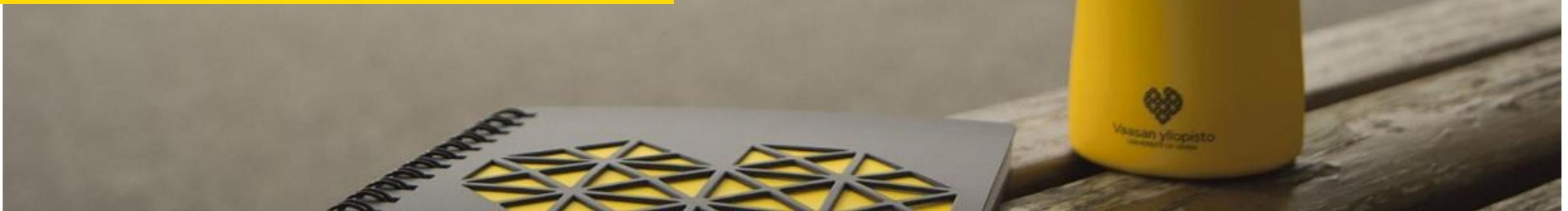


*HAMK Guest Lecture*

# Generative AI (et al.)

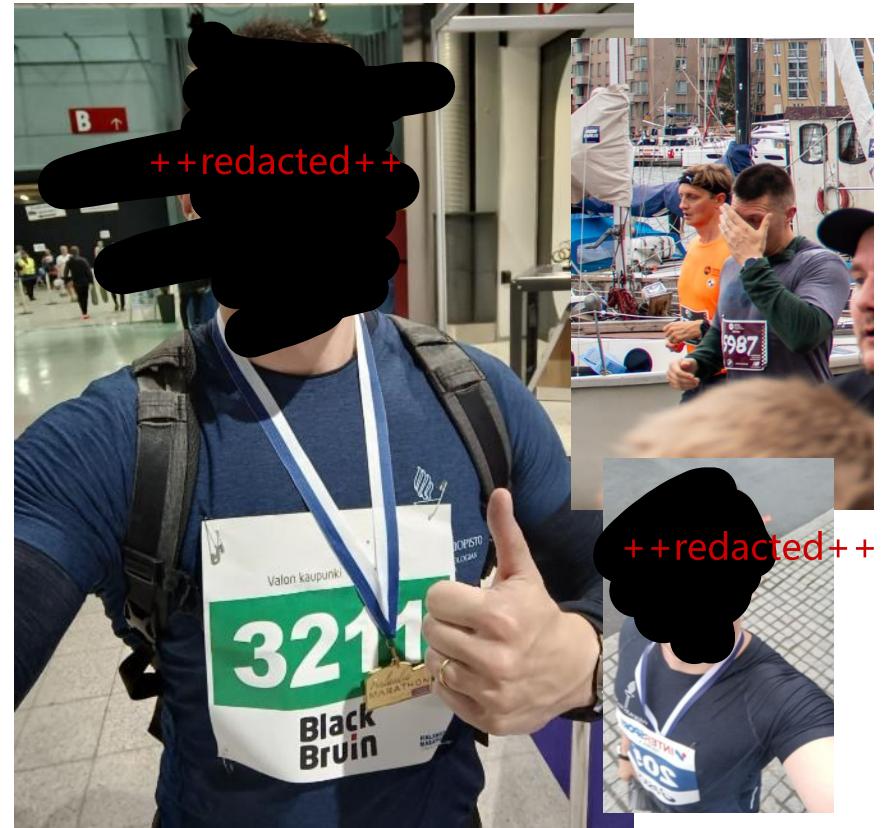
-  
**Juhani Merilehto**

[juhani.merilehto@student.uwasa.fi](mailto:juhani.merilehto@student.uwasa.fi) / [merilehto@pm.me](mailto:merilehto@pm.me)



# Juhani Merilehto

- ▶ Doctoral Researcher – DSc. (Admin.) in Social and Health Sciences
- ▶ MSc. Student in Cybersecurity
  
- ▶ MSc. in Security and Strategic Analysis
- ▶ MSc. in Cognitive Sciences
- ▶ MSc. (Econ.) in Information Systems
  
- ▶ Data Analyst at Welfare region of Central Finland
- ▶ OSINT-Analyst (Freelancer)



**Research keywords:** *Distributed Cognition; Hybrid Work; Cognitive Warfare; Organizational Studies; Strategy; Artificial Intelligence*

► Generative AI

► Data Analysis

- ▶ Do you use Generative AI?

**SO CHATGPT IS A GENERATIVE  
PRETRAINED TRANSFORMER YOU CAN  
USE TO BE MORE PRODUCTIVE & CREATIVE.  
YOU REALLY NEED TO START USING IT.**



# Generative AI (LLM's) & Data Analysis

- ▶ Generative AI
- ▶ AI that creates new content based on training patterns
- ▶ Neural nets for generating text responses
- ▶ Models that predict and produce output
- ▶ Natural language understanding and generation
- ▶ Data analysis
- ▶ Systematic examination of data to extract insights
- ▶ Process of cleaning, transforming, and interpreting information
- ▶ Uses statistical methods to identify patterns and relationships
- ▶ Converts raw data into actionable knowledge for decision-making

Co-worker

Process



Vaasan yliopisto  
UNIVERSITY OF VAASA

\* Evening, Juhani

How can I help you today?



Claude 3.7 Sonnet



Write



Learn

</> Code

Life stuff

Connect apps



Now?

Good evening, Juhani Merilehto.

How can I help you today?



Grok 3



Hello, opiskelija!

My co-workers!

Ask Gemini

+ Deep Research Canvas

What can I help with?

