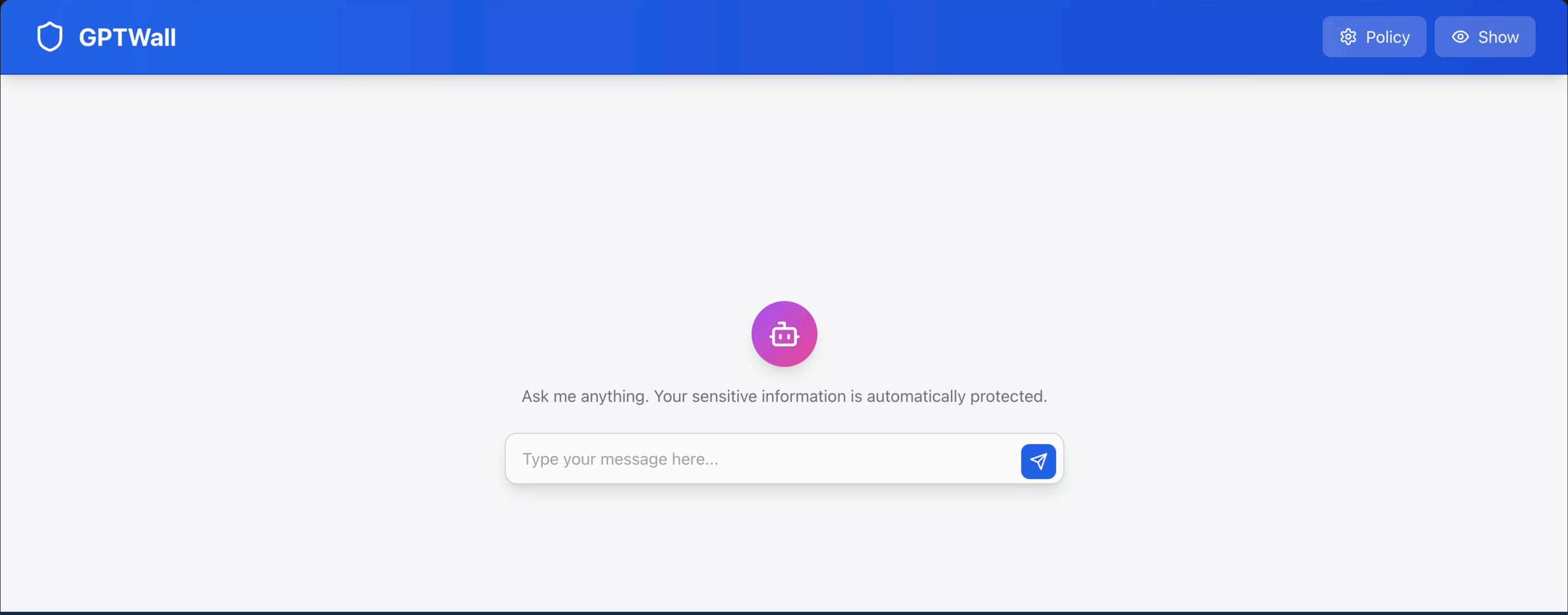


Governing Open-Vocabulary Data Leaks using an Edge LLM through Programming by Example

Qiyu Li Jinhe Wen Haojian Jin

UC San Diego

Problem

Data Leak in ChatGPT Prompts

TECH

Amazon, Apple, and 12 other major companies that have restricted employees from using ChatGPT

