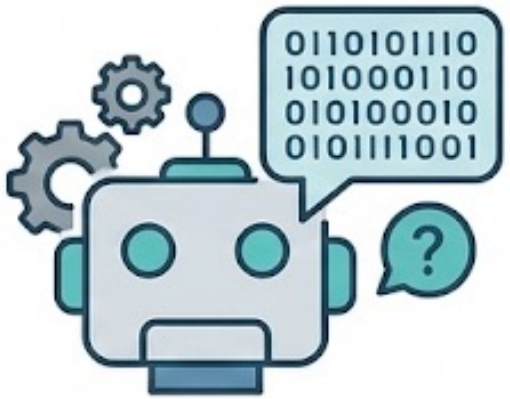
CoScientist

: A multi-agent framework for autonomous scientific discovery

Team: Tennis-Running-Swimming

https://github.com/seoklab/ai-cosci-all.git

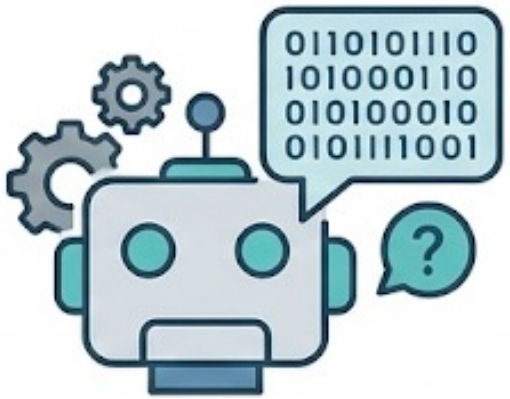
Can “machine” conduct scientific research?



Statistically probable tokens

Hallucination
Superficial answer

Can “machine” conduct scientific research?



Statistically probable tokens

Hallucination
Superficial answer

Needs:

Minimizing hallucination

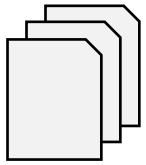
Specializing

“Divide-and-Conquer” with “evidence”

Minimizing hallucination

Specializing

“Divide-and-Conquer” with “evidence”



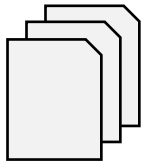
Literatures
Databases

Retrieval Augmented Generation

Minimizing hallucination

Specializing

“Divide-and-Conquer” with “evidence”



Literatures
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Retrieval Augmented Generation

Agent Critic

Critic-Refinement Loop

Q: Are claims supported by evidence?

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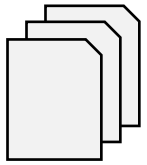

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Q: Are claims supported by evidence?

Subtask 1 → … → Subtask N

Sequential Subtask workflow

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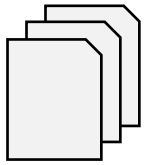

Literatures
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Retrieval Augmented Generation

Agent Critic

Critic-Refinement Loop

Q: Are claims supported by evidence?

Subtask 1 → ··· → Subtask N

Sequential Subtask workflow

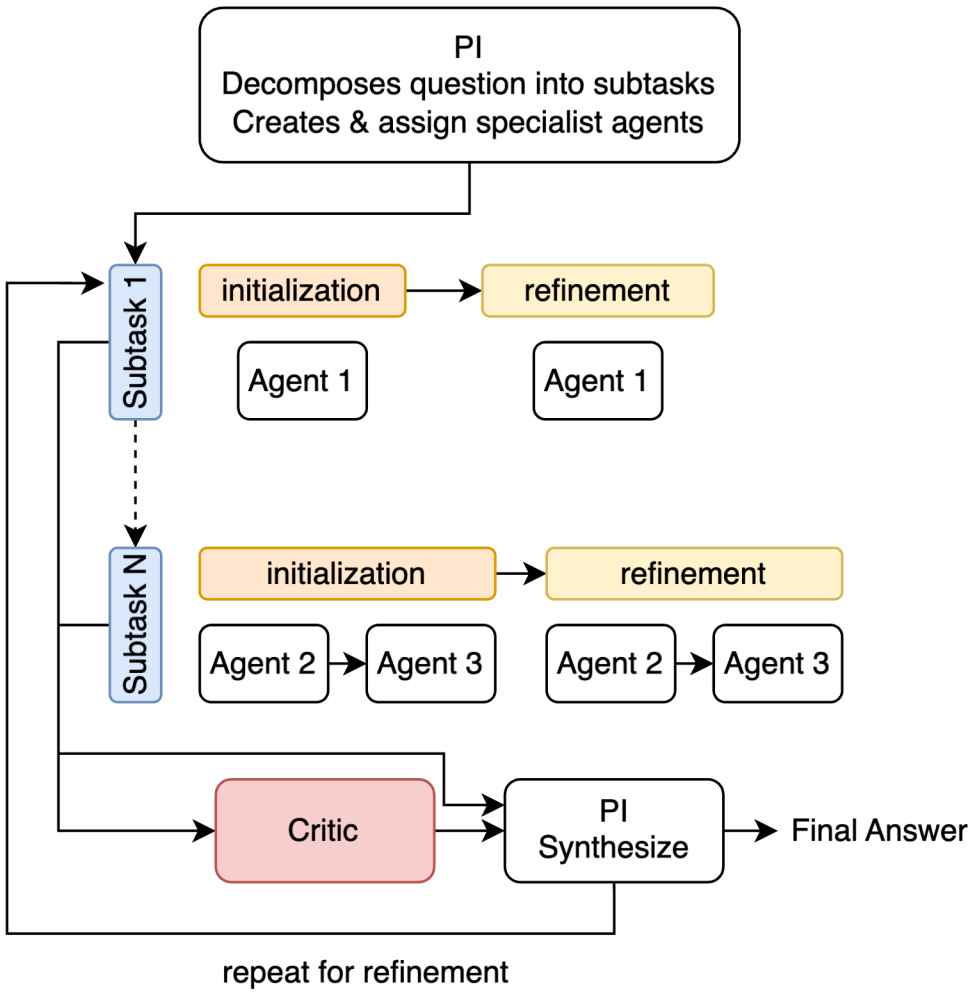
Dynamic agent generation & subtask assignment

