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Leveraging Generative AI for Granular Credit Data Utilization: A Multi-Agent Approach

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Regulatory Data Transformation (RDT)

A transformative redesign from static Data Management System to granular-level regulatory reporting standard for credit data



Rich dataset with 1000+ fields and over 25 million loan accounts per month, including credit lines, interest rate plan, and outstanding amount



Multi-faceted data architecture with specialized cubes for diverse and thorough credit data analysis



Enable insights for analyst and examiners across many domains from bank supervision to monetary policies



Complex data requires knowledge and advanced data analytical skills



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Challenges with RDT Utilization



Problem translation

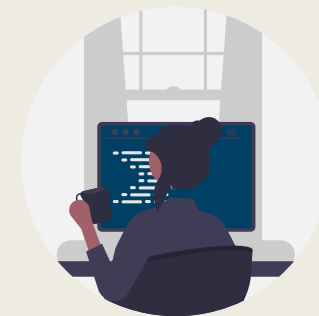
Users may not be able to translate business questions into data queries



Data understanding

RDT's data is complex

- Numerous data fields
- Structured into multiple “cubes” for different usages



Coding skills

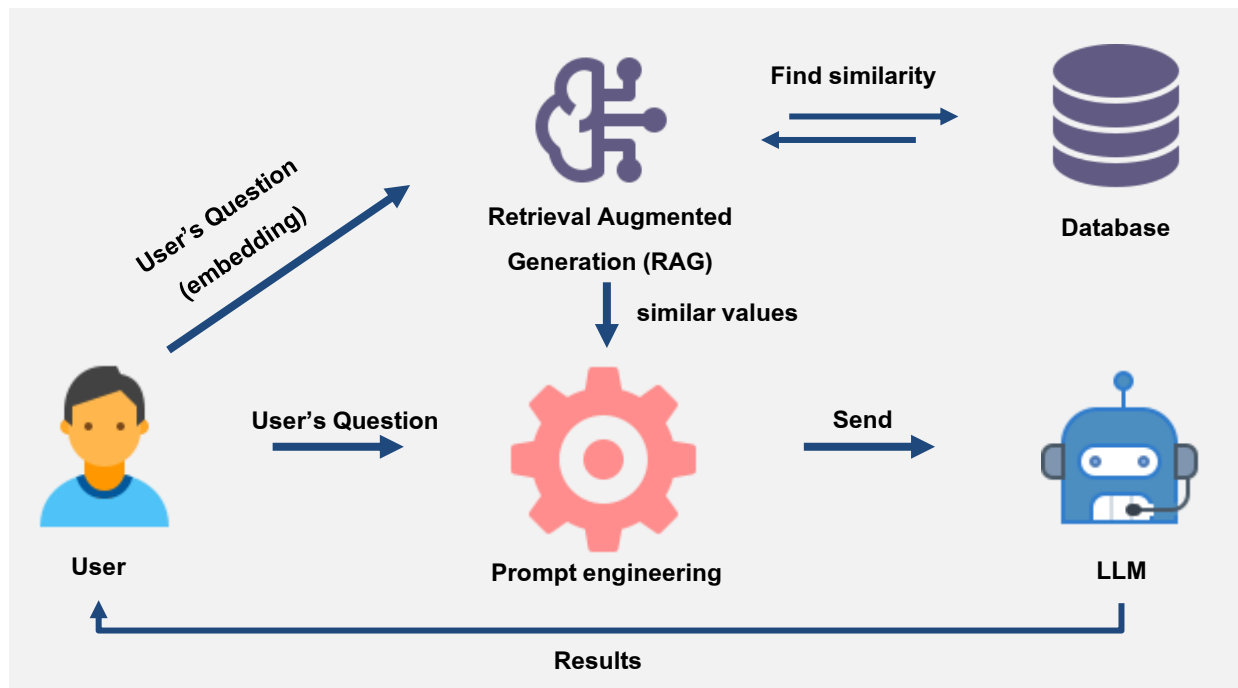
Require SQL / python knowledge to wrangle granular data effectively

- Most analysts and examiners are not proficient in coding



Generative AI as RDT assisting agents

- **Large Language Model (LLM)** can be utilized as a copilot for answering users' questions.
- **Retrieval-augmented Generation (RAG)** is used to provide internal knowledges such as metadata to GenAI .
- **Prompt Engineering** instructs GenAI to produce SQL code based on questions and retrieved metadata.