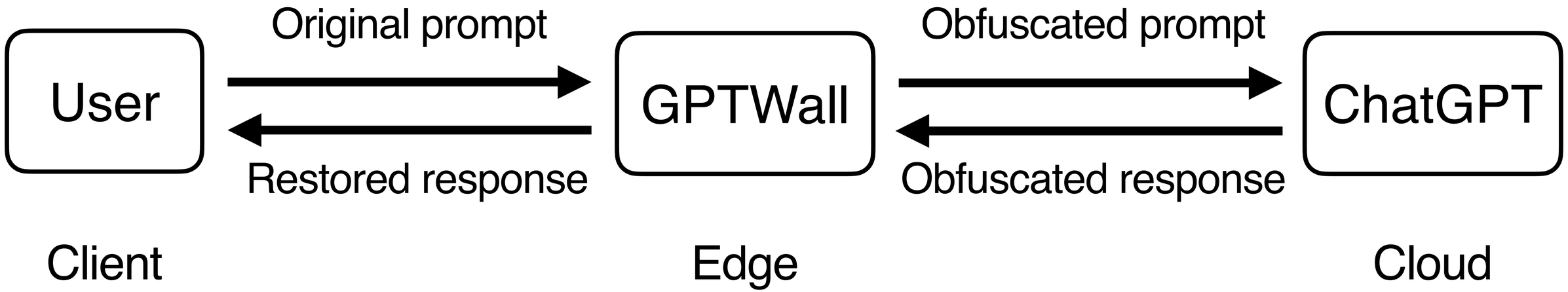
BREAKING | BUSINESS

Samsung Bans ChatGPT Among Employees After Sensitive Code Leak

Employees are accidentally leaking company data through ChatGPT, report warns

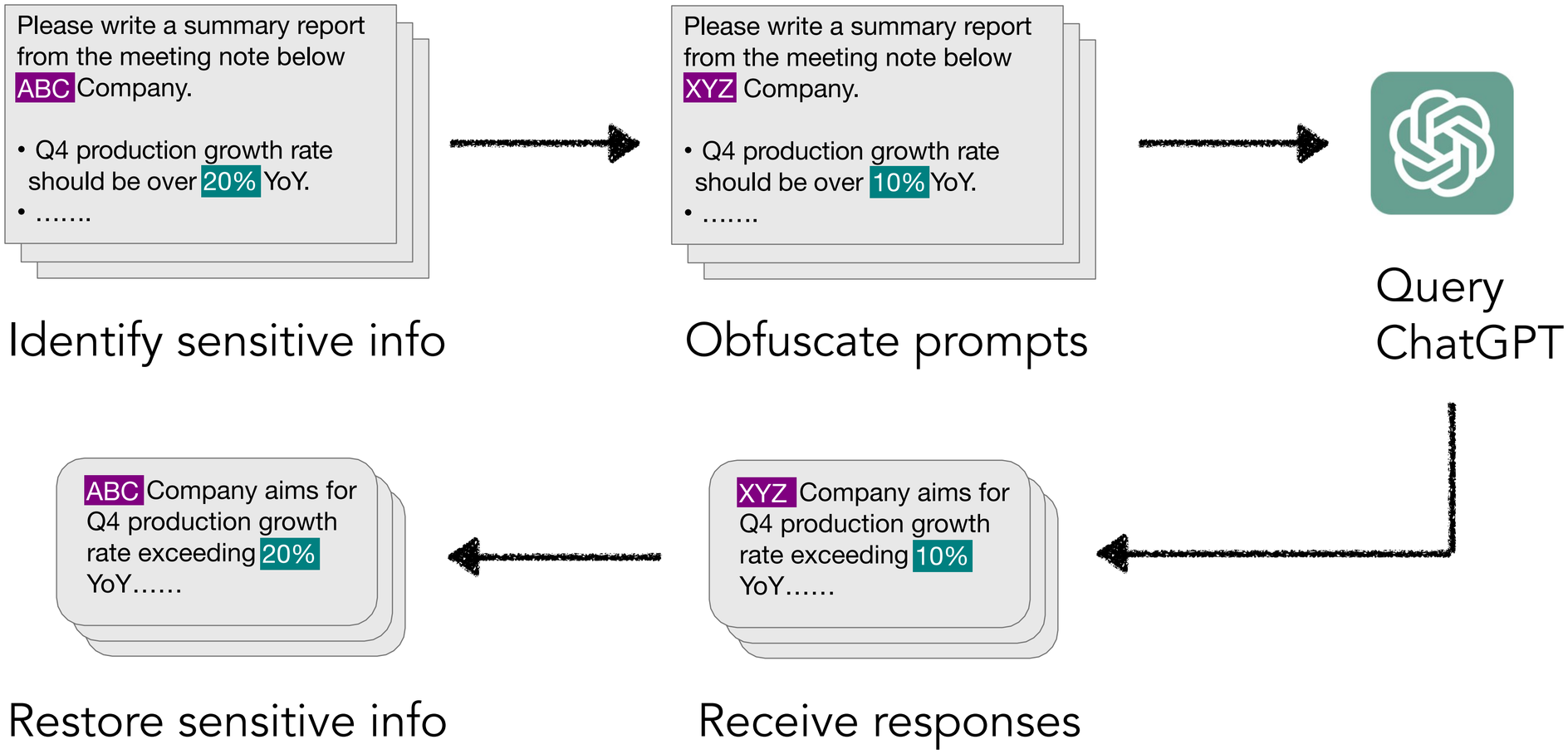
A new Cyera report reveals ChatGPT, Microsoft Copilot, and other AI tools are now the leading source of workplace data leaks, often occurring without companies noticing.

