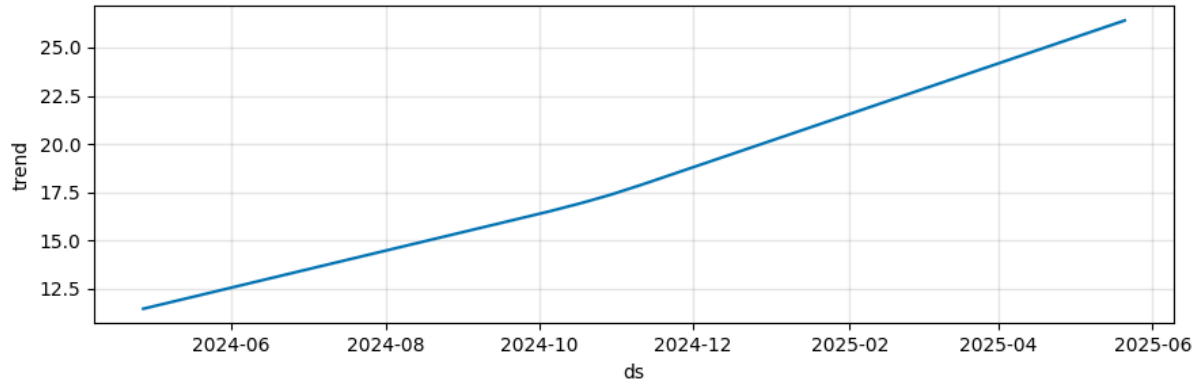
Turning Forecasts into Action

▶ Understand when to expect higher activity

▶ Adjust monitoring schedules and team resources accordingly

▶ Use trend insights to track effectiveness of fraud prevention campaigns

Telegram - Breaking Down the Forecast
Understanding why the number of fraud-related messages changes

Upward Trend:

▶ Fraud mentions rose from ~12/day → ~26/day over 12 months

Weekly Pattern:

▶ Highest: Monday

▶ Lowest: Sunday

▶ Mid-Week Dip: Tue–Thu

▶ Weekend Moderate: Fri & Sat

Takeaway:

▶ Spam volume is not uniform—peak at week's start, lull on Sundays, then climb again into weekend.

Telegram - Rolling Z-Score Plot

Spotting Anomalies with Z-Scores

- Purple line = z-score for each day

- Dashed red lines = alert thresholds (+2 or –2)