PI agent generates specialized agents

Minimizing hallucination

Specializing

System architecture



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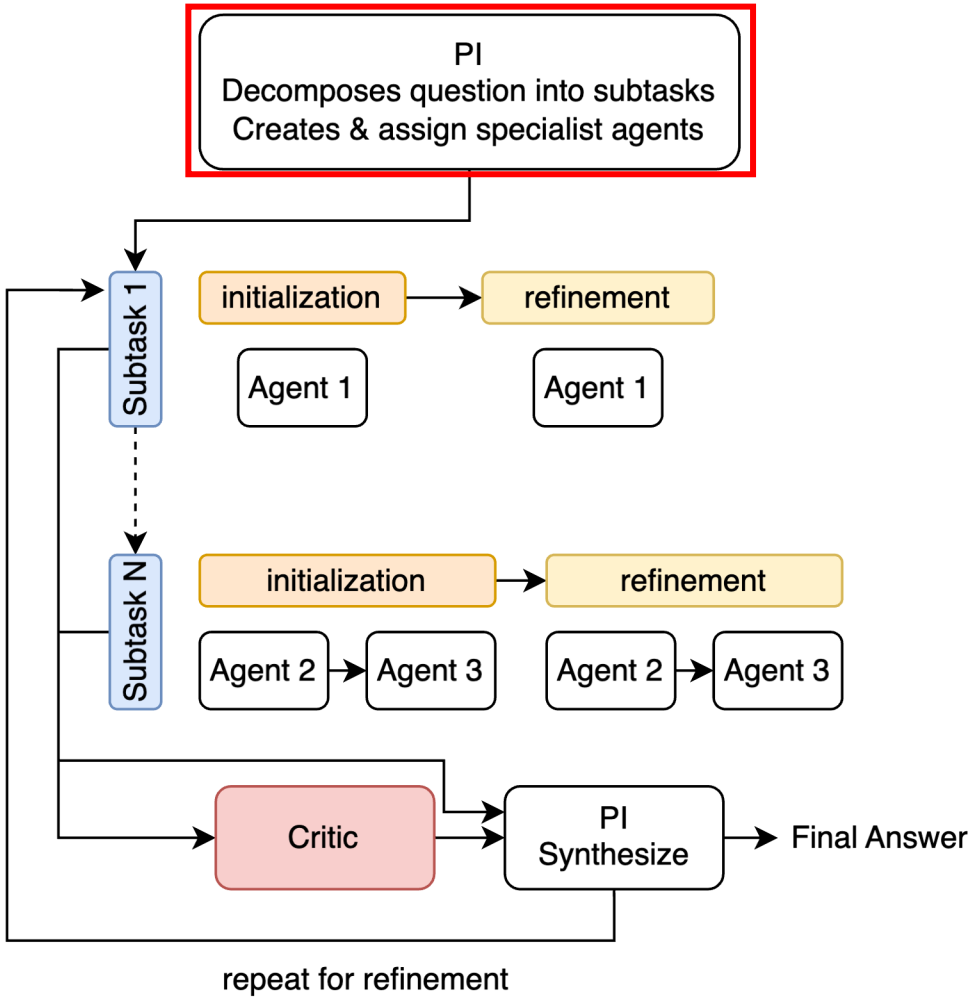

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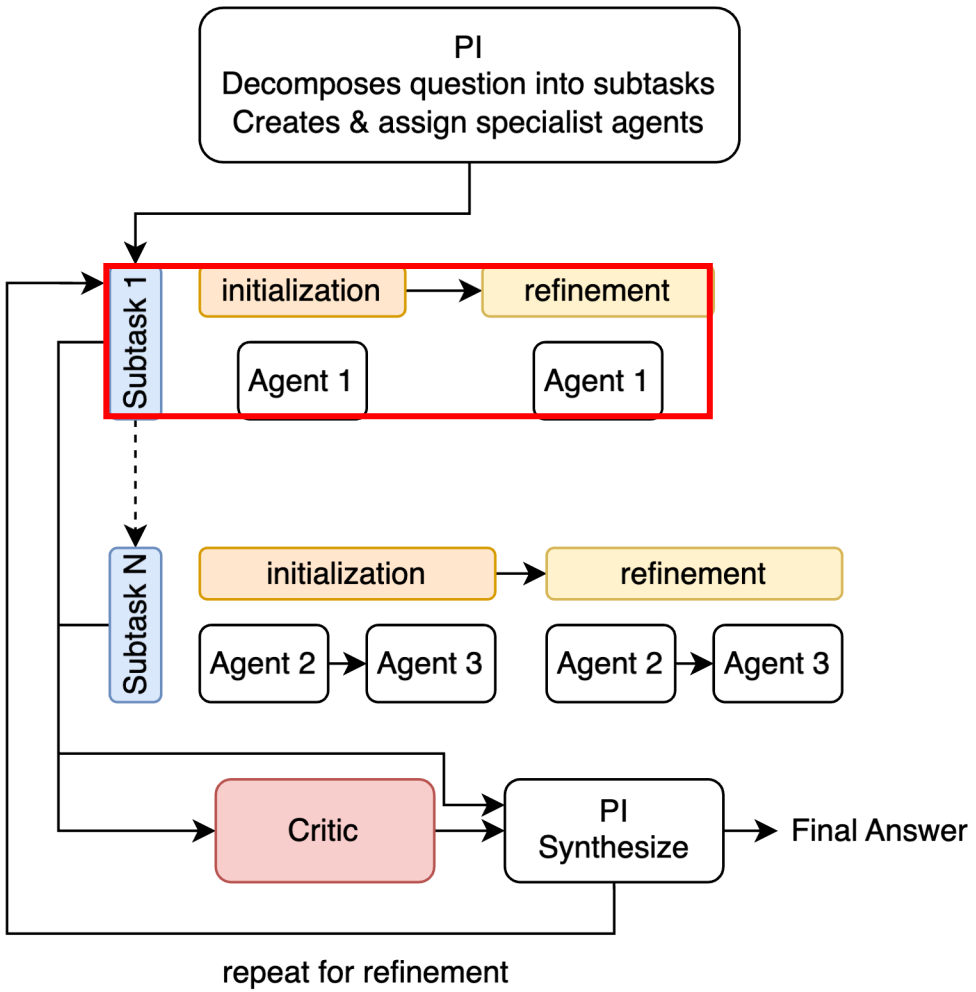