standard single-agent GenAI with RAG workflow

*Ask a plain language
question about RDT*



Field selection



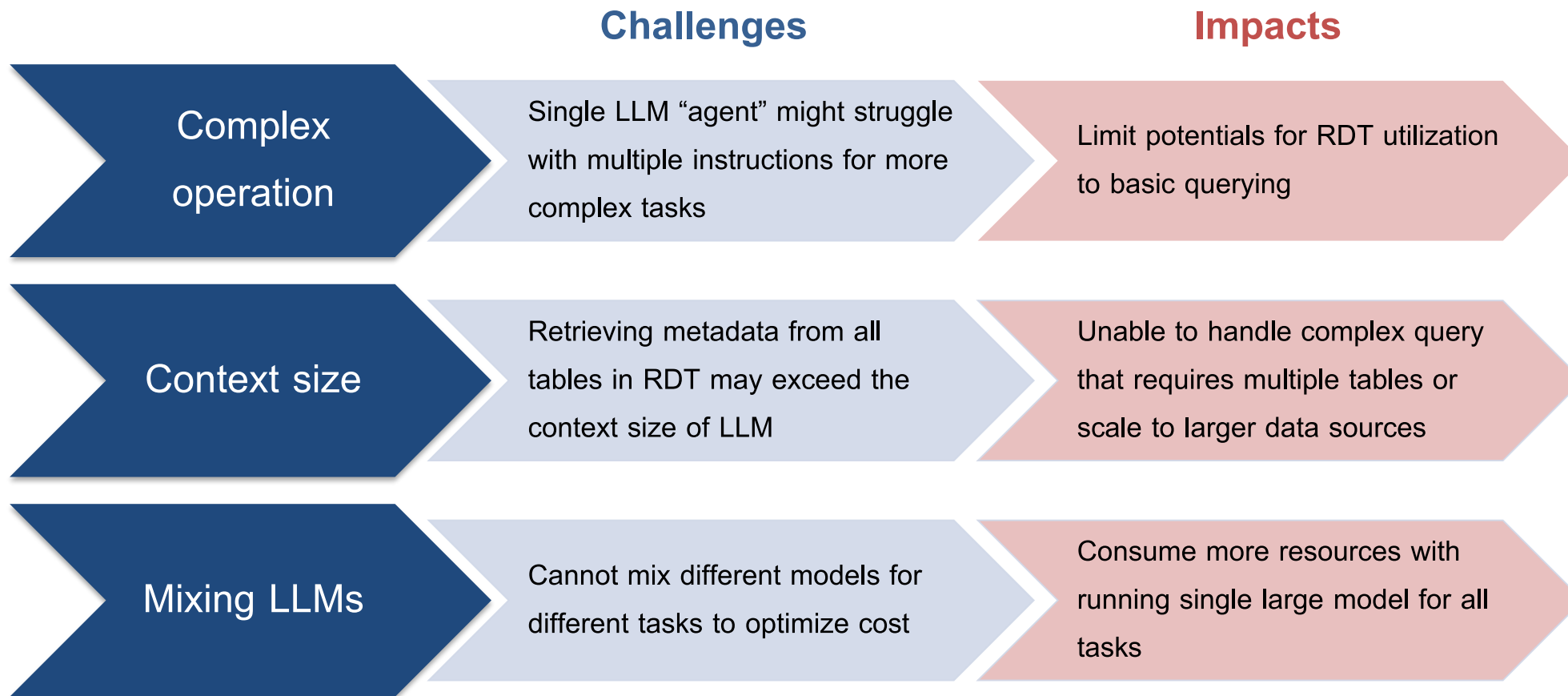
SQL query drafting

SQL

```
SELECT
  customers.name,
  SUM(loans.amount) AS total_loan_amount
FROM customers
INNER JOIN loans ON customers.customer_id = loans.customer_id
GROUP BY customers.name
ORDER BY total_loan_amount DESC
LIMIT 3;
```



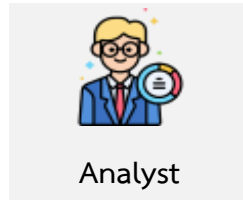
Challenges with GenAI workflow for RDT





Single-agent Framework

A large agent capable of executing diverse tasks comprehensively.