- When the line goes above +2, it means today had unusually high activity

- When below -2, it was unusually low

Rolling Z-Score of Daily Fraud-Related Message Counts
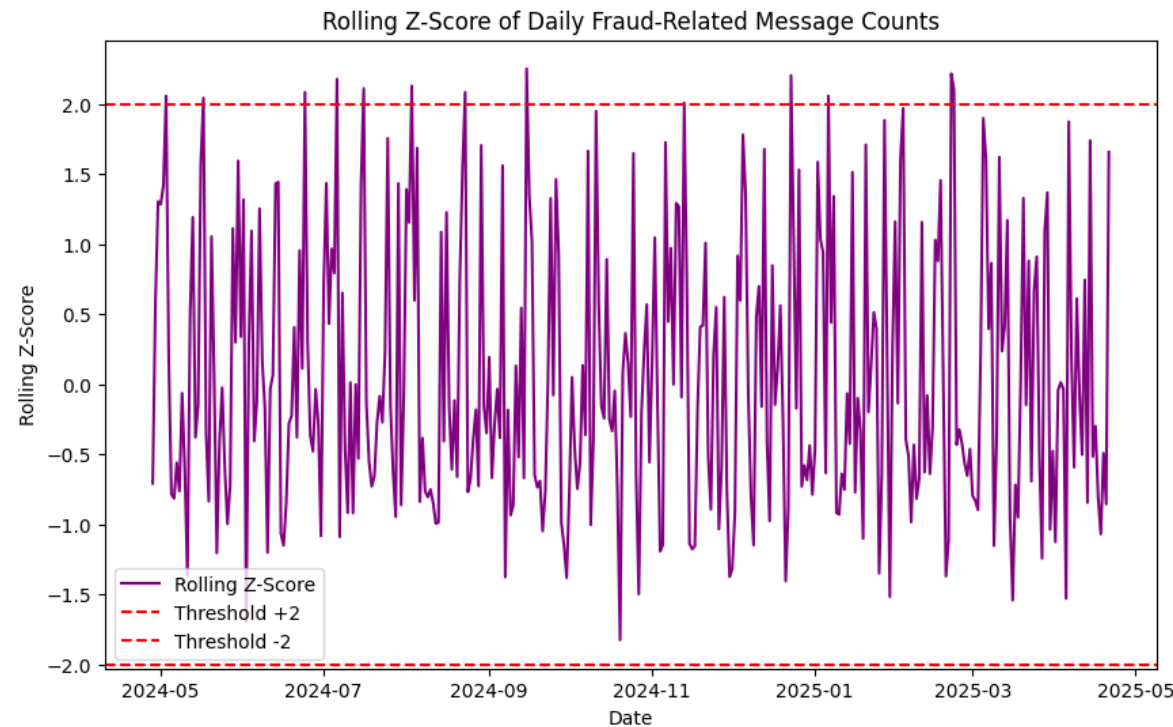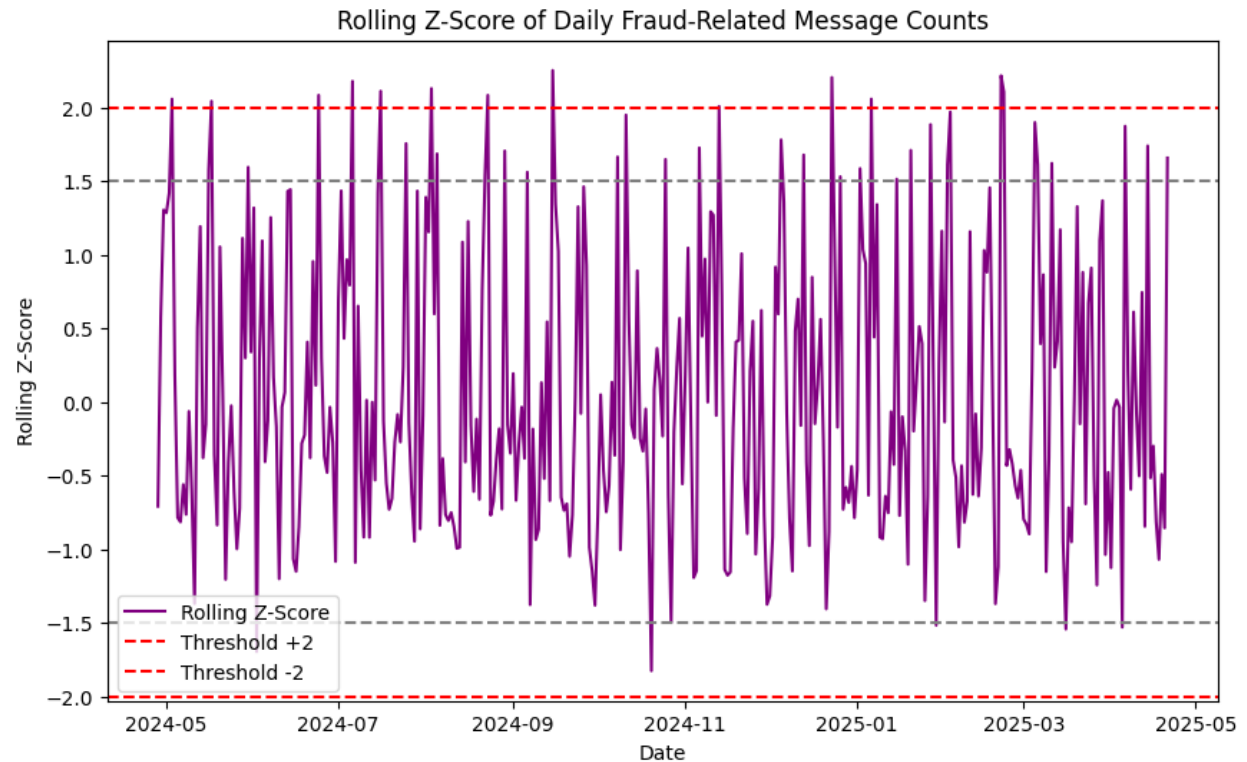
Telegram - Rolling Z-Score Plot

Key Findings:

▶ Multiple days exceed +2, especially Feb 3, 21, 22, 2025, caught the same outliers as Prophet forecast plot's

▶ Very few days fall below –2—volume surges more common than drops

Noise vs. Spikes:

▶ Normal noise stays within ±1.5

▶ ±2 cutoff isolates real fraud-spam floods

Takeaway:

▶ Use ±2 for robust anomaly detection—captures major bot campaigns without flagging everyday volatility.