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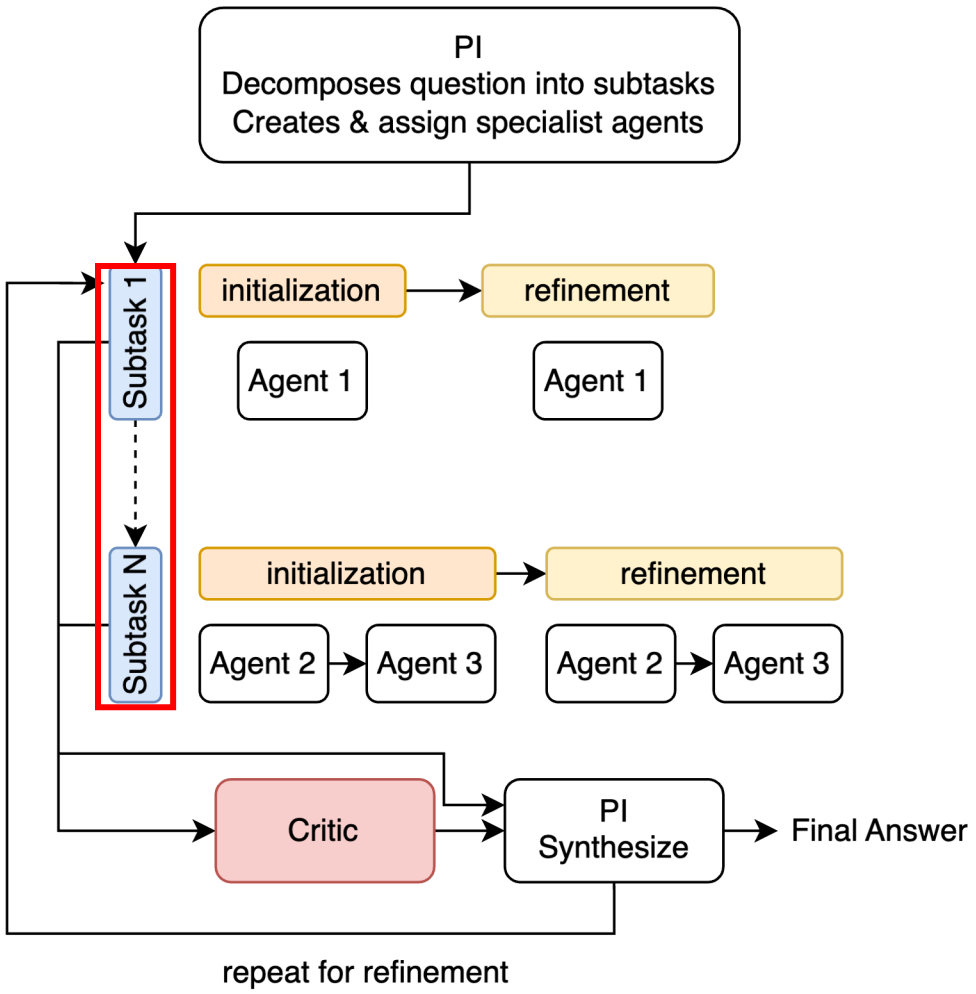

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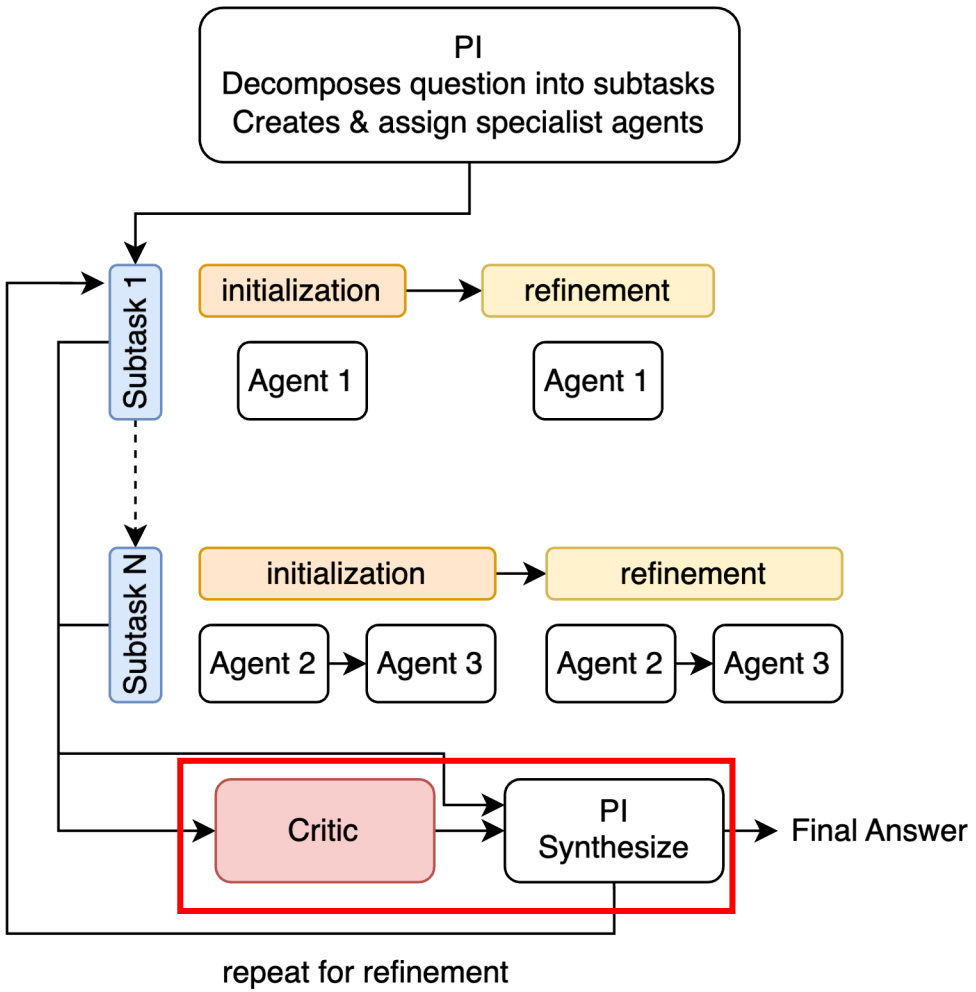