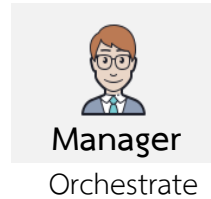
Analyst

Data analytics tasks

- Analyze questions
- Retrieve data
- Select fields
- Write SQL

Multi-agent Framework

A multi-agent approach decomposes the task into subtasks to be executed by different agents.



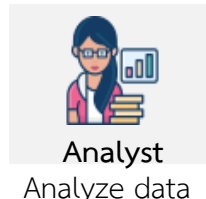
Manager

Orchestrate



Data Engineer

Retrieve data



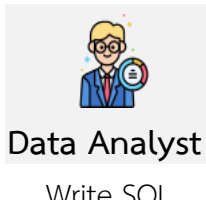
Analyst

Analyze data



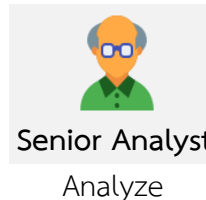
Secretary

Communicate and assist user



Data Analyst

Write SQL



Senior Analyst

Analyze questions

Multi-agent framework

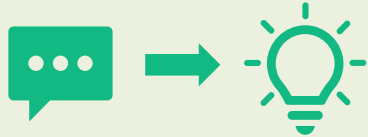
Framework	Pros	Cons
Single-agent	<ul style="list-style-type: none">• Easier to manage• Lower complexity to develop• Consume less resource	<ul style="list-style-type: none">• Limit expertise for complex tasks• Limit on context size• Less flexibility• No steps provided to users
Multi-agent	<ul style="list-style-type: none">• Able to deal with more complex tasks• Less limitation on context size• Assign different task to agents with specialities• Users can see broken-down steps	<ul style="list-style-type: none">• More complexity• Consome more resource



RDT Copilot: Modules



Brainstormer



Translate user's problem into tangible statements and identify relevant data sources

Q: What should be the minimum payment rate for credit card debt repayment?

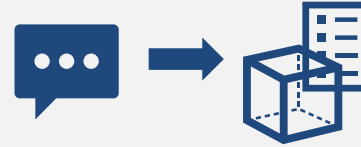
Brainstormer:

Find relationship between *credit_card_type*, *first_payment_amount* and *total_interest_and_fee_rate* to evaluate relationship between risks and payment.

...



Metadata Copilot



Search for the best data cube and fields required to answer users' questions

Q: How many debtors have joined the debt restructuring program this year?

Metadata Copilot:

Field	Description
entity_id	Id for debtors
debt_restructuring_date	Date of debt restructuring
...	...



SQL Coder



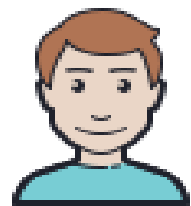
Assist users by converting natural language questions in to SQL query

SQL Copilot:

```
SELECT
  COUNT(distinct entity_id) AS number_of_debtors
FROM CUBE_1
WHERE debt_restructuring_date > '2024-01-01'
```



Brainstormer



Users

**Information Gathering
Agent**

Select data cube and
analyse the questions

Field Finder Agent

Select related fields from
each chosen data cube

**Question Breaker
Agent**

Analyze information and
provide step-by-step
answer to user's questions

Ask follow-up
question to guide the
discussion forward

Follow Up Agent





• LIVE

New Chat

Task:

- ☒ RDT Brainstorming
- ☐ RDT Copilot - Metadata
- ☐ RDT Copilot - SQL Coder

Select Cube



Chat History



Report / Feedback



Change Password



Logout (nontawic)



Hi Nontawit Cheewaruangroj! I am BotGPT, ready to provide assistance.