Ask anything



Search



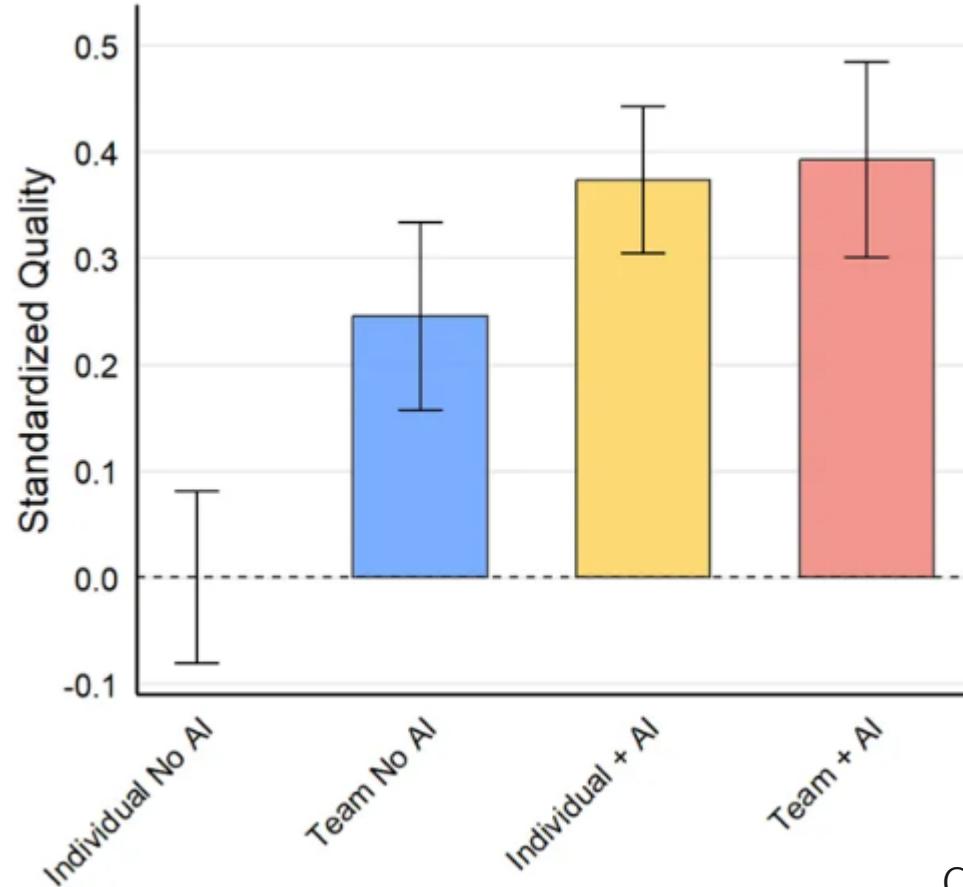
Deep research



Create image

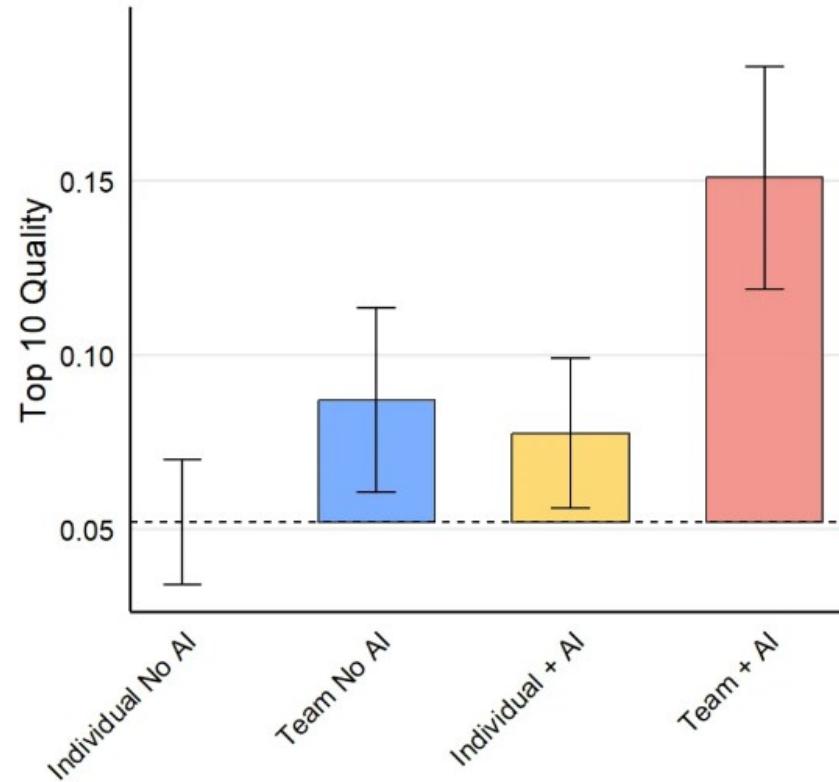


# GenAI & Experts work like a team



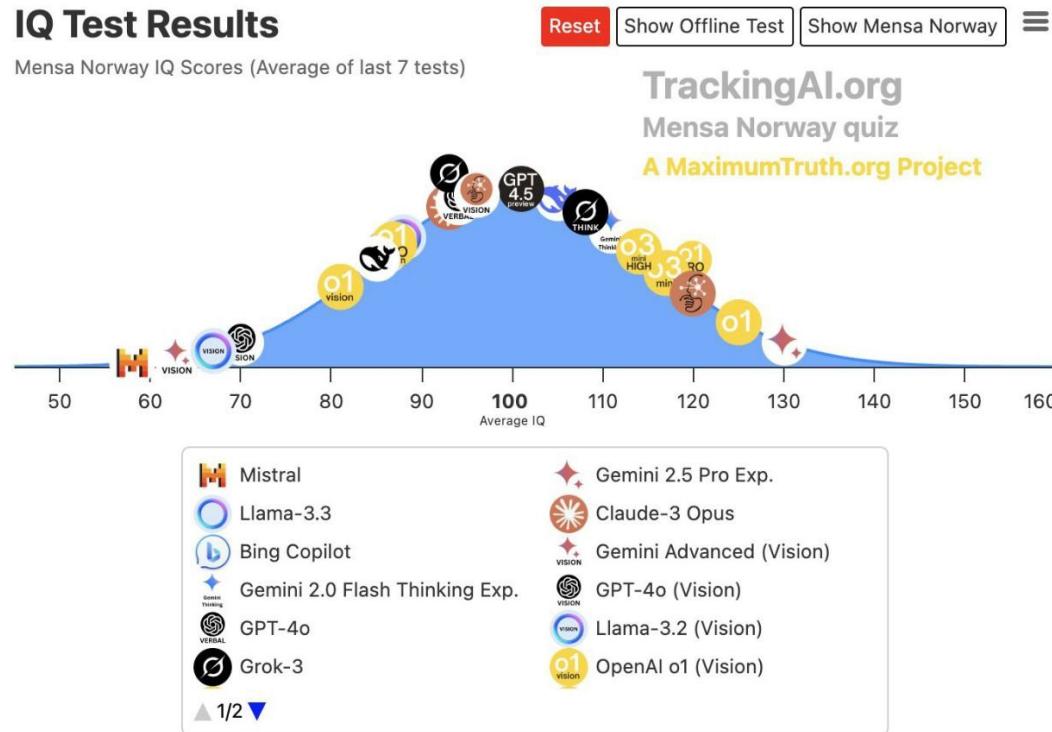
Commercial experts and technical R&D experts

# GenAI & Teams produce more Top 10 results



**Notes:** This figure displays the proportion of top 10% solution across different treatments with standard errors.

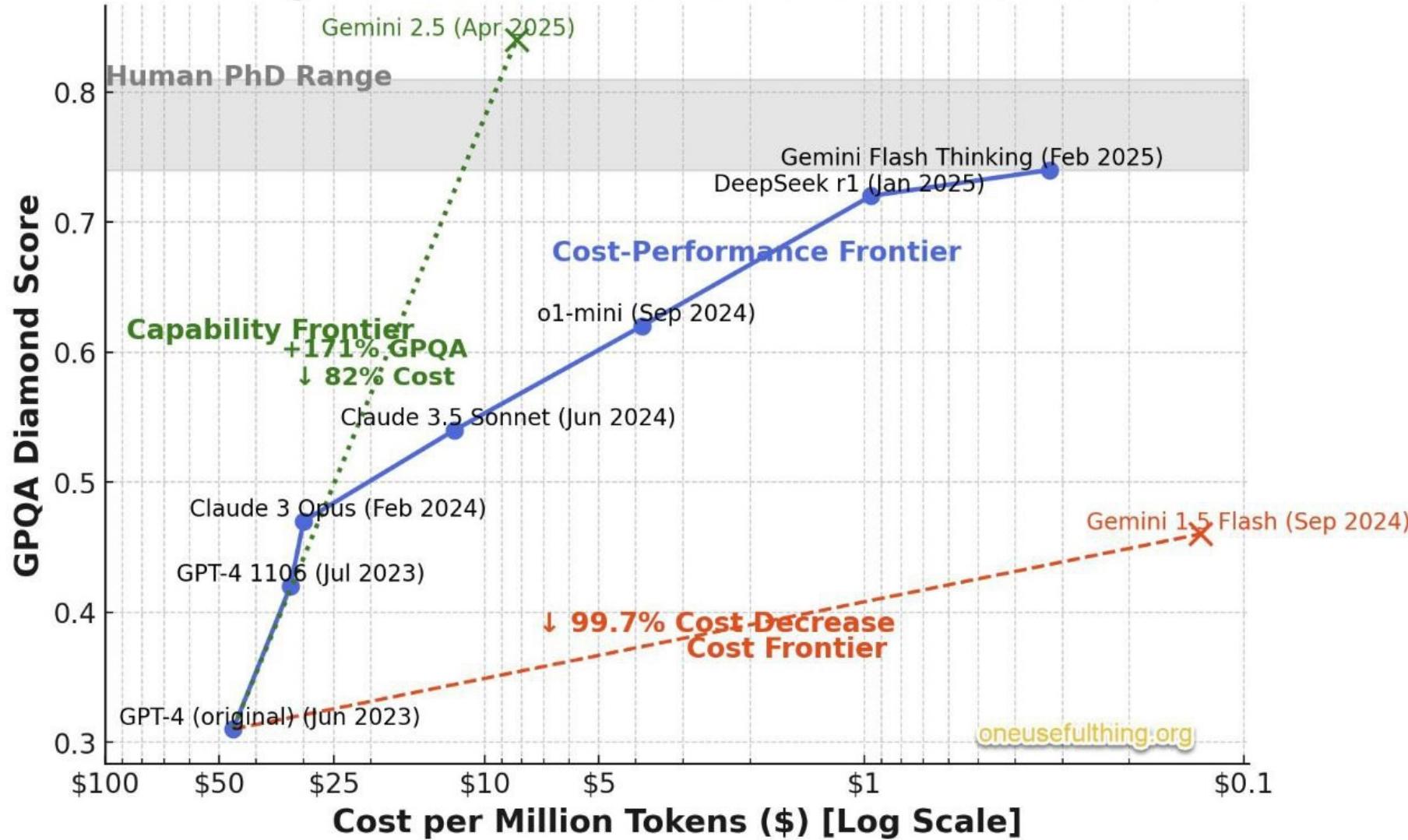
# Generative AI is improving with rapid pace



Tracking AI. (2025) IQ Test Results.  
<https://www.trackingai.com>

Jones, C. R., & Bergen, B. K. (2025). Large Language Models Pass the Turing Test. *arXiv preprint arXiv:2503.23674*.

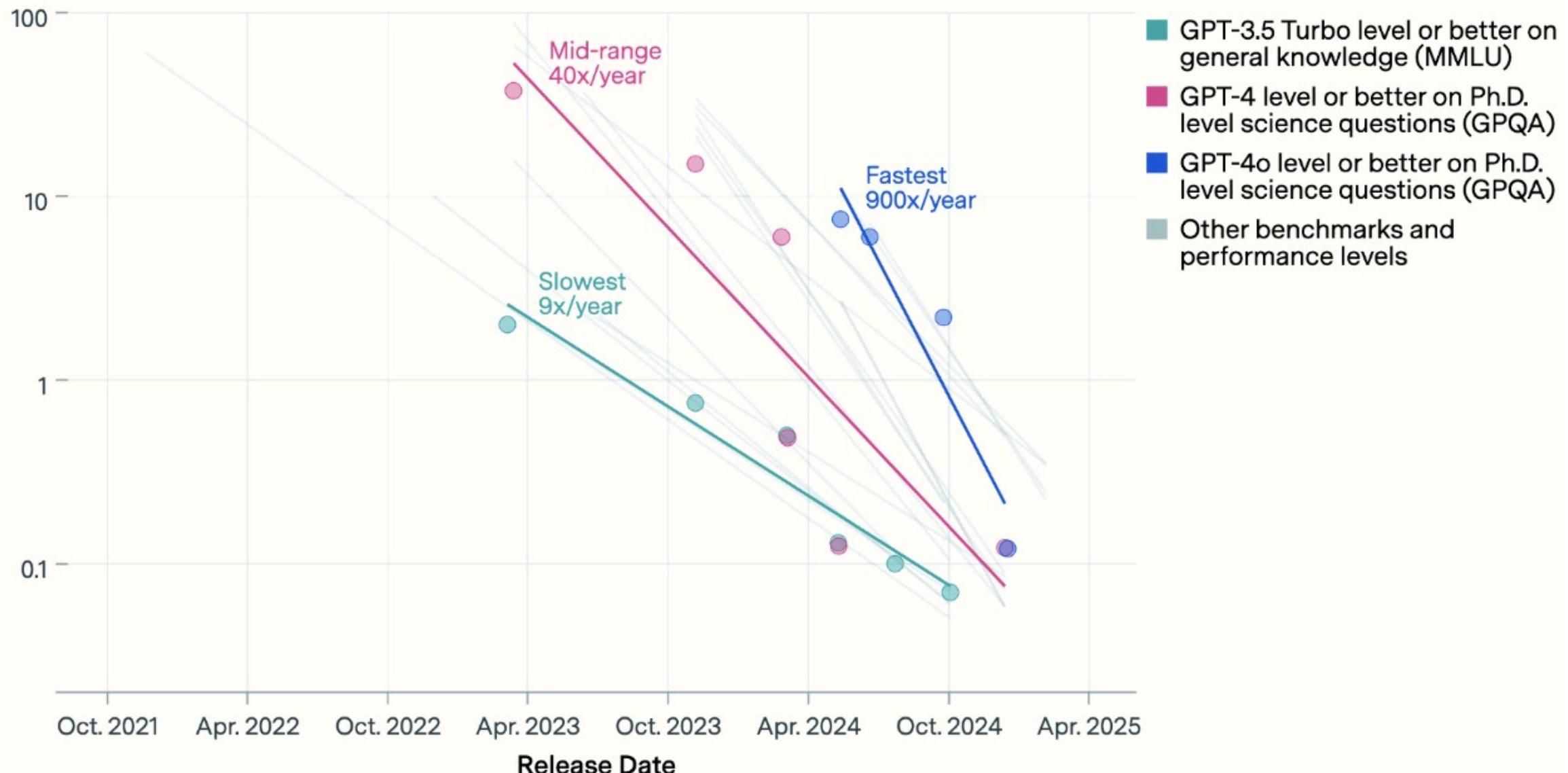
# Shifting Frontier of AI Model Performance and Cost