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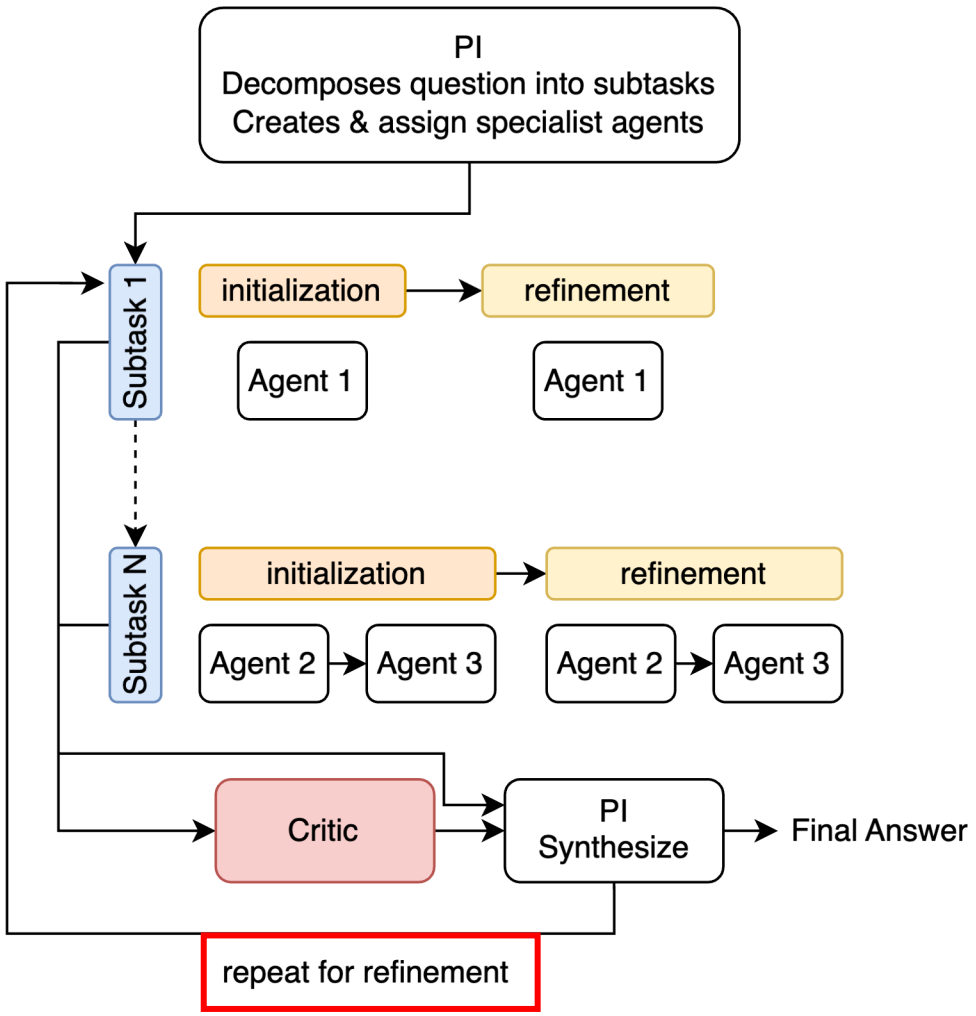

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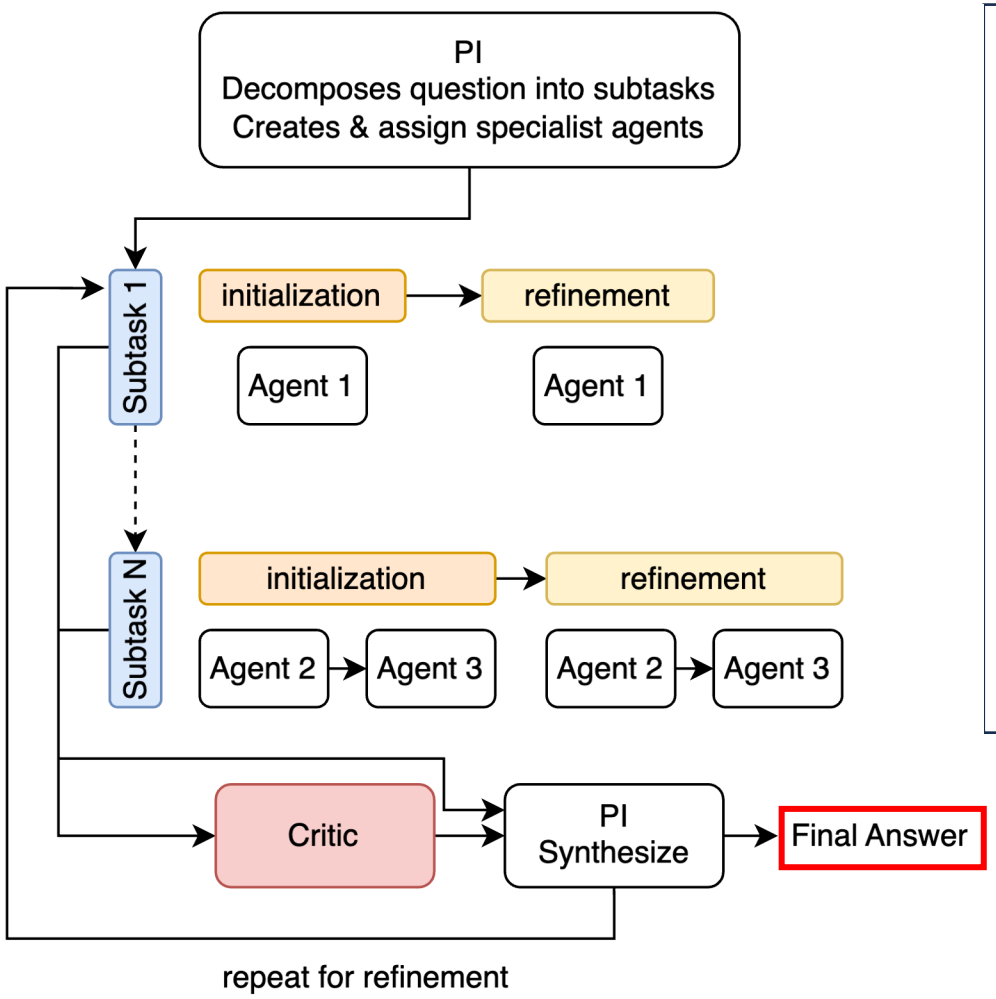