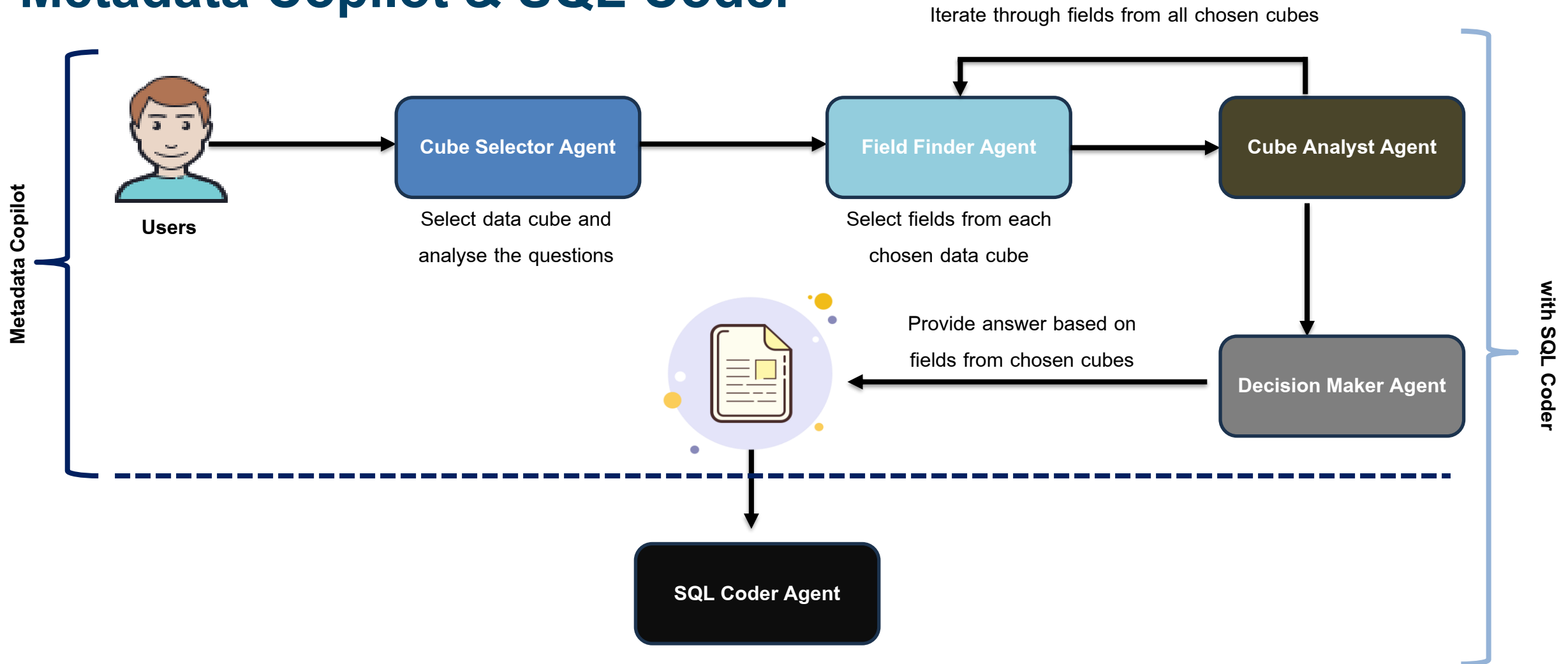
Input Question: I want to determine appropriate criterias for debt restructuring program.

Kindly input your query or command for prompt assistance...





Metadata Copilot & SQL Coder





• LIVE

New Chat

Task:

- ☐ RDT Brainstorming
- ☐ RDT Copilot - Metadata
- ☒ RDT Copilot - SQL Coder

Select Cube



Chat History



Report / Feedback



Change Password



Logout (nontawic)



Hi Nontawit Cheewaruangroj! I am BotGPT, ready to provide assistance.

Input Question: Please find the "% MoM growth" of the total outstanding balance before deducting unearned revenue for OD loan, categorized by financial institutions and segmented by months.

Kindly input your query or command for prompt assistance...





Evaluation



Experiment: Compare the performance of each module against the *single-agent* versions.