# LLM inference prices have fallen 9x to 900x/year, depending on the task

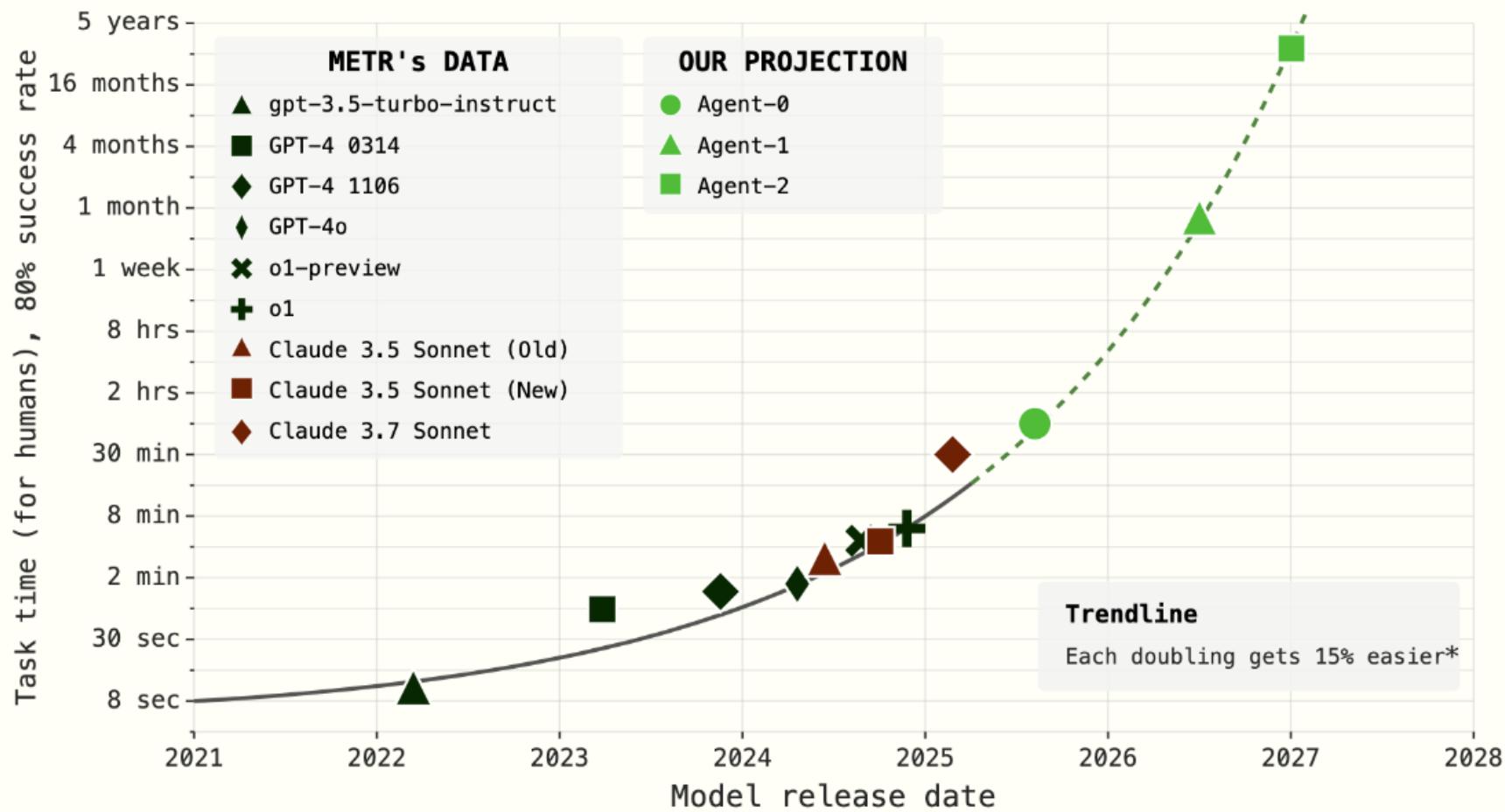
EPOCH AI

Price (USD per million tokens)

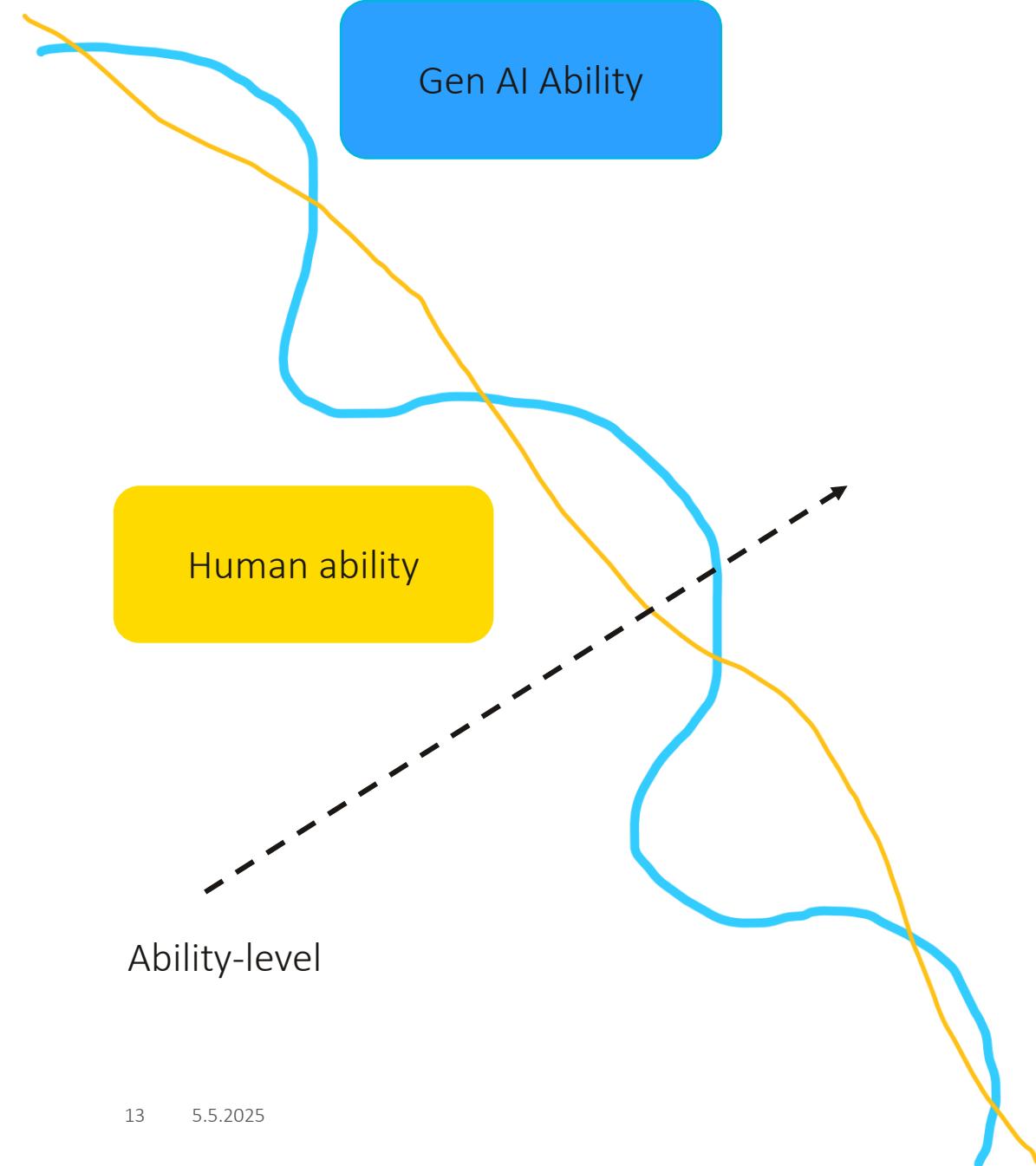


Data source: Epoch AI, Artificial Analysis

## Length Of Coding Tasks AI Agents Can Complete Autonomous



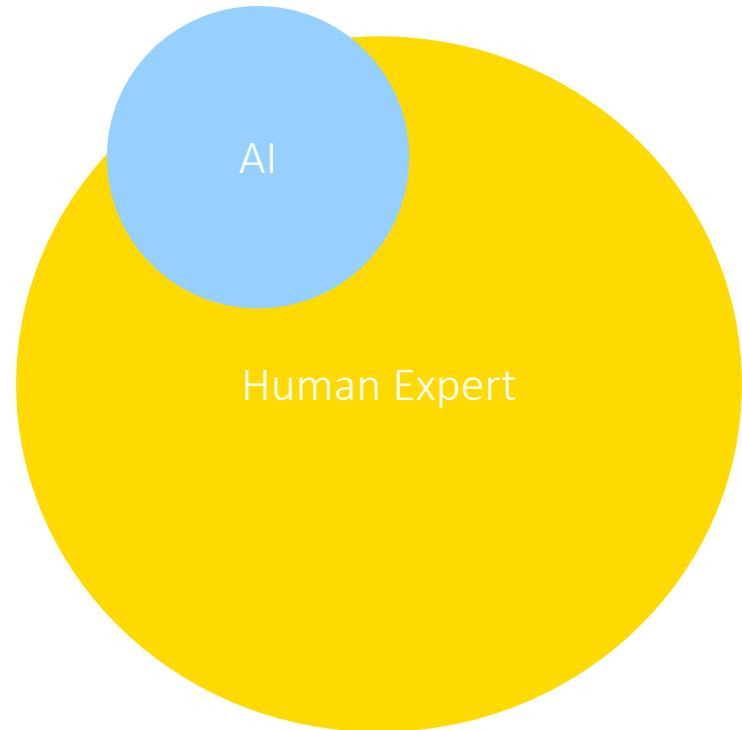
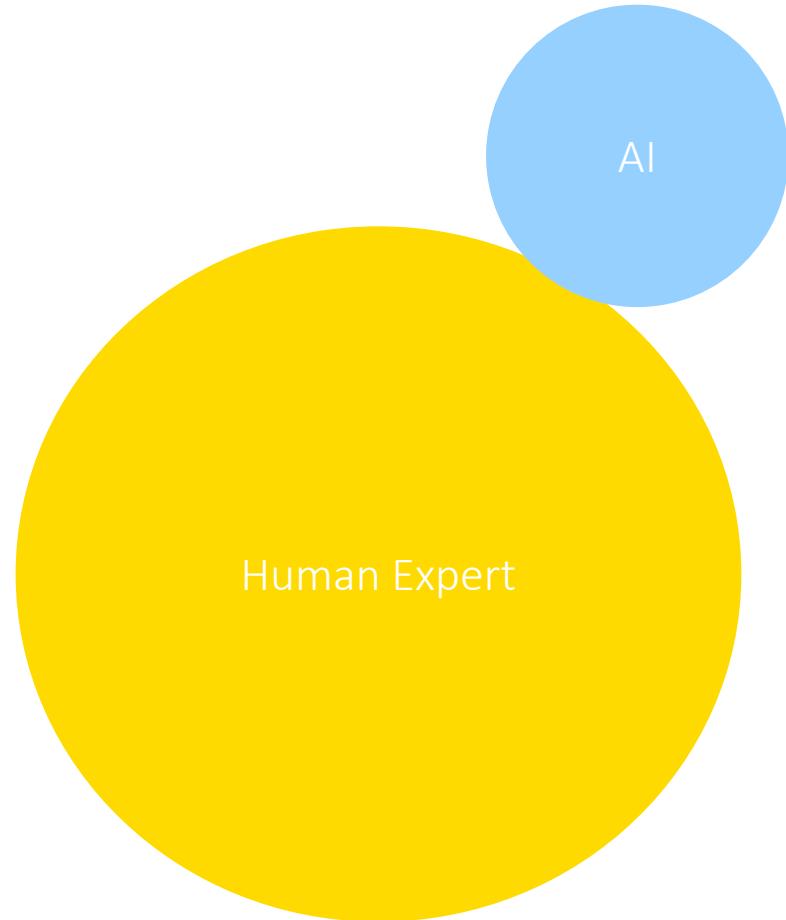
Kokotajlo, D., Alexander, S., Larsen, T., Lifland, E., & Dean, R. (2025). AI 2027. AI Futures Project. <https://AI-2027.com>



- ▶ The “Jagged Frontier” (Dell’Acqua, 2024)
- ▶ The ability of AI is uneven (much more than human)
- ▶ This leads to situations where AI can in certain scenarios produce unexpected failures
- ▶ I.e., data is false -> false analysis that human could have noticed