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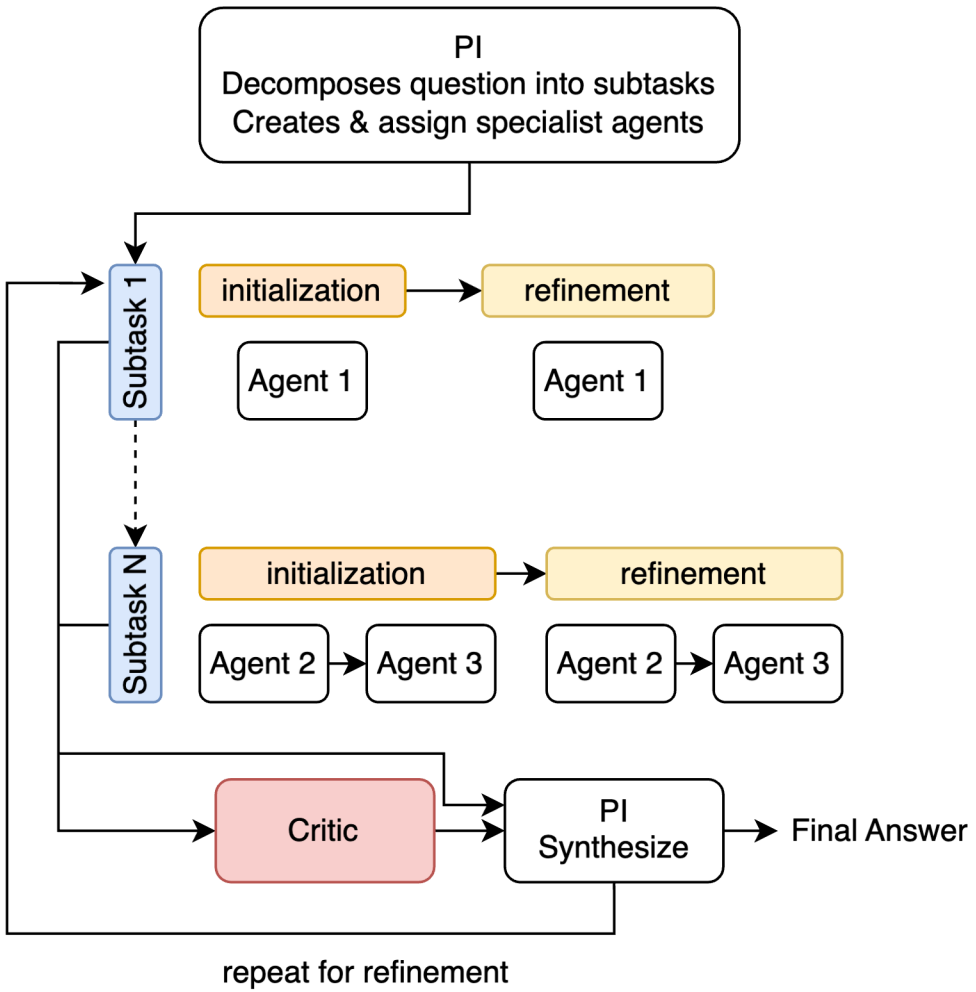
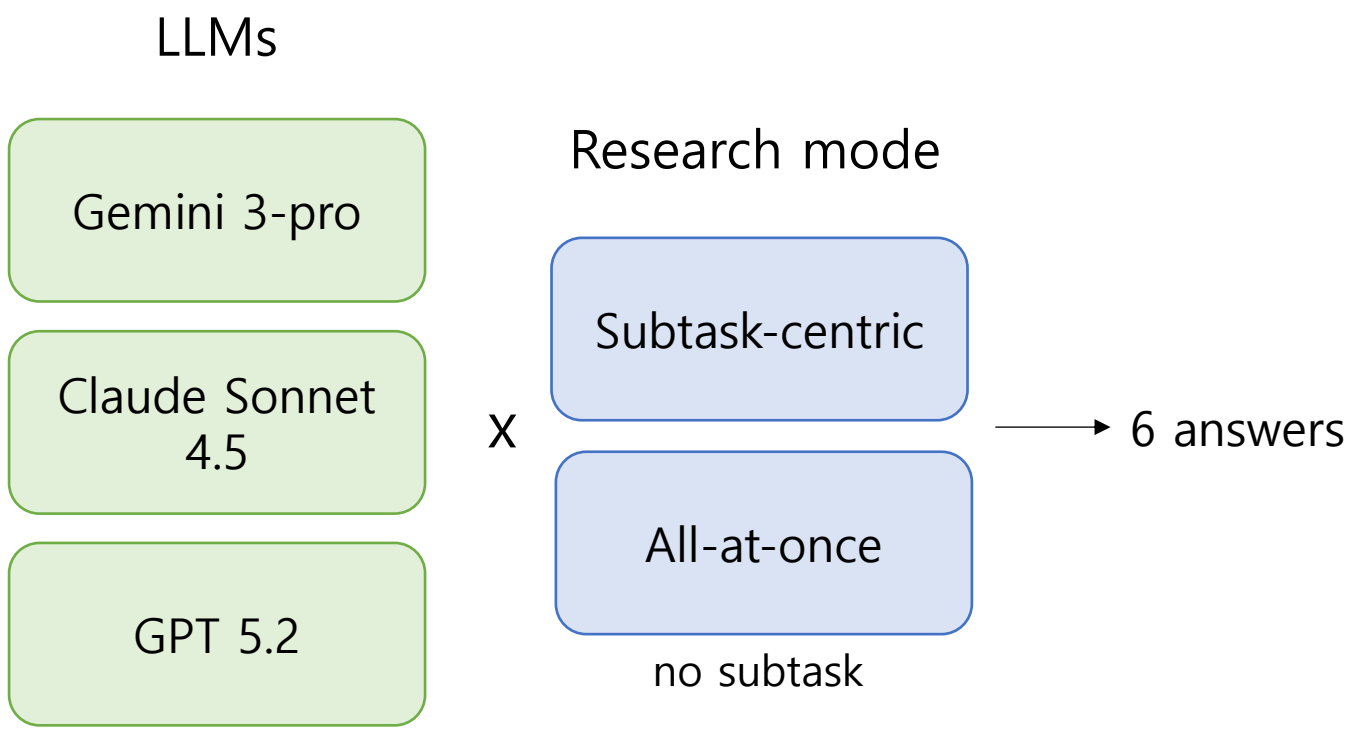


Automated workflow



Scoring by LLM-based evaluator

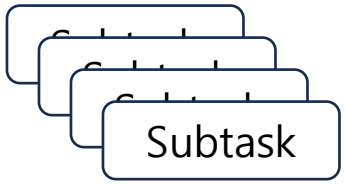
Evaluator

Prompt:
Evaluate answers according to the following criteria;
1. Scientific accuracy
2. Evidence quality
3. Methodological rigor
4. …