GPTWall: A Privacy Firewall for Mitigating ChatGPT Data Leaks



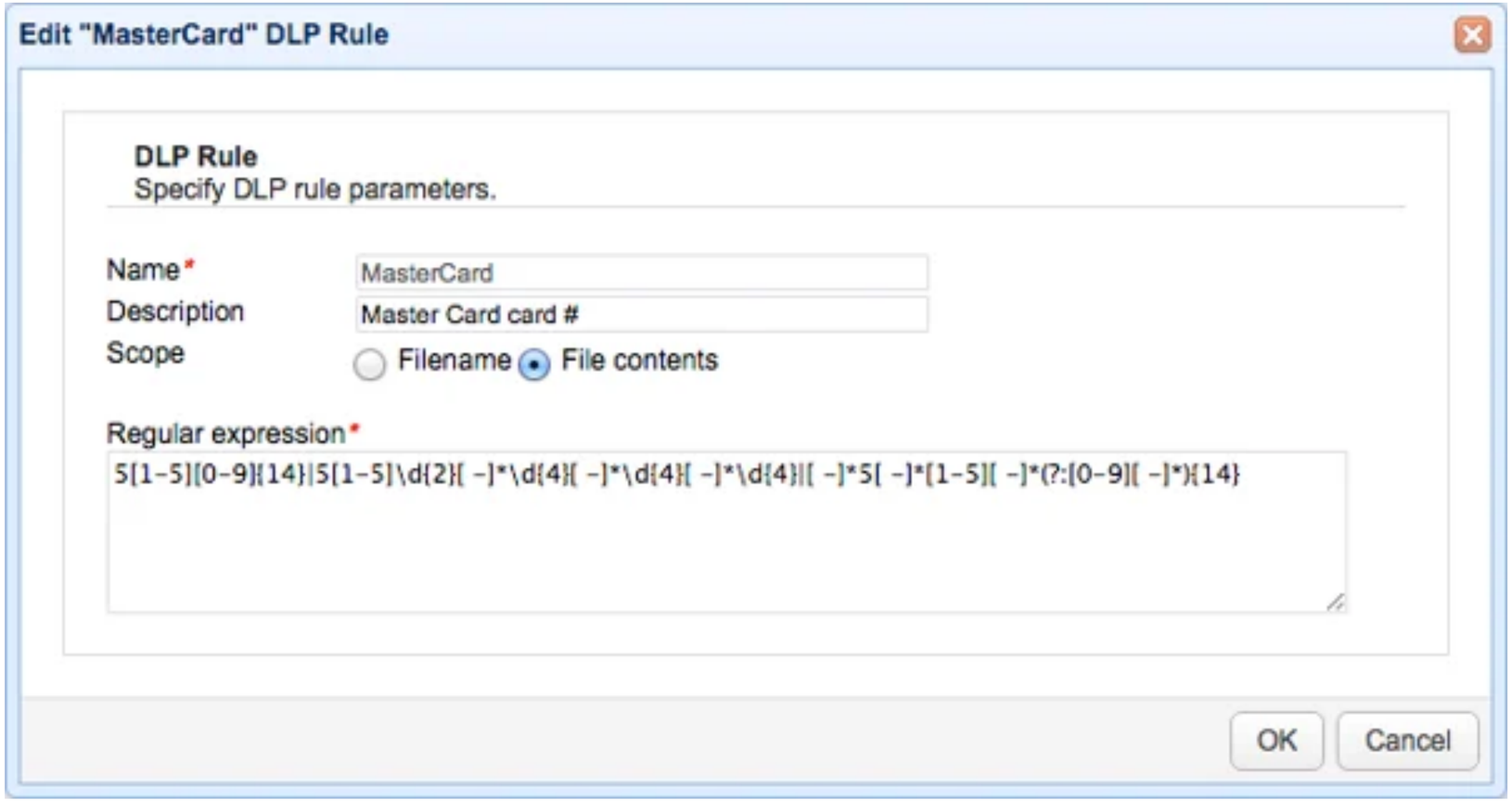
Example Data Flow

Policy: Replace `company_name` with synthetic values; Add noise to `financial_figure`



Related Work

Data Leak Prevention – Regex Rules



Related Work

Data Leak Prevention – Named Entity Recognition

contentSkip to site indexPoliticsSubscribeLog InSubscribeLog InToday's PaperAdvertisementSupported ORG byF.B.I. Agent Peter Strzok PERSON , Who Criticized Trump PERSON in Texts, Is FiredImagePeter Strzok, a top F.B.I. GPE counterintelligence agent who was taken off the special counsel investigation after his disparaging texts about President Trump PERSON were uncovered, was fired. CreditT.J. Kirkpatrick PERSON for The New York TimesBy Adam Goldman ORG and Michael S. SchmidtAug PERSON . 13 CARDINAL , 2018WASHINGTON CARDINAL — Peter Strzok PERSON , the F.B.I. GPE senior counterintelligence agent who disparaged President Trump PERSON in inflammatory text messages and helped oversee the Hillary Clinton PERSON email and Russia GPE investigations, has been fired for violating bureau policies, Mr. Strzok PERSON 's lawyer said Monday DATE .Mr. Trump and his allies seized on the texts — exchanged during the 2016 DATE campaign with a former F.B.I. GPE lawyer, Lisa Page — in PERSON assailing the Russia GPE investigation as an illegitimate "witch hunt." Mr. Strzok PERSON , who rose over 20 years DATE at the F.B.I. GPE to become one of its most experienced counterintelligence agents, was a key figure in the early months DATE of the inquiry.Along with writing the texts, Mr. Strzok PERSON was accused of sending a highly sensitive search warrant to his personal email account.The F.B.I. GPE had been under immense political pressure by Mr. Trump PERSON to dismiss Mr. Strzok PERSON , who was removed last summer DATE from the staff of the special counsel, Robert S. Mueller III PERSON . The president has repeatedly denounced Mr. Strzok PERSON in posts on