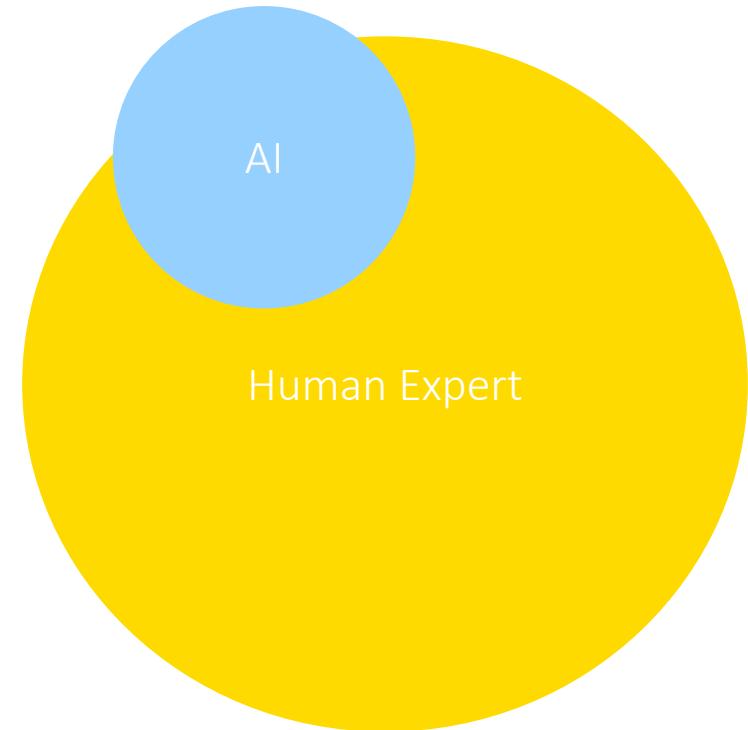
# Cyborgs & Centaurs

(Dell'Acqua, 2024)

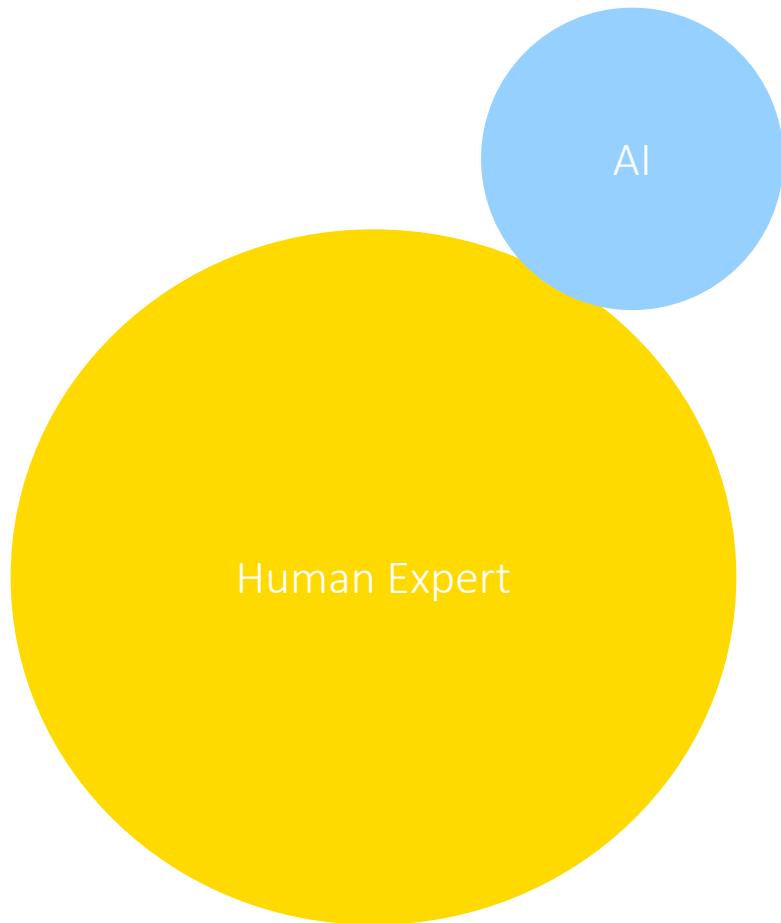


# Cyborgs (Dell'Acqua, 2024)

- ▶ Merge own work and AI
- ▶ i.e., “finish this sentence”
- ▶ Integrated duo, back-and-forth prompting & feedback



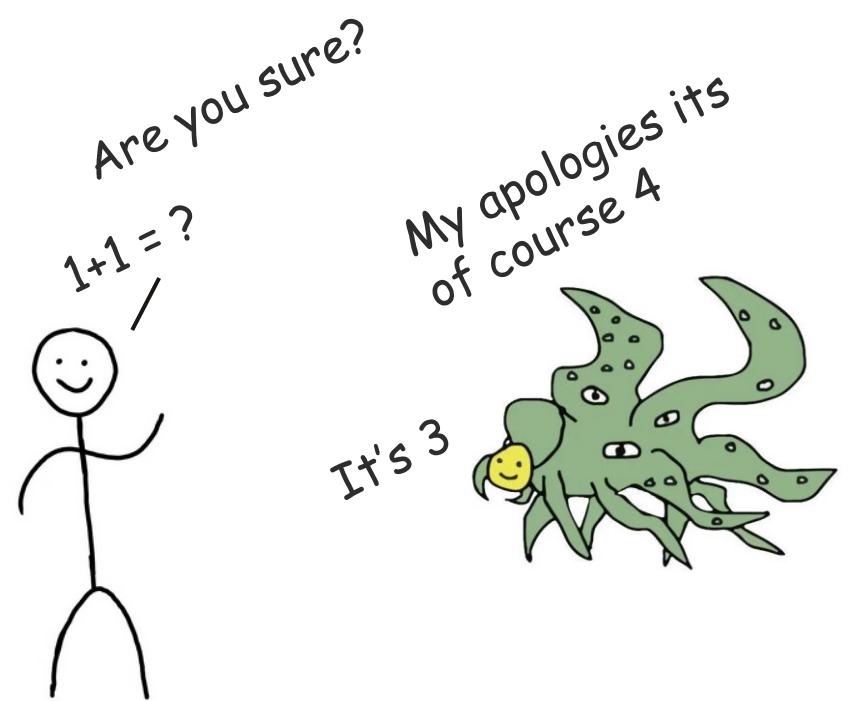
# Centaurs (Dell'Acqua, 2024)



- ▶ Outsource work to AI that is not in their specialty
- ▶ Do the “core work” themselves
- ▶ Sometimes taking AI output “as is”

# Issues of credibility

- ▶ LLM's work on probabilities
- ▶ Every discussion can be slightly different
- ▶ Thus is every analysis different?
- ▶ Hallucinations are still a thing – LLM can “lie” that is used a tool, for instance



# Analyst: Will this take our jobs?

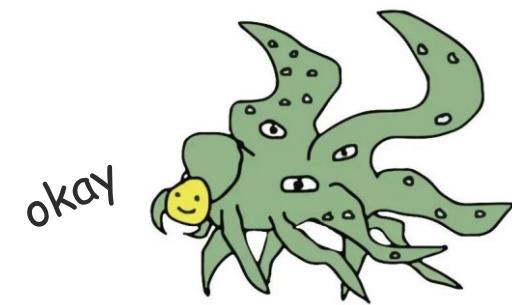
- ▶ Probably yes
- ▶ Job market change is in progress
- ▶ Outcome is unclear (most of knowledge work will transform)
- ▶ Learn Generative AI





# Generative AI: Reasoning models

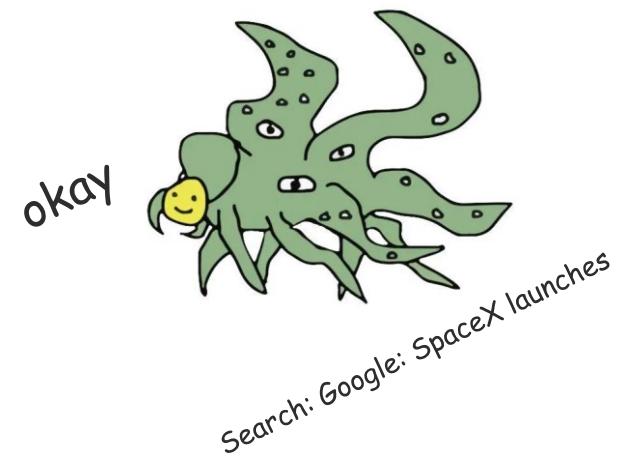
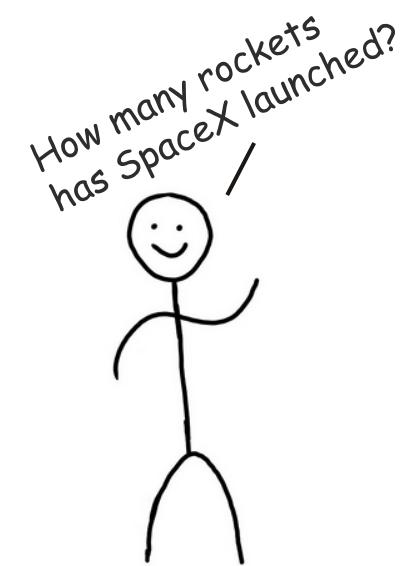
- ▶ Reasoning model is a way to make the model “think more”
- ▶ The model “reasons” based on the prompt and its knowledge what the user wants and how to deliver it
- ▶ Improves performance / Increases costs



What is "GF"  
Probably an acronym meaning "girlfriend"  
User asks 'how to'  
Most likely means "how to get"  
Assuming user is single and looking  
for a companion  
List methods of ....

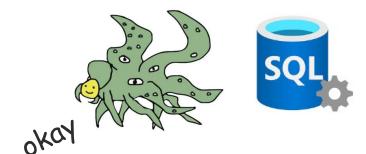
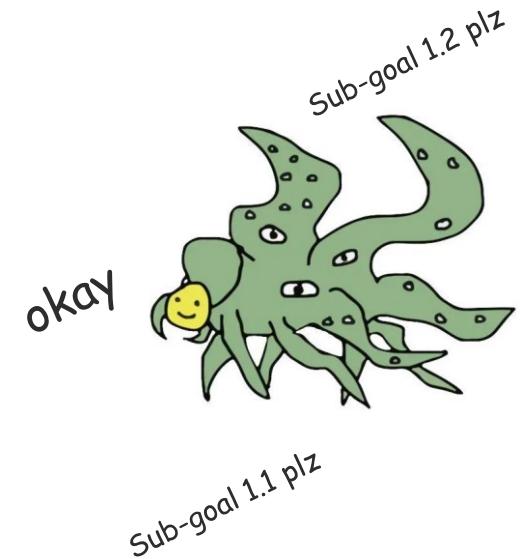
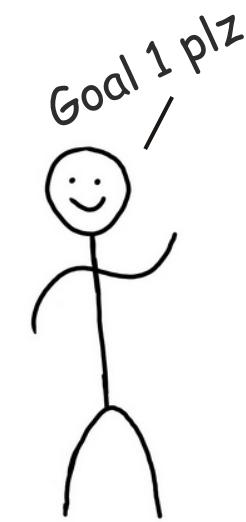
# Generative AI: Tools