Problems of automated answers

Problems of automated answers

Sub-optimal subtask split



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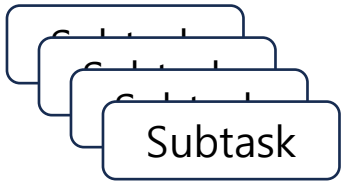
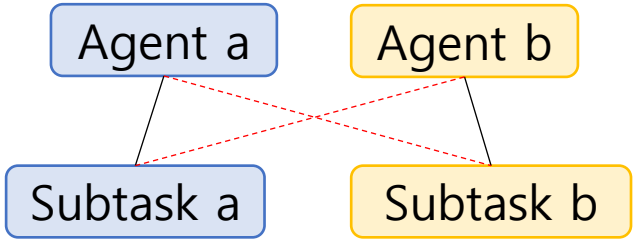


Subtask-Agent miss-match



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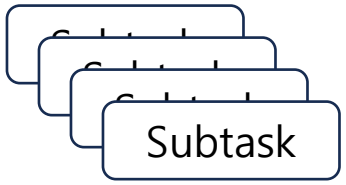

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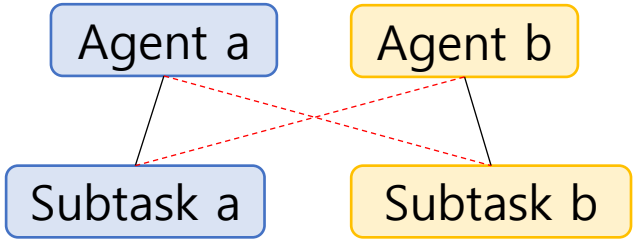
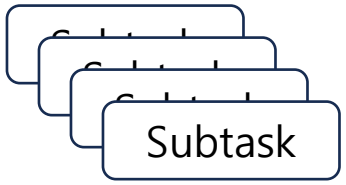


Repeating meaningless search & analysis

Problems of automated answers

Sub-optimal subtask split



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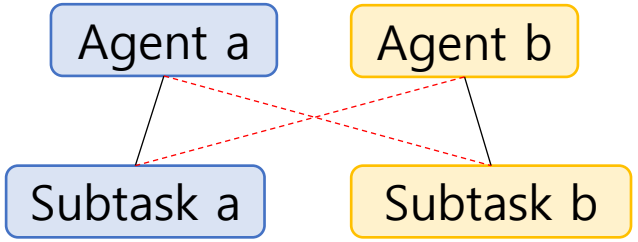

Repeating meaningless search & analysis

Ignoring previous results & Fabricating data & claims

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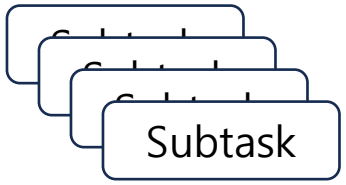

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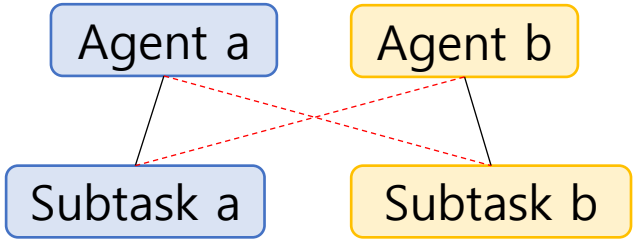


Loss of Context

Hallucination

Repeating meaningless search & analysis

Ignoring previous results & Fabricating data & claims

Human guided workflow

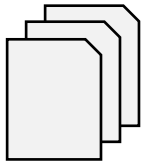
Human guided workflow

Direct human guidance

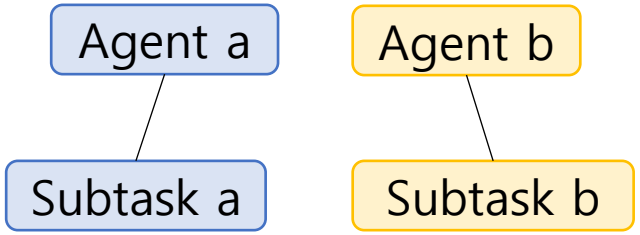
Prompt modification

```
Prompt:
Answer based on the
literature and
previous results.
```

answer based on
human-curated literatures



Human-guided task-agent-tool setting



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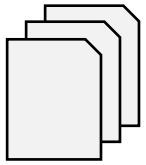

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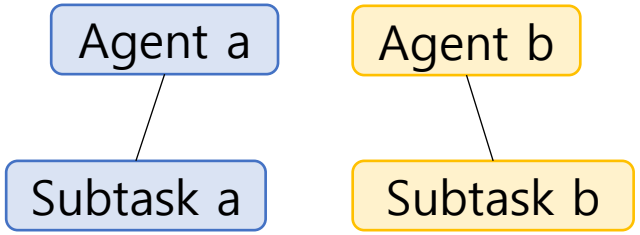
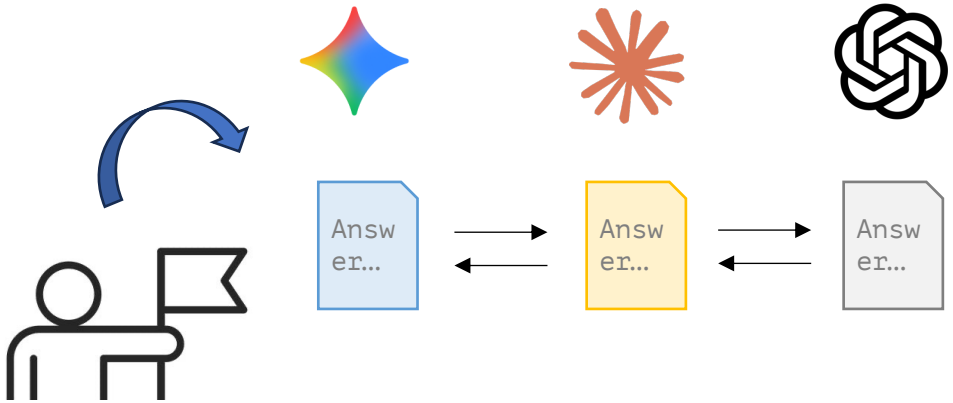