Challenges

#1 Open-vocabulary & #2 Context-dependent

PII

Personal information

Financial data

Business secrets

……

Challenge #1

Challenges

#1 Open-vocabulary & #2 Context-dependent

PII

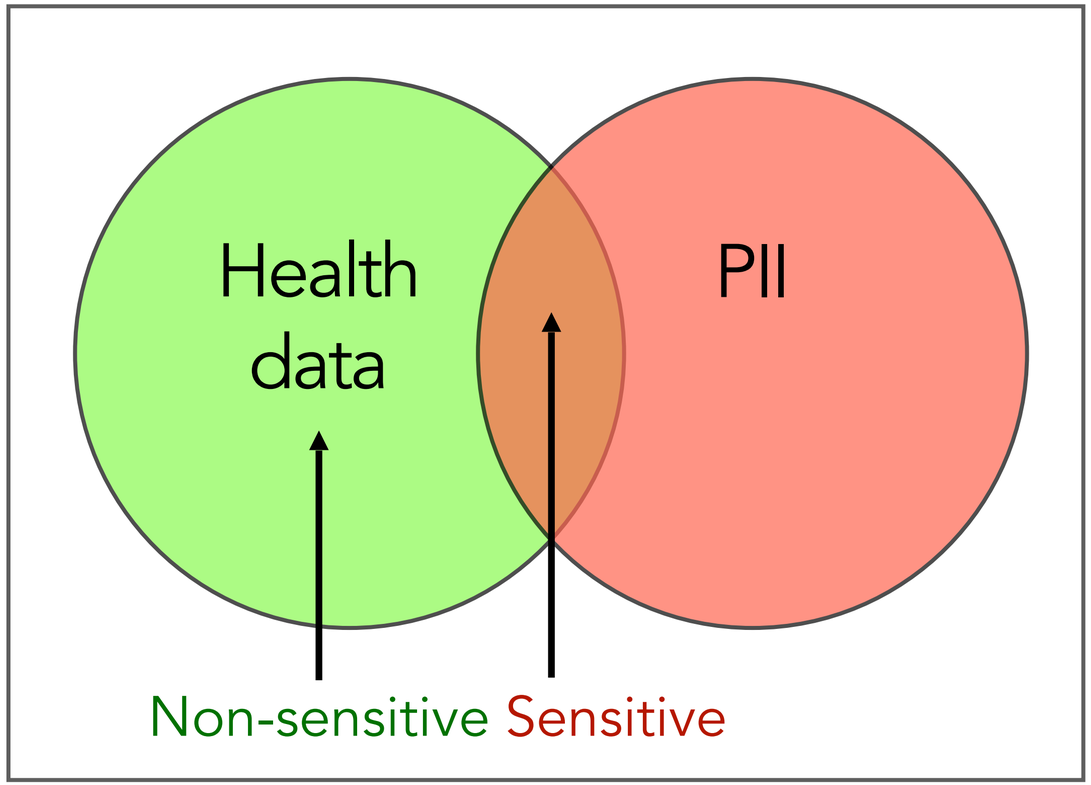
Personal information

Financial data

Business secrets

……

Challenge #1



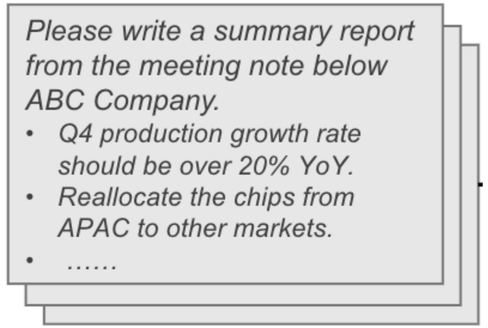
Challenge #2

Method

Understanding Privacy Leaks in LLM Prompts

50K real-world conversations

10K sensitive prompts



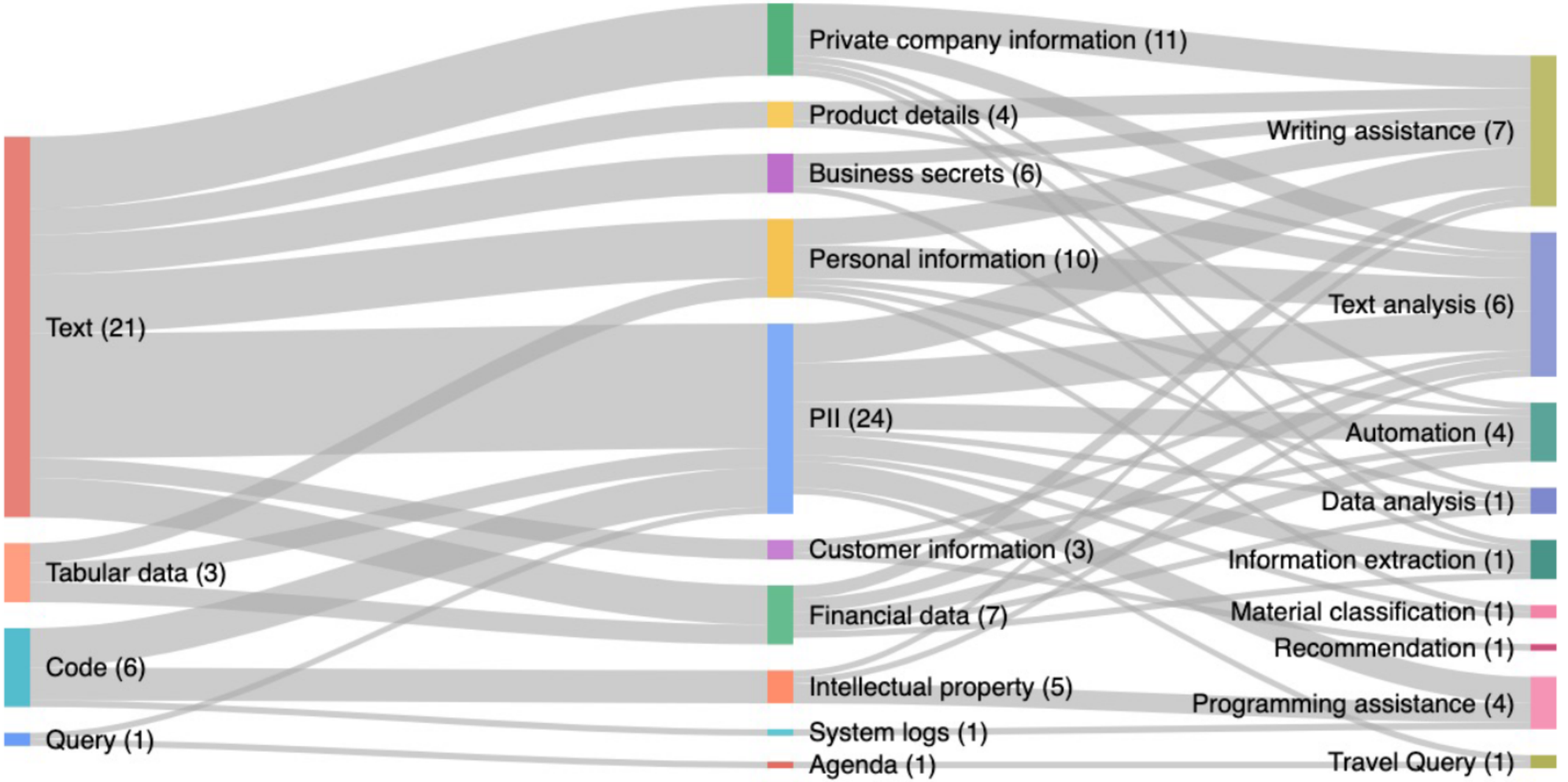
300 prompts

4 data leak channels
10 leaked data types
9 usage scenarios

Check details in our paper

Results

Understanding Privacy Leaks in LLM Prompts



Leaking Channel | Leaked Data Type | Usage Scenario

Use Case

Policy Representation

{ “method”: “mask | anonymize | replace | noisify | fuzzify”,
“information_type”: {“value”: {“sensitive”: <value list>, “non-sensitive”: <value list>},
“label”: {“sensitive”: <label list>, “non-sensitive”: <label list>} },
“context”: <context list> }

- **Type-based**: e.g., personal_name
- **Value-based**: e.g., ”123-45-6789” for the SSN
- **Context-based**: e.g., when health data co-exists with “personal name” in the same prompt