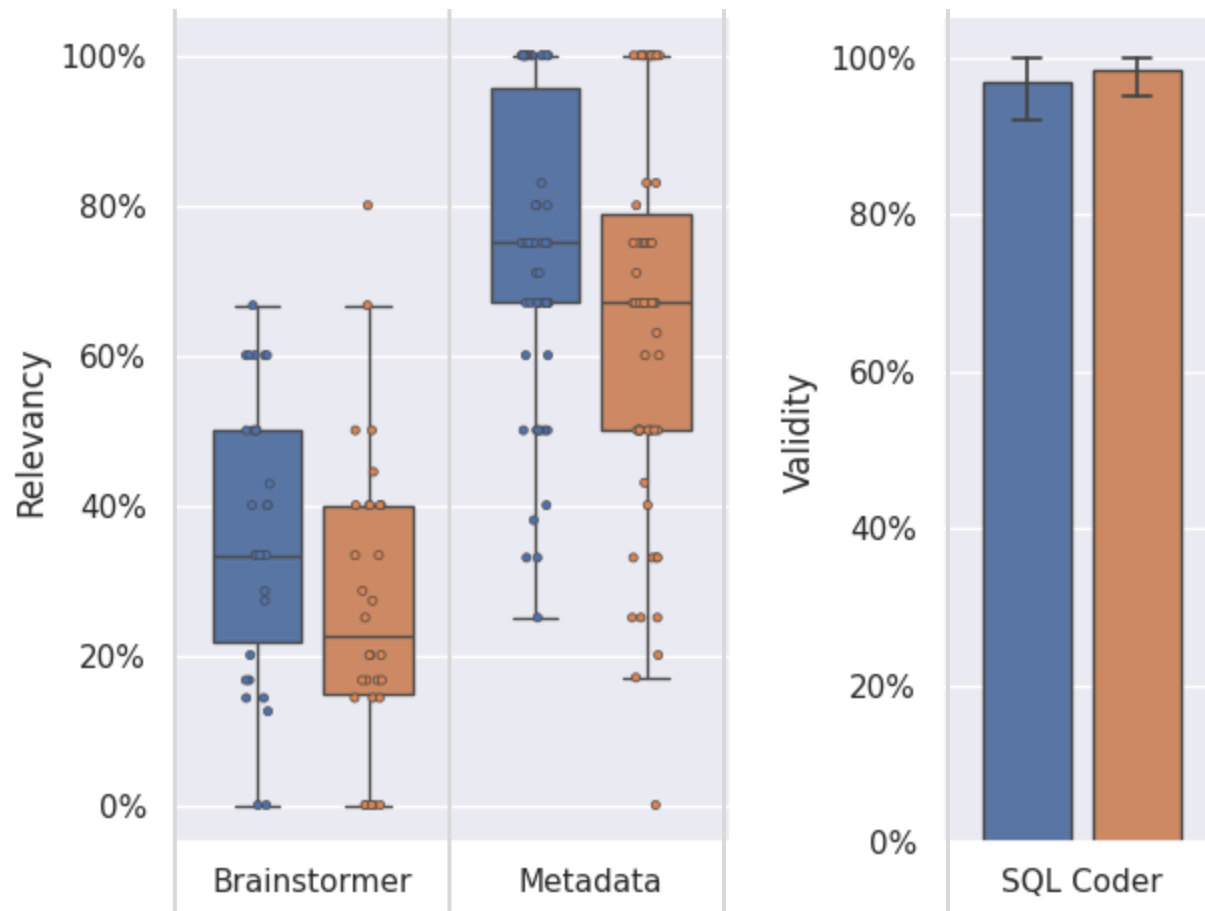
Metrics:

Module	Automated evaluation	Human evaluation
Brainstormer	Relevancy (Recall of expected fields required for business problem solving)	Usefulness (How useful the output for answering the question) - Likert scale of 1 to 7 - Evaluated by BOT's examiners & analysts
Metadata Copilot	Relevancy (Recall of expected fields required for querying data)	
SQL Coder	Validity (Whether the generated SQL syntax is valid, i.e., executable)	