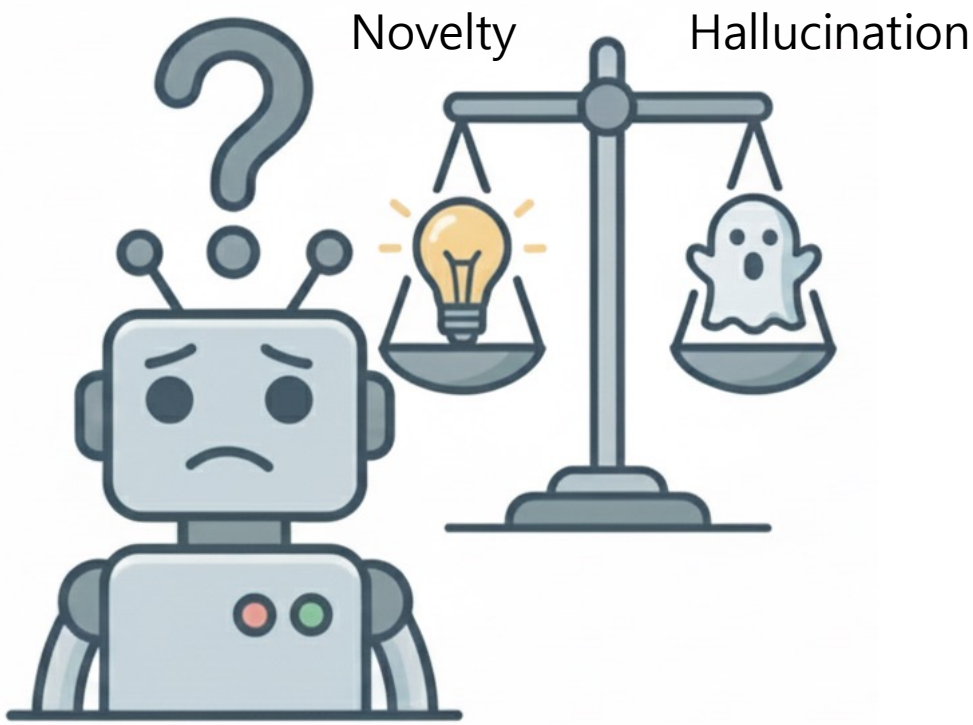
Cross-model validation

(using commercial LLM assistant)



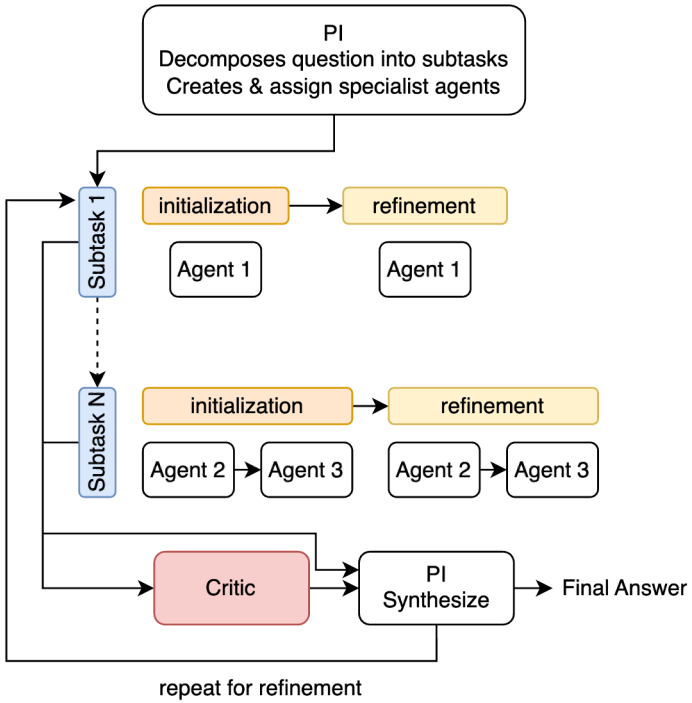

```
Q: Can the claims be derived from only given data?
Q: Is there conflicts or complementary claims?
Q: Refine answers considering feedback by other models
Q: Synthesize the final answer.
                                    ...
```

Limitations

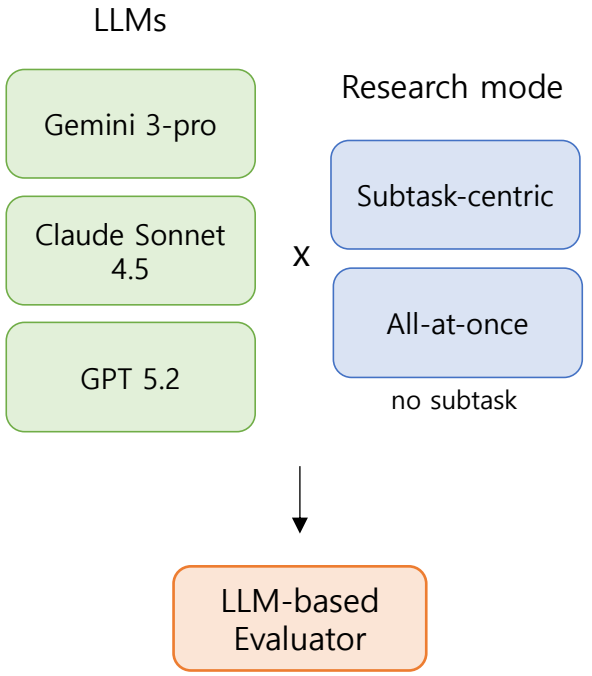


Conclusion

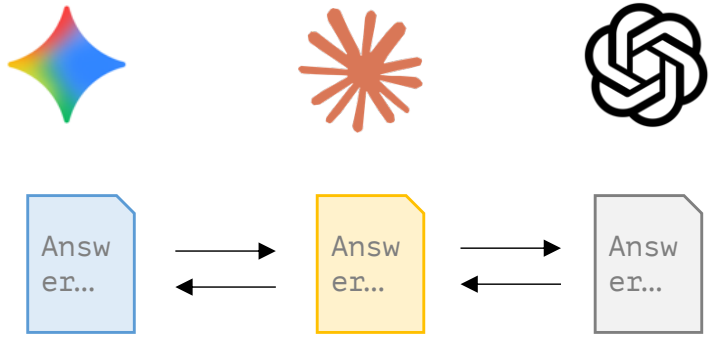
Multi-agent subtask-centric



Automation category



Cross-model checking



Q&A

Thank you for listening!