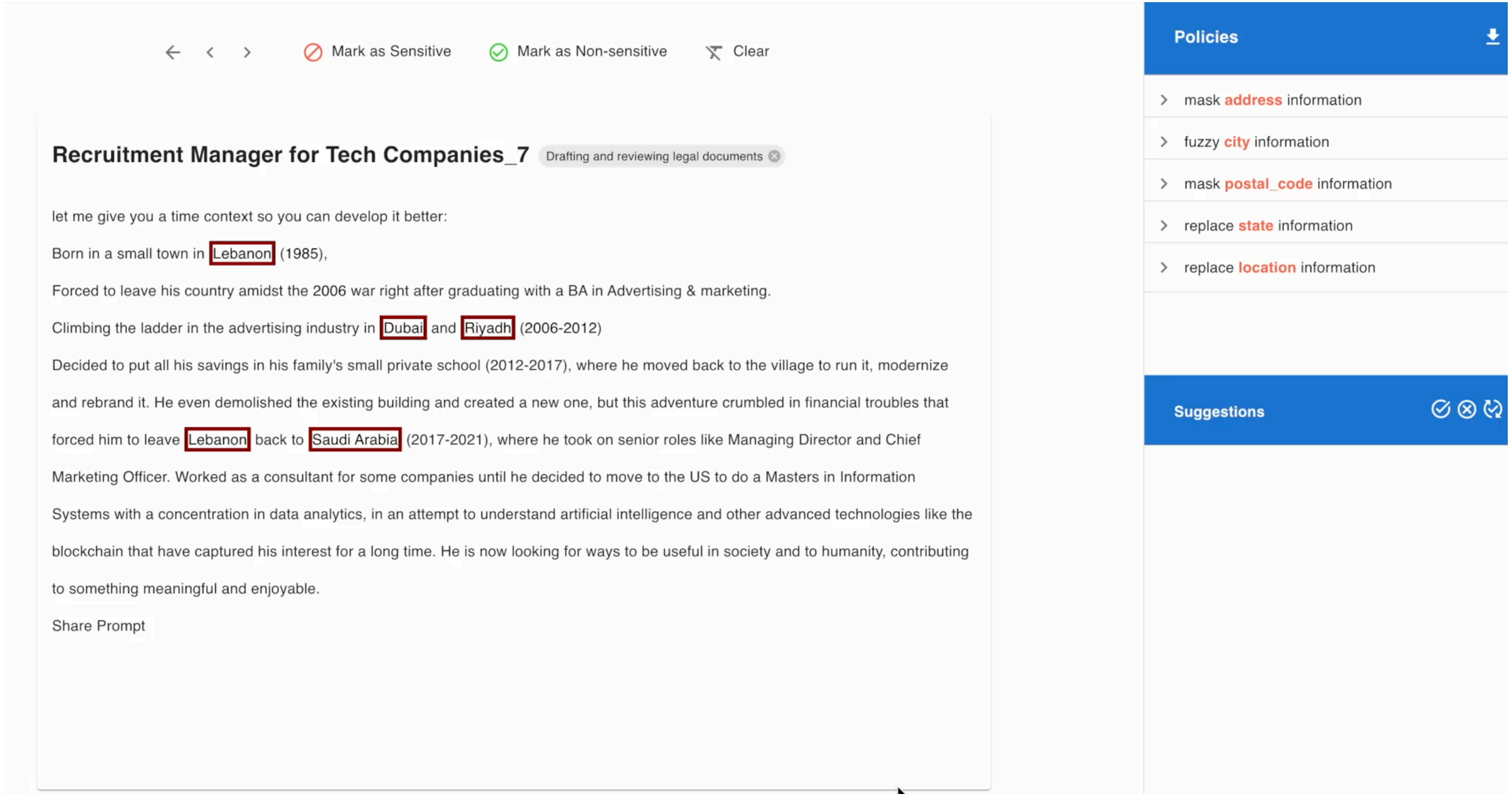
Obfuscation Method

Policy Representation

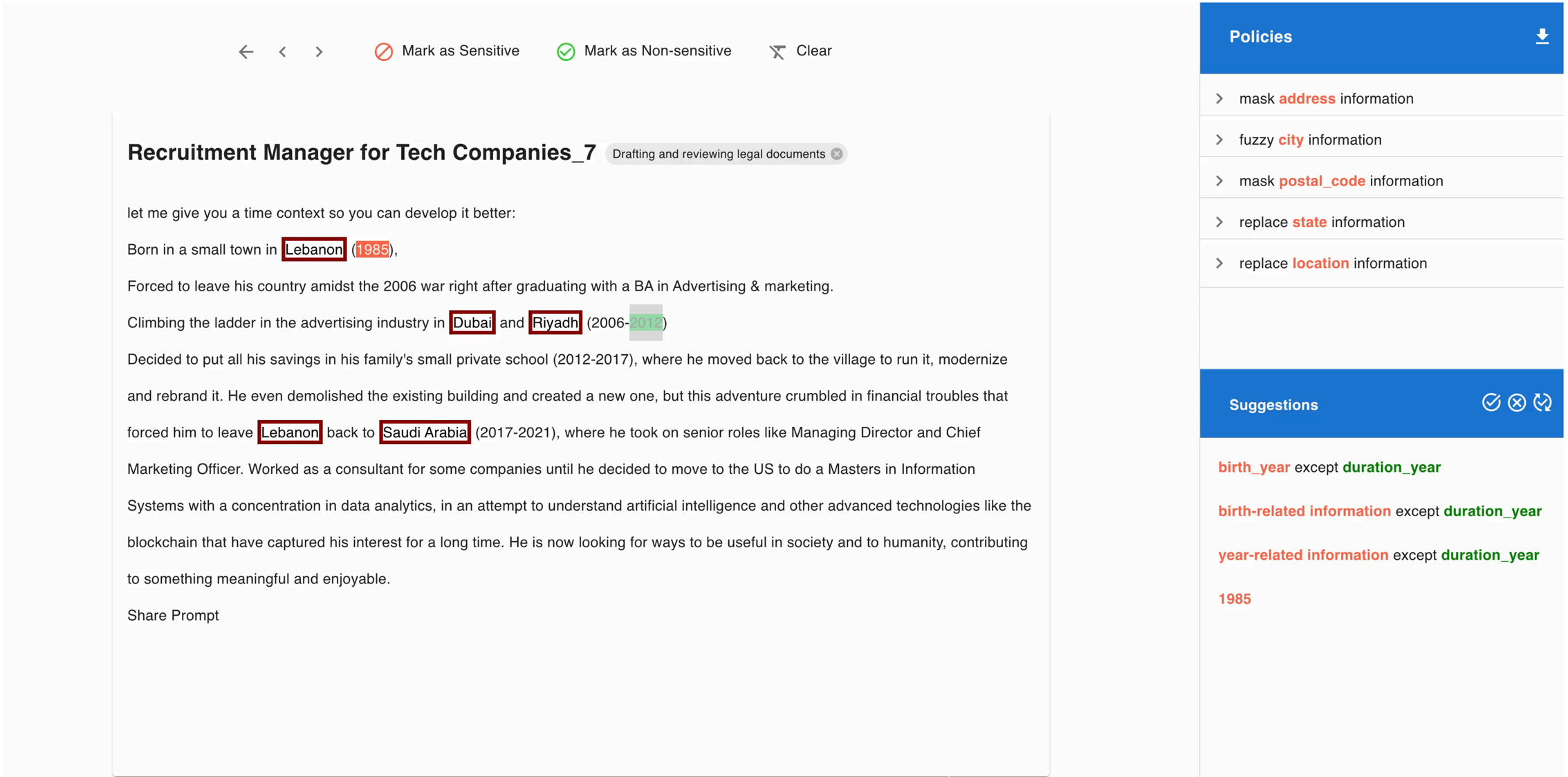
{ “method”: “mask | anonymize | replace | noisify | fuzzify”,
“information_type”: {“value”: {“sensitive”: <value list>, “non-sensitive”: <value list>},
“label”: {“sensitive”: <label list>, “non-sensitive”: <label list>} },
“context”: <context list> }

- **Anonymize**: “John Doe” → “<personal_name>”
- **Mask**: “1234-5678” → “XXXX-XXXX”
- **Replace**: “John Doe” → “Jane Smith”
- **Noisify**: “$10,000” → “$12,000”
- **Fuzzify**: “28 years old” → “late 20s”