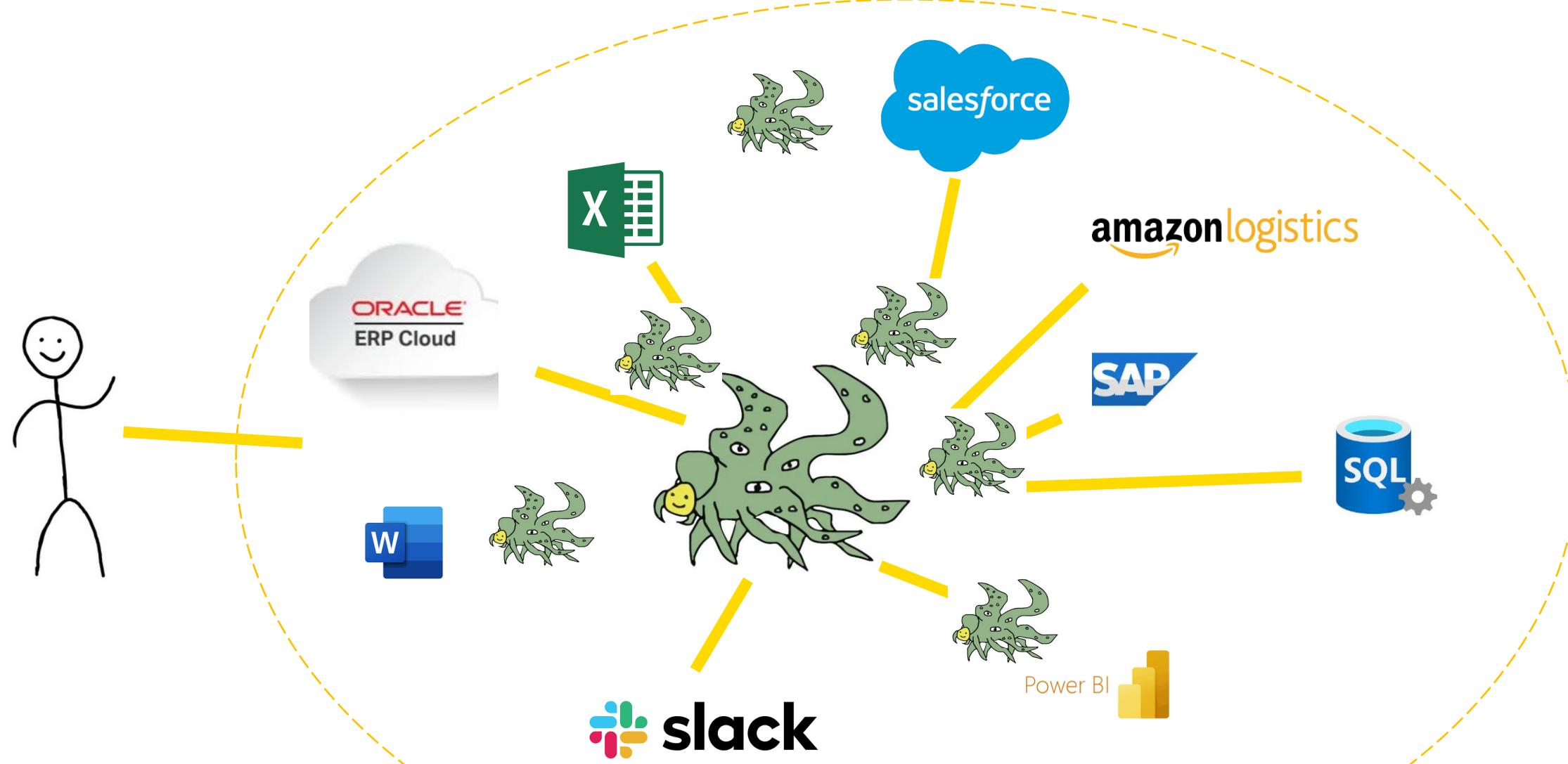
- ▶ LLM's (or, systems that use LLM's) can access tools to accomplish a task
- ▶ Most commonly built-in to the UI (i.e., web search)
- ▶ Rising technology is the MCP (Model Context Protocol) where LLM can access data/tools in a given address



# Generative AI: Agent Technology

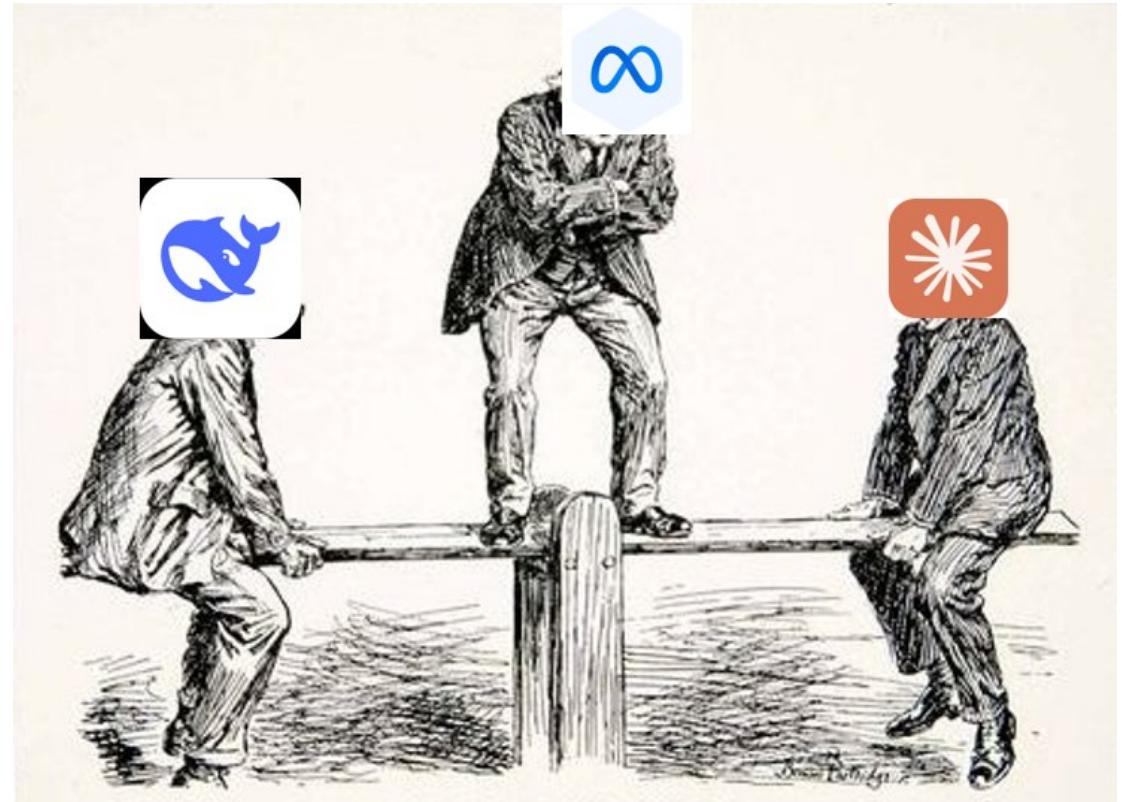
- ▶ Agent: Autonomous task completion
- ▶ Enables orchestration of work between different LLM's and tools
- ▶ Example: Powerful LLM plans the work, distributes it so specialized smaller models, and reviews the result to achieve task





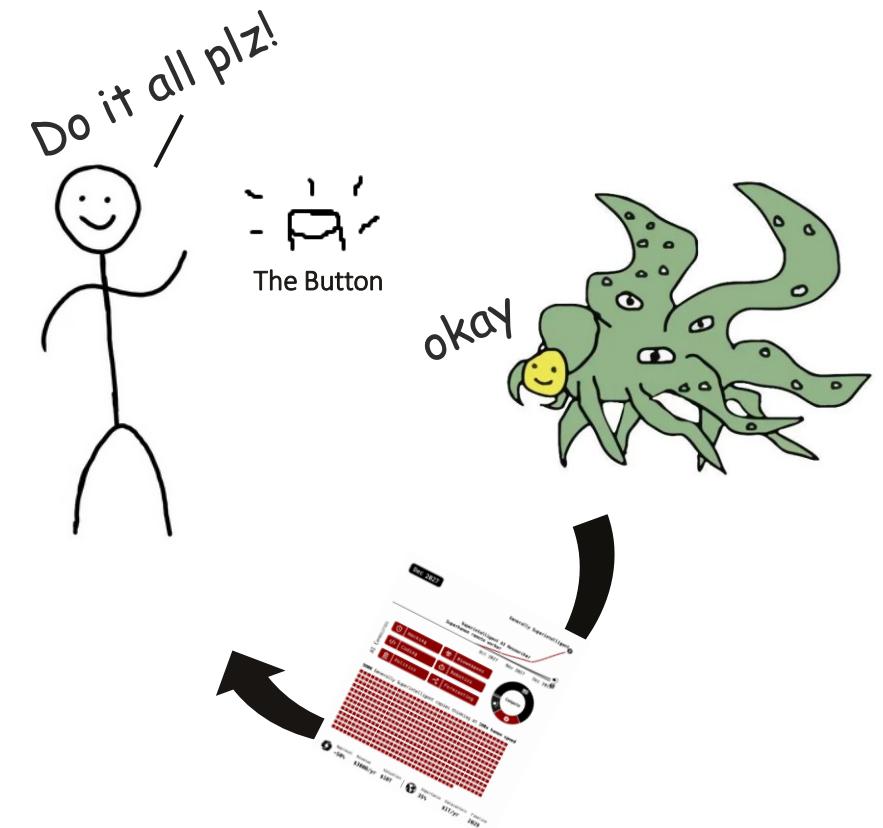
# To local or not to local?

- ▶ Current situation in organizational landscape is almost like “Cloud or Local?”
- ▶ As open-source models improve, organizations can enjoy inhouse-solutions
- ▶ Frontier model orchestrates, small local models do the work?



# Generative AI: “The Button” an issue for the Analyst

- ▶ Easy to outsource own reasoning!
- ▶ If AI designs the analysis, runs the analysis, and then gives a visualization...
- ▶ ...then there is no learning process for the analyst, no critical thinking, and opaque process!