Sumin Lee

Jiho Sim

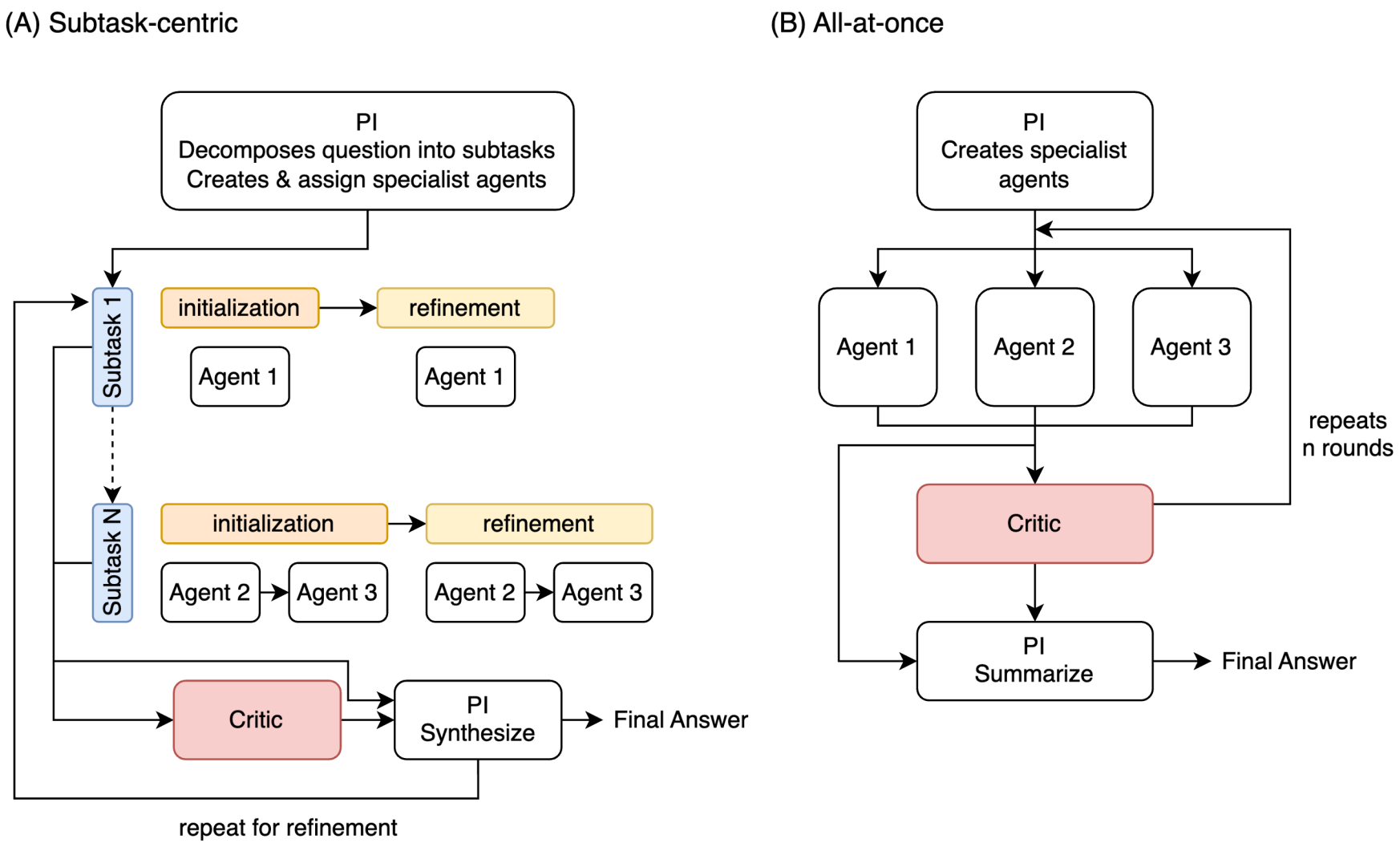
Seeun Kim

Yubeen Kim

Sujin Park

Tennis-Running-Swimming Seok Lab

Two research modes



Q5 cross-model check example

Based on my verification, here's the definitive answer:

✅ VERIFIED ACCURATE Claims (Not Hallucinated)

Claim	q5final Value	Actual Data	Status
IL2 L35→L60 log2FC	+1.33	+1.33	✅ **Exact match**
CHEK2 L35→L60 log2FC	-1.18	-1.18	✅ **Exact match**
CCL8 L35→L60 log2FC	+3.49	+3.49	✅ **Exact match**
CCL12 L35→L60 log2FC	+3.00	+3.00	✅ **Exact match**
CCL1 L35→L60 log2FC	+2.77	+2.77	✅ **Exact match**
TRAV3-1 L35→L60 log2FC	+6.45	+6.45	✅ **Exact match**
Gene names exist	GM42878, DUXBL3, TRAV genes	Present in data	✅ **Verified**

❌ HALLUCINATED or INCORRECT Claims

Claim	q5final Value	Actual Data	Status
GM42878 L35→L60 upregulation	+32.6×	**~1.1×** (no change)	❌ **Hallucinated**
DUXBL3 L35→L60 upregulation	+24.0×	**~1.0×** (no change)	❌ **Hallucinated**
L35→L60 DEG count	3,923 genes	**264 genes** (	LFC
Exhaustion score L35	-0.269	**+0.517** (my calc)	⚠️ **Discrepant**
Exhaustion score L60	+0.534	**+0.251** (my calc)	⚠️ **Discrepant**

Q6 novel target example

자동화 답안
- **FGFR1c/FGF21**: 포도당 흡수, 지방 산화 등 지방세포 대사 촉진

휴먼 답안
- **ActRIIB/Myostatin :** 근육을 녹이는 경로 ← 차단. 근육 감소 최소화
- **GIP 수용체 :** 지방 세포에 직접 작용, 대사 저하 방지

REGENERON
mounjaro®

AI consensus: "ActRII와 GIPR는 GLP-1의 '실패 지점'을 직접적으로 보완하는 compensatory nodes인 반면, FGFR1c/FGF21은 GLP-1 이후 대사 건강을 증폭시키는 보조 축이기 때문에 본 문제의 핵심 요구(한계 극복)에서는 2순위로 판단."

휴먼 답변의 두 타겟은 이미 임상을 통과했거나 진행중. 즉 이미 실험적으로 충분히 밝혀져 novel target으로 보기 어려움.