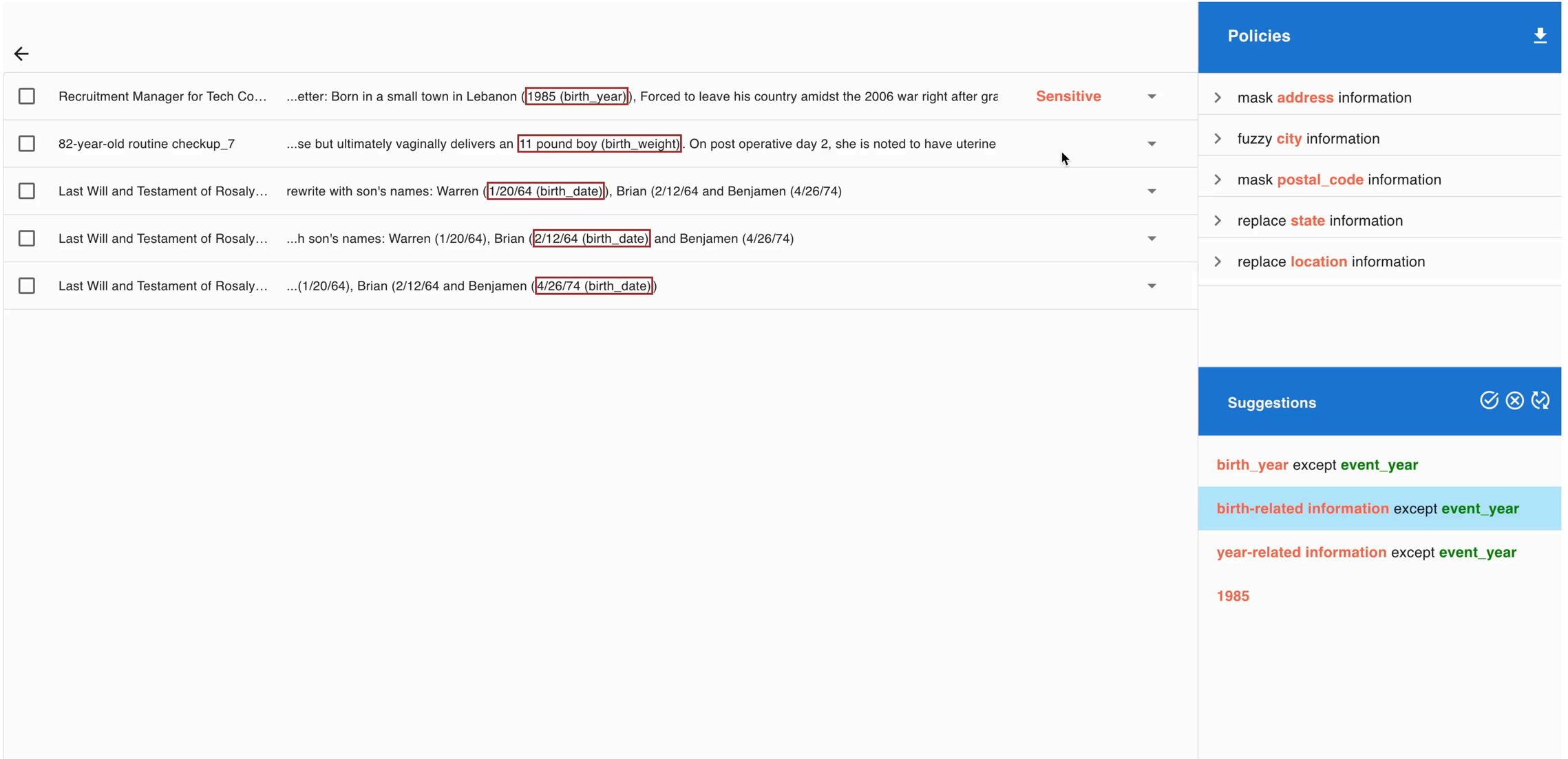
Annotating Data Leaks with Positive and Negative Examples