Rolling Z-Score of Daily Fraud-Related Message Counts

Legend:
- Rolling Z-Score
- Threshold +2
- Threshold -2

X-axis: Date (2024-05, 2024-07, 2024-09, 2024-11, 2025-01, 2025-03, 2025-05)
Y-axis: Rolling Z-Score (-2.0 to 2.0)

Data Collection Limitations

Limited Platform Access	Manual Scraping of Telegram
Invest in APIs to provide access to real-time data across different platforms	Automate the scraping process to reduce manual effort and human error
Expand keyword strategy to improve relevance and capture across platforms	Implement scheduled scraping to ensure continuous and up-to-date collection

Data Quality and Noise Issues

Noisy Data and Irrelevant mentions dilute insights

- Use NLP to remove irrelevant data
- Retain only fraud-related content

Limited Key Terms and Few relevant posts make detection harder

- Expand keyword list and variations
- Capture more comprehensive fraud discussions

Improving Data Relevance and Coverage

- Narrow platform and keyword focus limits detection of broader fraud patterns.

- Short data collection window misses emerging trends and long-term fraud activity.

- Limited data reduces model training and validation effectiveness.

Future Improvements:

- Expanding to platforms like YouTube, TikTok, and Facebook captures a broader range of fraud discussions.

- Longer data collection periods reveal evolving fraud trends and provide richer context.

- Broader platform and timeframe coverage strengthens fraud detection model robustness.

Challenges in Forecasting Fraud Trends

▶ Prophet model struggled to consistently predict sudden spikes in fraud-related mentions.

▶ Rolling Z-score detected major anomalies but missed some real-time fraud trends.

▶ Both methods showed promise but had limitations in capturing all fraud activity accurately.

Future Improvements:

▶ Advanced ML models (LSTM/XGBoost) can better predict fraud spikes by capturing complex patterns.

▶ Enhanced forecasting algorithms identify long-term dependencies missed by traditional models.

▶ Real-time monitoring systems detect unusual keyword activity as it happens rather than retrospectively.

▶ Automated alerts enable immediate response to emerging fraud trends before significant damage occurs.
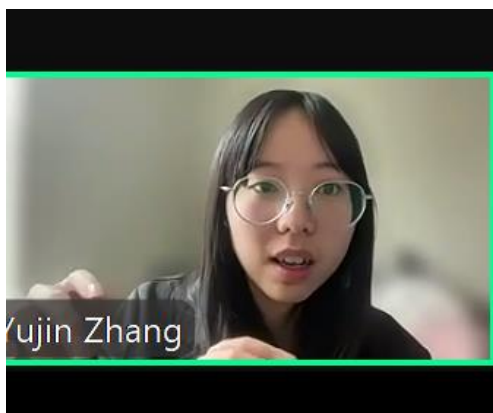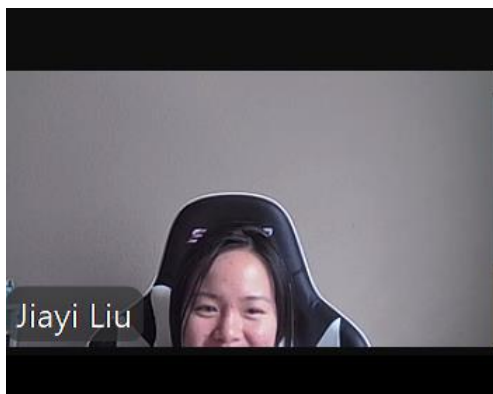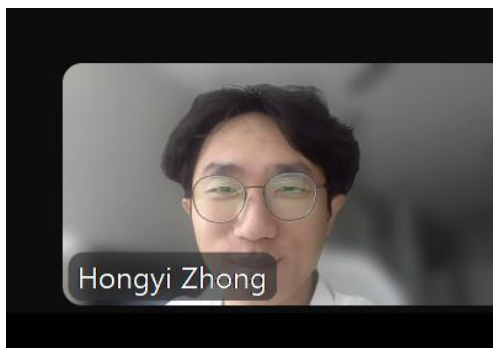
Thank You

- We want to say Thank You for allowing us to work on this project
- This project has been very interesting to work on and has allowed us to further our learning

Questions?