# Generative AI (LLM's) & Data Analysis (recap)

- ▶ Generative AI
- ▶ AI that creates new content based on training patterns
- ▶ Neural nets for generating text responses
- ▶ Models that predict and produce output
- ▶ Natural language understanding and generation
- ▶ Data analysis
- ▶ Systematic examination of data to extract insights
- ▶ Process of cleaning, transforming, and interpreting information
- ▶ Uses statistical methods to identify patterns and relationships
- ▶ Converts raw data into actionable knowledge for decision-making

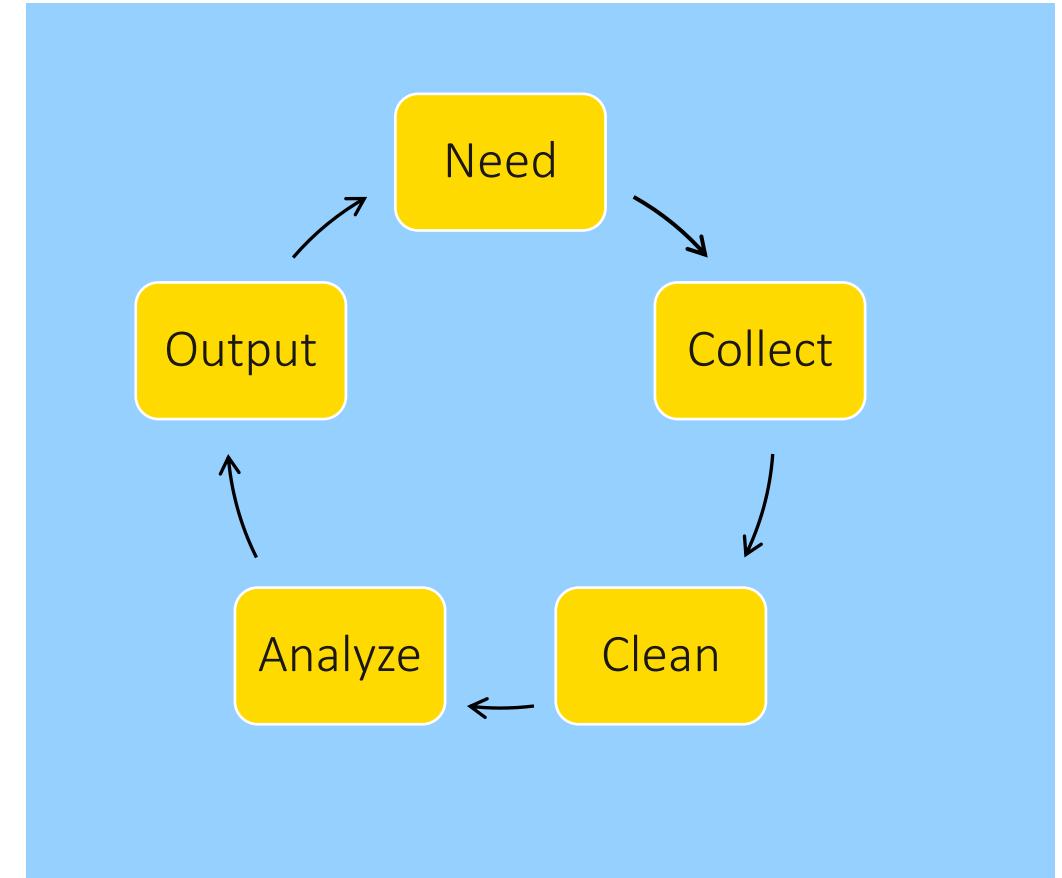
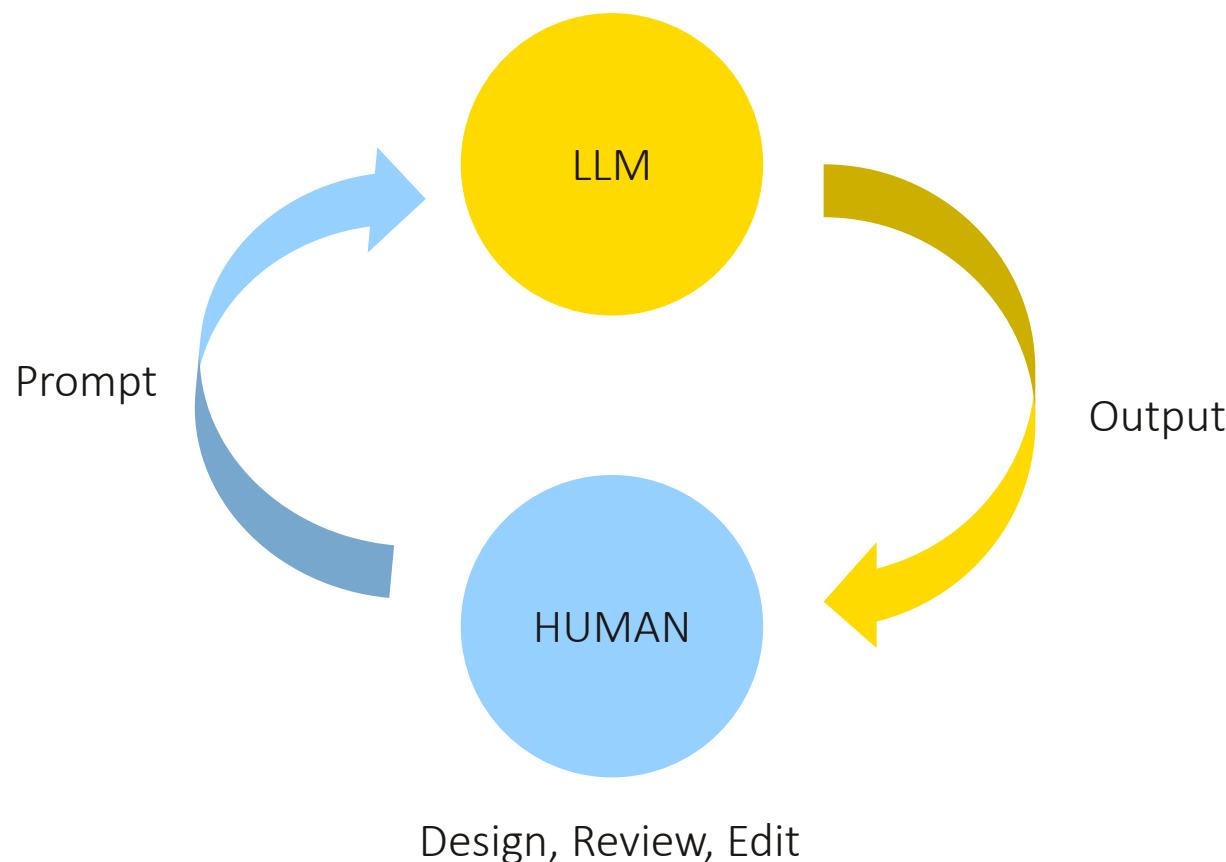
Co-worker