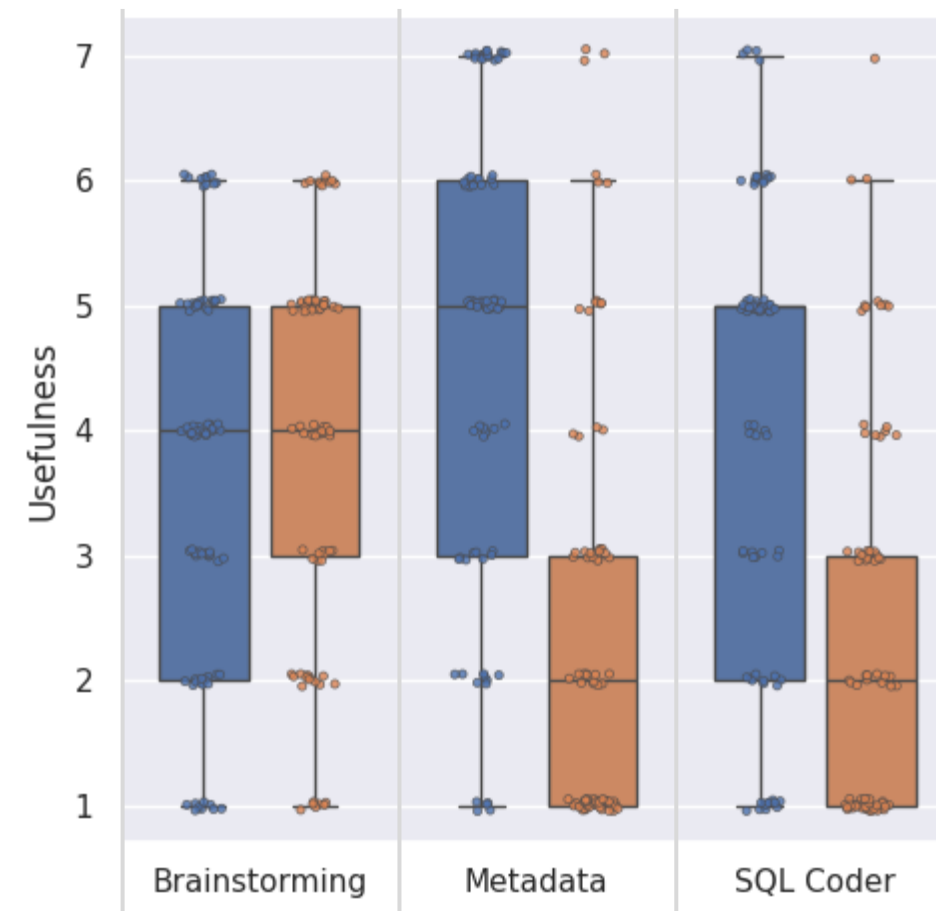


Results from evaluation

Automated Evaluation



User Evaluation



Multi-agent

Single-agent

* For automated evaluation, Brainstormer is evaluated with 30 qualitative questions. Metadata Copilot and SQL coder are evaluated with 62 quantitative questions.

** For user evaluations, each module is evaluated with 10 questions by 8 analysts / examiners.



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Discussion

Automated evaluation

- RDT Copilots can perform objective tasks, such as retrieving fields and writing SQL, very well.
- Multi-agent framework show good improvements in retrieving correct fields. For SQL generation, single-agent framework is already good.

User evaluation

- Users find multi-agent Metadata Copilot and SQL coder useful for answering quantitative questions.
- However, users do not find Brainstormer particularly useful for qualitative questions. Multi-agents framework does not show improvements over single-agent framework.
- Users also show different preferences towards writing styles of Brainstormer versions. Results are varied for different questions for all modules.



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Conclusion

GenAI Tools can be useful in helping RDT data utilization.

- RDT Copilots can help analysts and examiners find and retrieve required data.

Multi-agent framework can be applied to enhance RDT Copilots:

- Help address issues of **limited context length** for multiple tables data.
- Improve **performance** over single-agent approach for some tasks, especially in more objective tasks that require large contexts.
- Can be adopted for **variety of tasks**, both objective (coding) and subjective (brainstorming).



Challenges and Next Steps



Challenges

- Incomplete metadata. Internal jargons.
- Some domain knowledge not in documents or LLM knowledge.
- Difficult to get users engagement in designing and adoption.
- Difficult to experiment with different LLMs due to compliance & security concerns.

∞ Further Work

- Improve data dictionary. Enhance prompt to incorporate more domain knowledge.
- Brainstormer needs a revision to produce more useful outputs.
- Explore LLMs with improved reasoning capabilities such as OpenAI o1 model.
- Incorporate ability to directly process data, e.g., plotting graph.
- Explore multi-agent solutions for problems such as KM chatbots, supervision assistant agents.



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Q & A