Policy Validation on Sample Prompts



Iterating Policies with Real-time Feedback



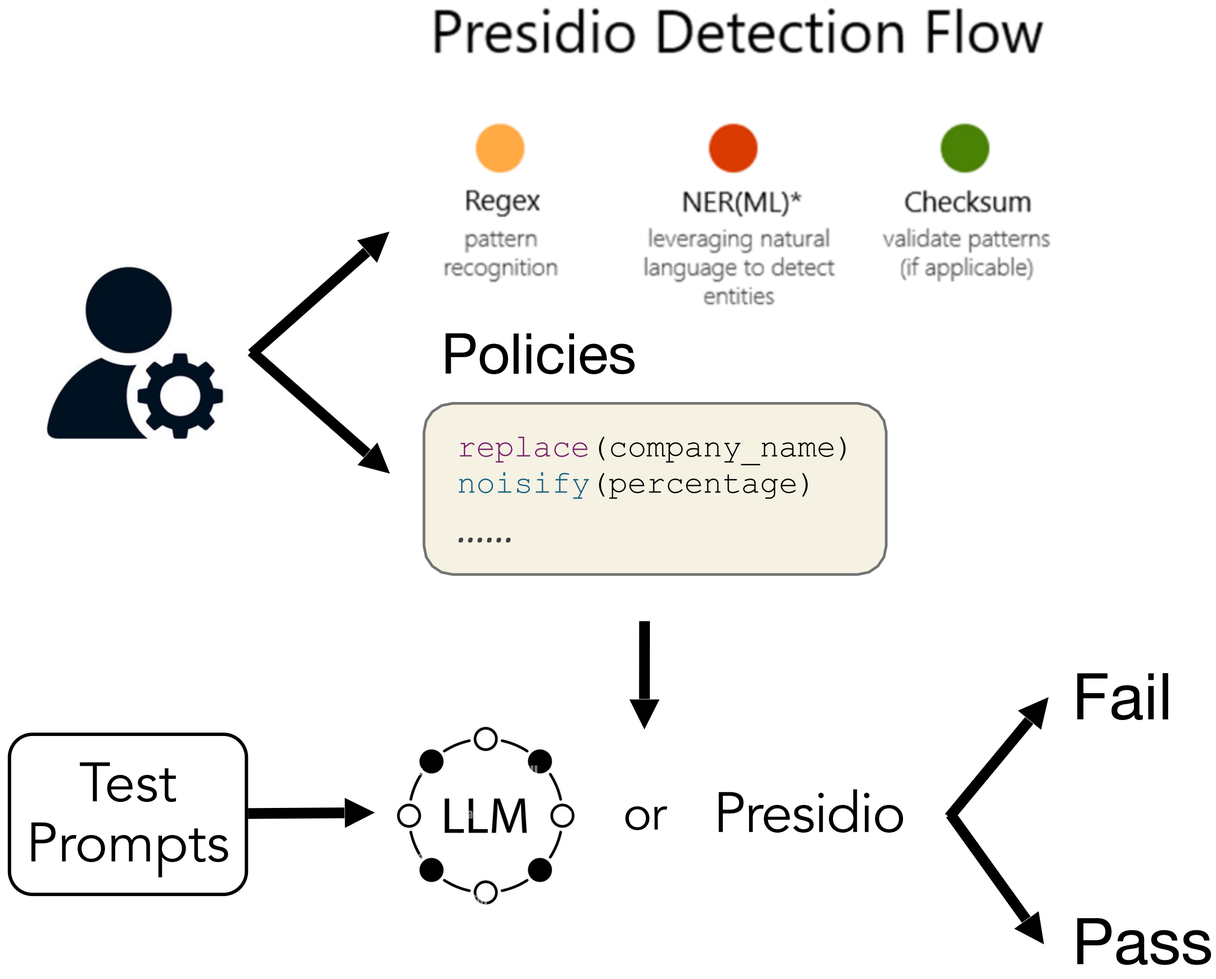
Evaluation

1. Effectiveness in identifying sensitive information
2. Policy usability for admins
3. Mitigation of inference attacks
4. Impact on response quality
5. System performance

Check details
in our paper

Method

Policy Usability for Admins



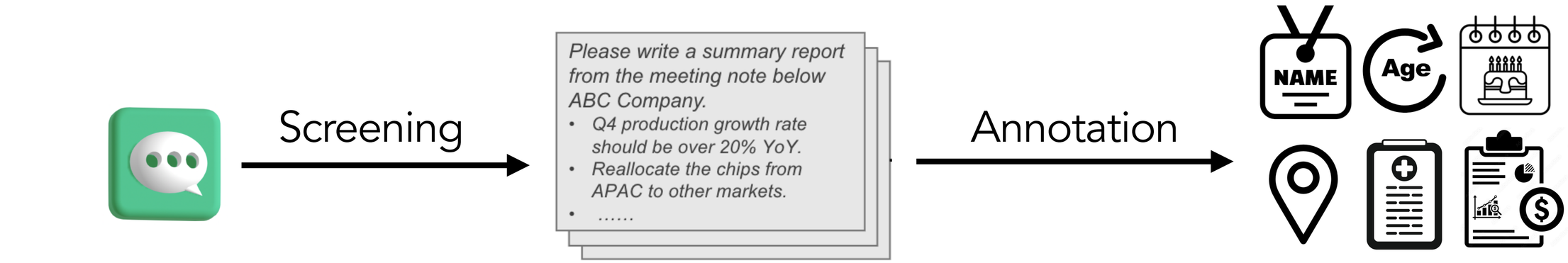
12 participants

Author policies for 6 tasks

10 unit test prompts

Dataset

Policy Usability for Admins



- Quasi-identifiers
- Personal Identifier Information (PII)
- Sensitive Data

Results

Policy Usability for Admins

1.6 v.s. 5.0 minutes
for a single policy

Precision: **84% v.s. 55%**
Recall: **76% v.s 54%**

Task	Presidio					GPTWall				
	Time (min)	#Rule	#Success	Precision	Recall	Time (min)	#Policy	#Success	Precision	Recall
Name	**4.49**±2.94	1.0	6	63.69%	86.52%	10.50±4.00	4.0	6	**77.41%**	**87.80%**
Location	12.80±7.23	1.4	3	67.78%	35.88%	**12.52**±7.82	3.8	5	**82.98%**	**68.29%**
Birthdate	11.72±5.75	1.7	2	49.71%	55.10%	**7.52**±4.93	2.7	5	**98.33%**	**97.57%**
Age	12.21±7.76	2.4	3	73.71%	36.83%	**4.38**±3.32	1.2	6	**93.73%**	**97.95%**
Financial	**9.25**±4.22	2.0	3	37.79%	54.55%	12.35±6.08	11.3	6	**52.37%**	**85.98%**
Health	13.22±7.86	4.4	5	50.12%	**63.89%**	**9.21**±1.50	12.2	6	**83.88%**	61.19%
Average	10.61±6.54	2.1	3.7	54.60%	53.98%	**9.42**±5.48	5.9	5.7	**83.91%**	**76.17%**

GPTWall: a policy-based data leak management system

(1) Conventional solutions are insufficient for open-vocabulary data leaks

(2) Introduce a man-in-the-middle edge LLM service

(3) Help admins create policies through programming by example

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