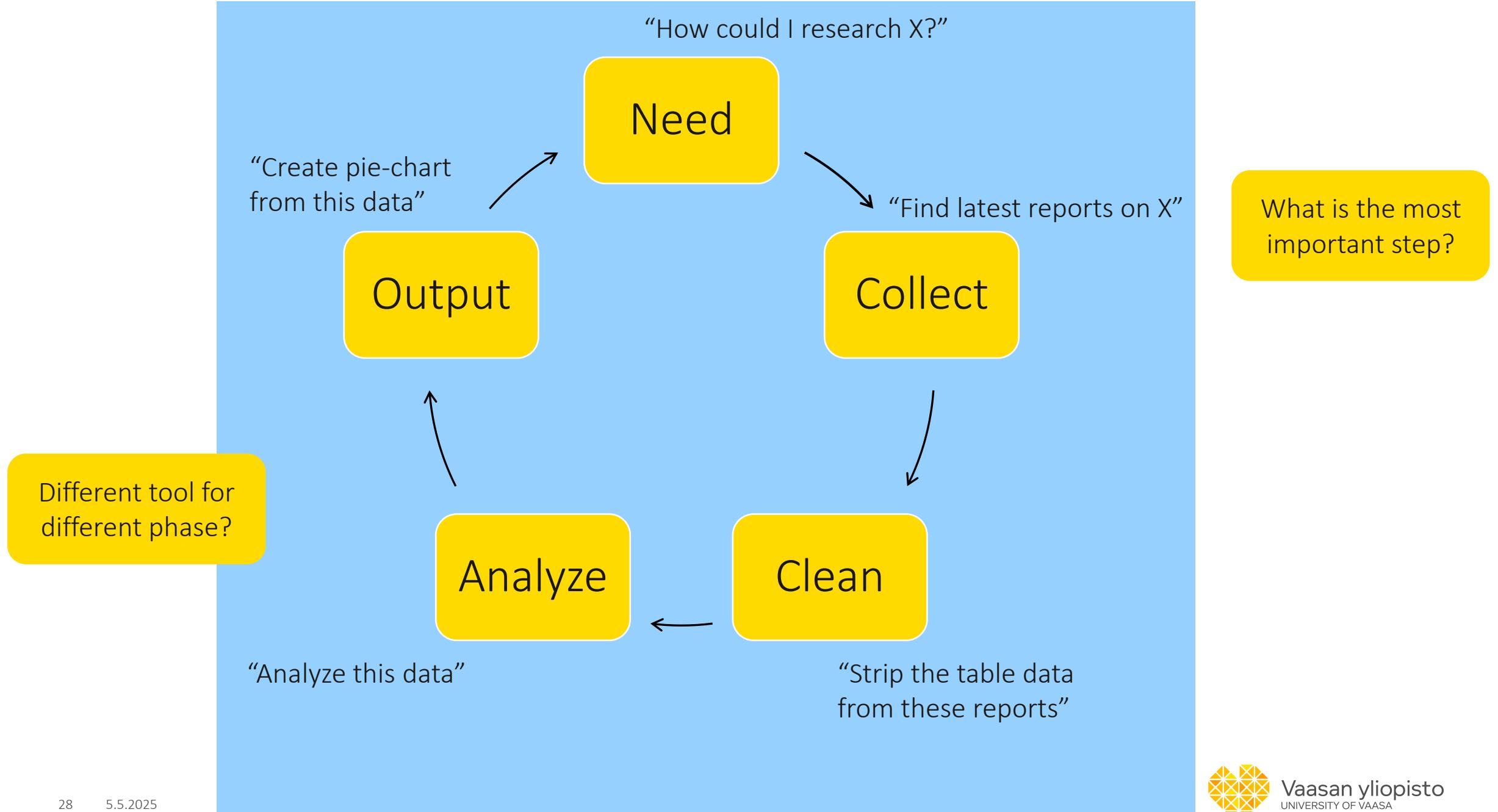
Process

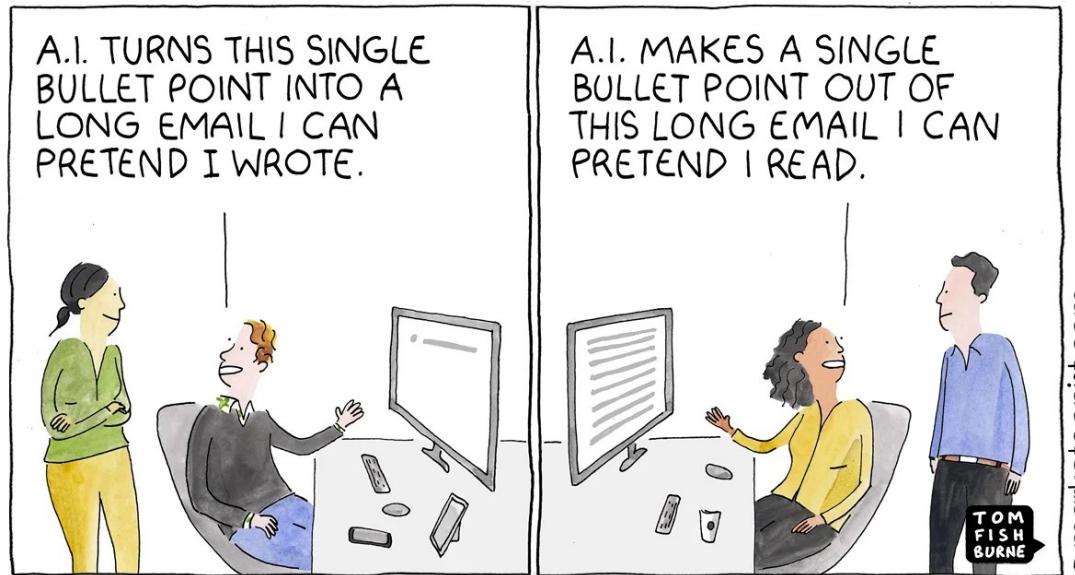


Vaasan yliopisto  
UNIVERSITY OF VAASA

# Generative AI (LLM's) & Data Analysis

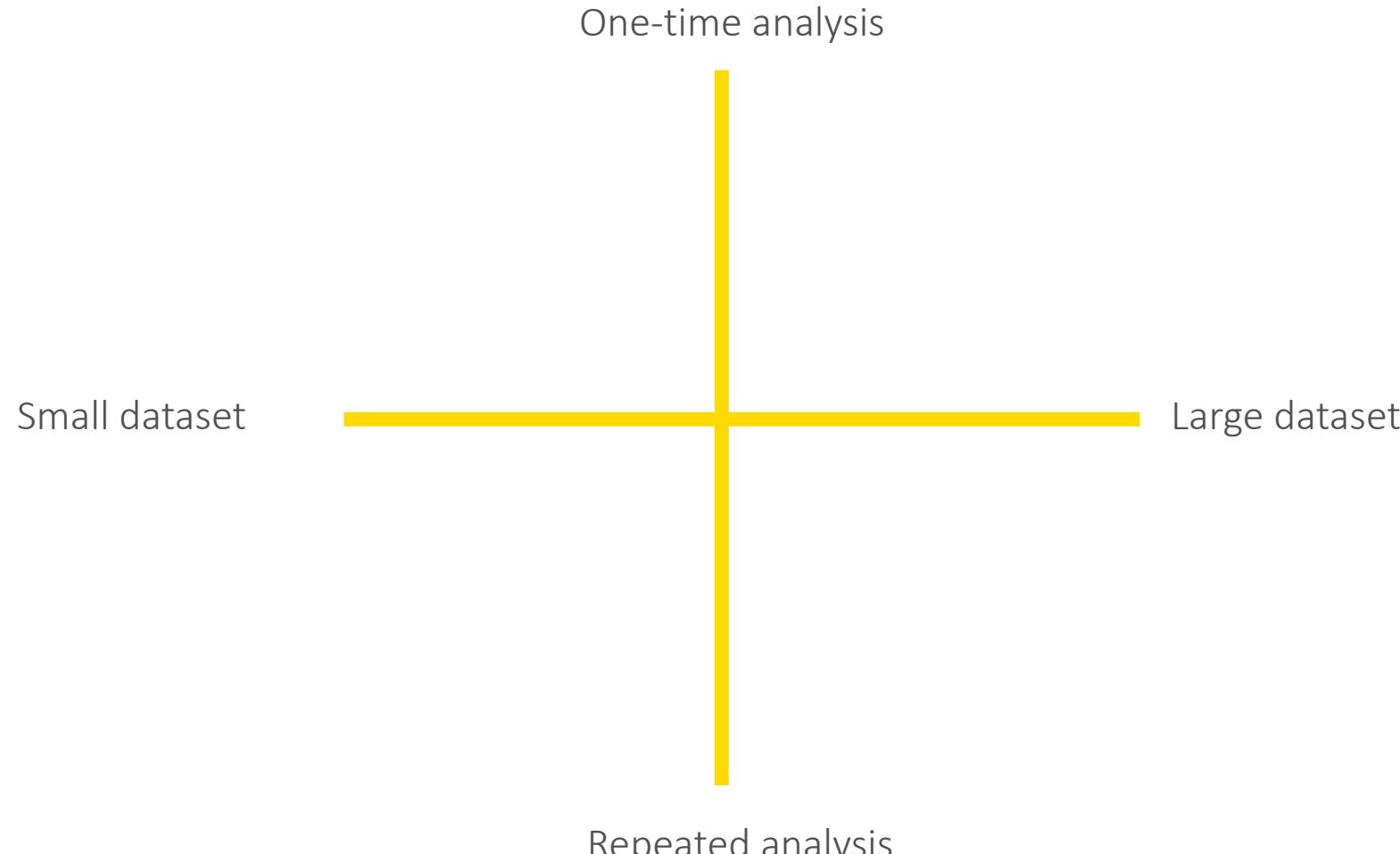




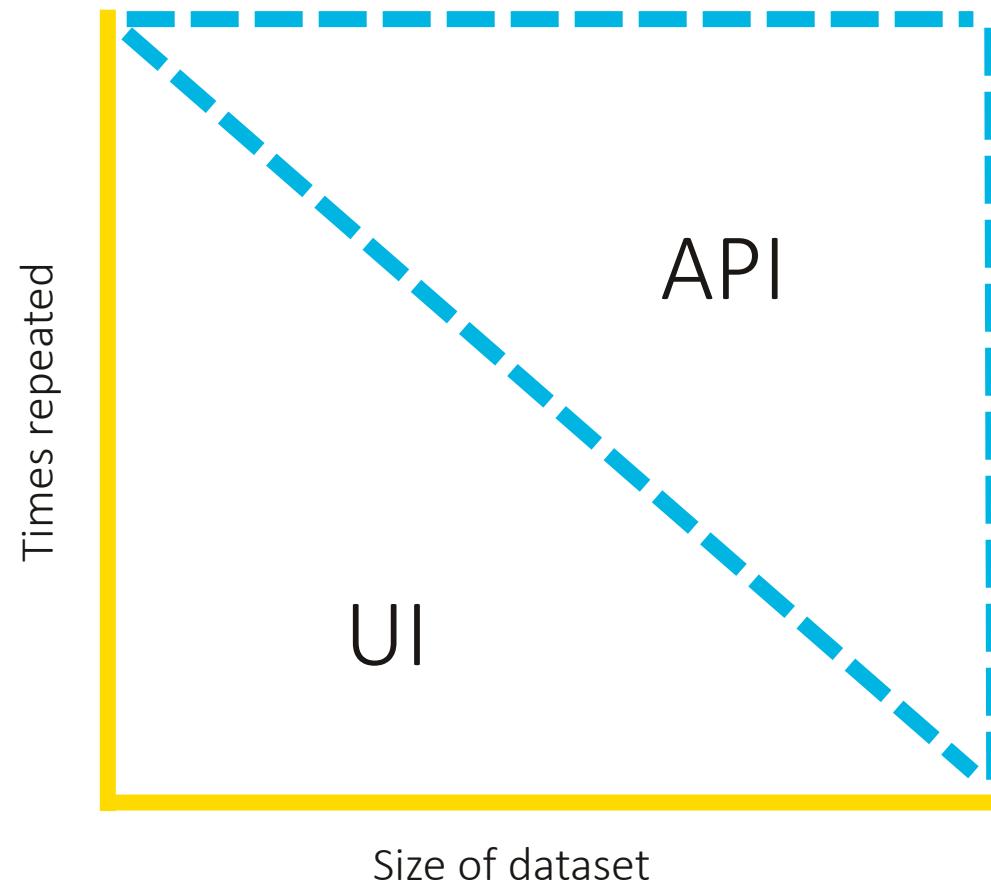


©marktoonist.com

# Generative AI & Data Analysis - API

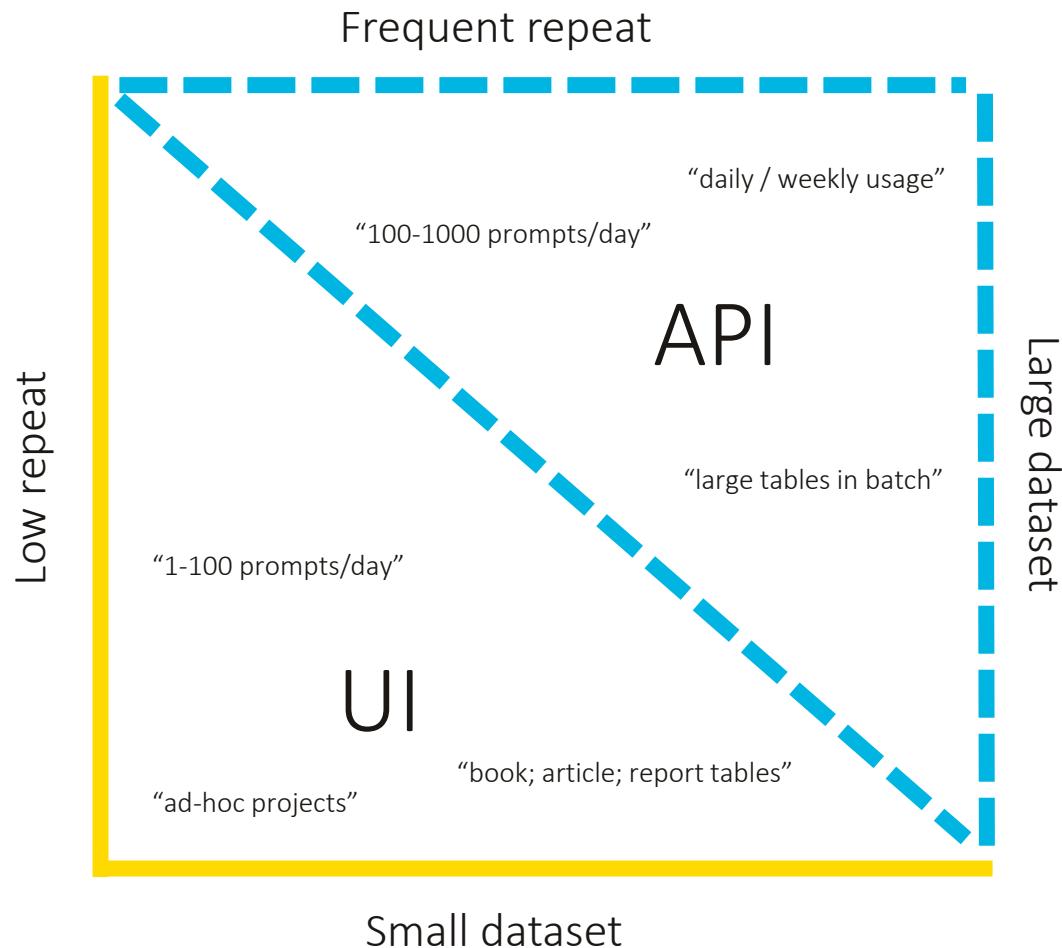


# Generative AI & Data Analysis

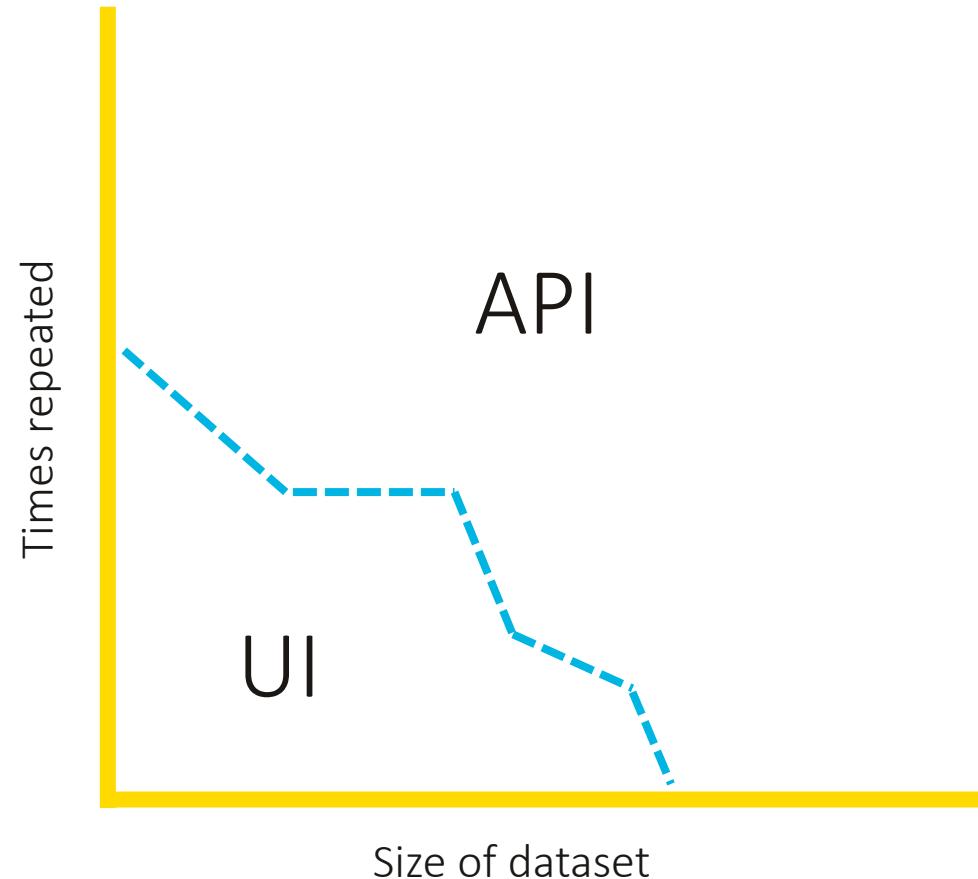


# Generative AI & Data Analysis

- ▶ UI excellent for good individual use
- ▶ i.e., ask to summarize table
- ▶ API better for repeated data extraction for scale
- ▶ i.e., feed 1000x row by row for analysis



# Generative AI & Data Analysis – borders are shady



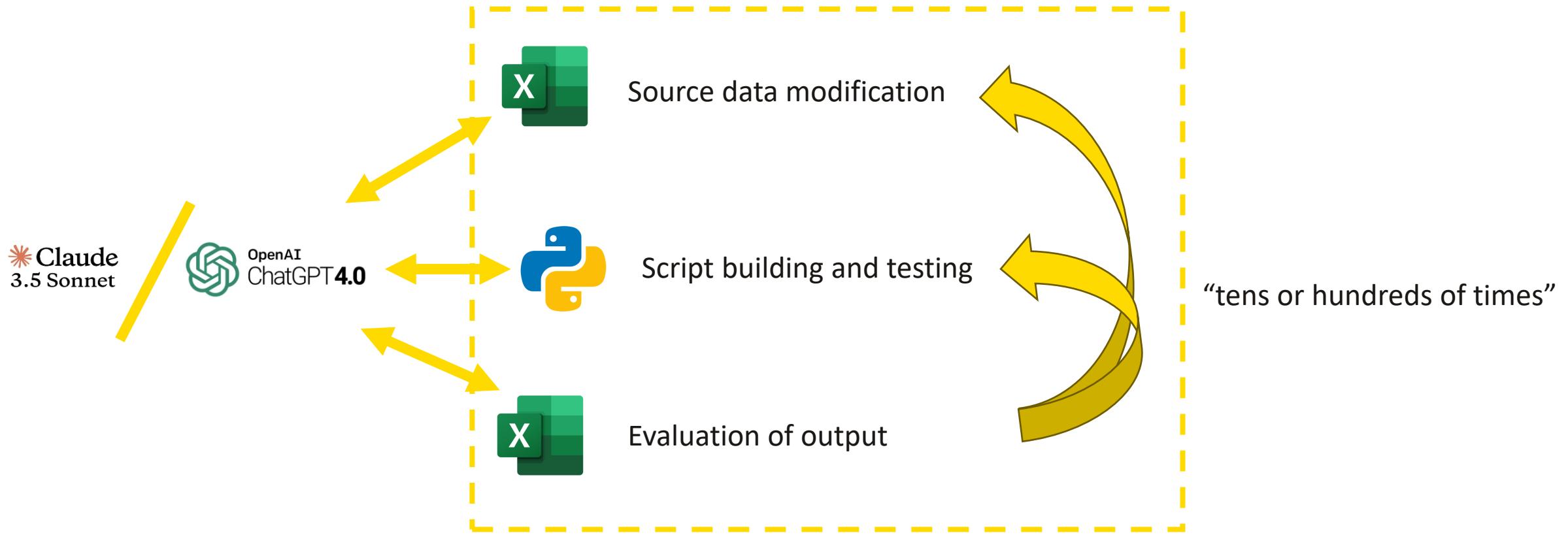
# API Use-case example

- ▶ Data & Statistics specialist
- ▶ Need to analyze extensive project-result data
- ▶ Tens to hundred rows in excel, each cell having hundreds to thousands of words of reports and plans
- ▶ Need: “What did they do?”



imgflip.com

# API – Iterative testing; a lot!



# Pipeline

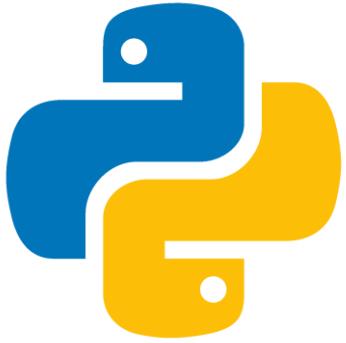




A	B	C	D	E	F	G
1	numero	Hanke	TavoitteetTeksti	ToimintasuunnitelmaTeksti		
2	E/2023	mukaan	lisen	al		
3	E/2023	Hanki	lisä	aiut		
4	E/2023	lisä	lisä	syk		
5	E/2023	uver	uver	ka		
6	L/2023	es	es	u		
7	L/2023	1.1	1.1	u		
8	L/2023	79/2023	V	u		
9	L/2023	26/2023	M	u		
10	L/2023	3/2023	1.1	u		
11	L/2023	9/2023	1.1	u		
12	L/2023	++REDACTED++	1.1	u		
13	L/2023	79/2023	1.1	u		
14	L/2023	26/2023	V	u		
15	L/2023	3/2023	M	u		
16	L/2023	9/2023	1.1	u		
17	L/2023	9/2023	1.1	u		
18	L/2023	1/2023	1.1	u		
19	L/2023	8/2023	1.1	u		
20	L/2023	9/2023	1.1	u		
21	L/2023	5/2023	1.1	u		
22	L/2023	2/2023	1.1	u		
23	L/2023	1/2023	1.1	u		
24	L/2023	1/2023	1.1	u		
25	L/2023	1/2023	1.1	u		
26	L/2023	1/2023	1.1	u		
27	L/2023	1/2023	1.1	u		
28	L/2023	1/2023	1.1	u		

# Pipeline





```
149     """
150     messages = [
151         {"role": "user", "content": human_prompt}
152     ]
153     try:
154         response = client.messages.create(
155             model="claude-3-5-sonnet-20240620",
156             system=system_prompt,
157             messages=messages,
158             max_tokens=max_tokens
159         )
160         # Assuming the 'response' structure is a Message object with a 'content' list of ContentBlocks
161         if response and response.content and isinstance(response.content, list):
162             # Concatenate the text from all content blocks (assuming there's at least one and it has a 'text' attribute)
163             full_text = "".join([block.text for block in response.content if hasattr(block, 'text')])
164             return full_text.strip()
165         else:
166             print(f"Unexpected API response format: {response}")
167             return None
168     except Exception as e:
169         print(f"Error in API response: {e}")
170     return None
171
172 # process_excel_row function:
173 def process_excel_row(text):
174     api_response = query_claude_api(text)
175     if not api_response:
176         return [0] * len(target_categories), "No response from API"
177
178     # Initialize results and explanation
179     results = [0] * len(target_categories)
180     explanation = ""
181
182     # Try to find the explanation and categorization sections
183     explanation_start = api_response.find("Selitys:")
184     categorization_start = api_response.find("Kategoriat:")
185
186     if explanation_start != -1 and categorization_start != -1:
187         # Extract explanation
188         explanation = api_response[explanation_start + 8:categorization_start].strip()
189
190         # Extract categorization
191         categorization_part = api_response[categorization_start + 11:].strip()
192
```

PROBLEMS ③ OUTPUT DEBUG CONSOLE TERMINAL PORTS COMMENTS

(pdf-analysis) PS C:\Users\juhan\Sync\1 Projects\VisualStudioCode\05 JAMK AI Marianne> python jamkmarianne1.1.py



# Pipeline



# Claude

## 3.5 Sonnet

```
def query_claude_api(tavoitteet, lopputulokset, max_tokens=4000):
    system_prompt = "Olet liikunta-hankkeisiin erikoistunut data-analyytikko. Tehtäväsi on analysoida hankkeiden tavoitteita ja lopputuloksia."
    human_prompt = f"""
Analysoi seuraavan hankkeen tavoitteita ja lopputuloksia. Kategorisoi tavoitteiden saavuttaminen yhteen seuraavista kategorioista: Kokonaan, Osittain, Ei ollenkaan.

Tavoitteet:
{tavoitteet}

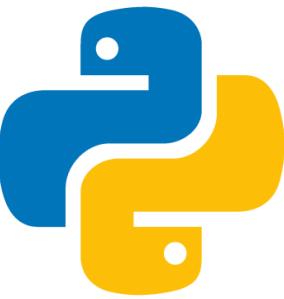
Lopputulokset:
{lopputulokset}

Anna vastauksesi seuraavassa muodossa:
Kategoria: [valittu kategoria]
Perustelu: [lyhyt perustelu valinnalle]
"""

    """
```

# Pipeline





```
# process_excel_row function:
def process_excel_row(text):
    api_response = query_claude_api(text)
    if not api_response:
        return [0] * len(target_categories), "No response from API"

    # Initialize results and explanation
    results = [0] * len(target_categories)
    explanation = ""

    # Try to find the explanation and categorization sections
    explanation_start = api_response.find("Selitys:")
    categorization_start = api_response.find("Kategoriat:")

    if explanation_start != -1 and categorization_start != -1:
        # Extract explanation
        explanation = api_response[explanation_start + 8:categorization_start].strip()

        # Extract categorization
        categorization_part = api_response[categorization_start + 11:].strip()

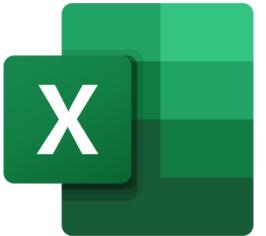
        # Process each category
        for i, category in enumerate(target_categories):
            # Look for exact category match followed by ': 1'
            if re.search(rf"\b{re.escape(category)}\s*:\s*1\b", categorization_part, re.IGNORECASE):
                results[i] = 1
    else:
        # If we can't find the expected sections, try to extract any useful information
        explanation = "Error: Could not parse response structure. Raw response: " + api_response[:200] + "..."

    # Log the results for debugging
    logging.info(f"Parsed results: {results}")
    logging.info(f"Explanation snippet: {explanation[:100]}...")

    return results, explanation
```

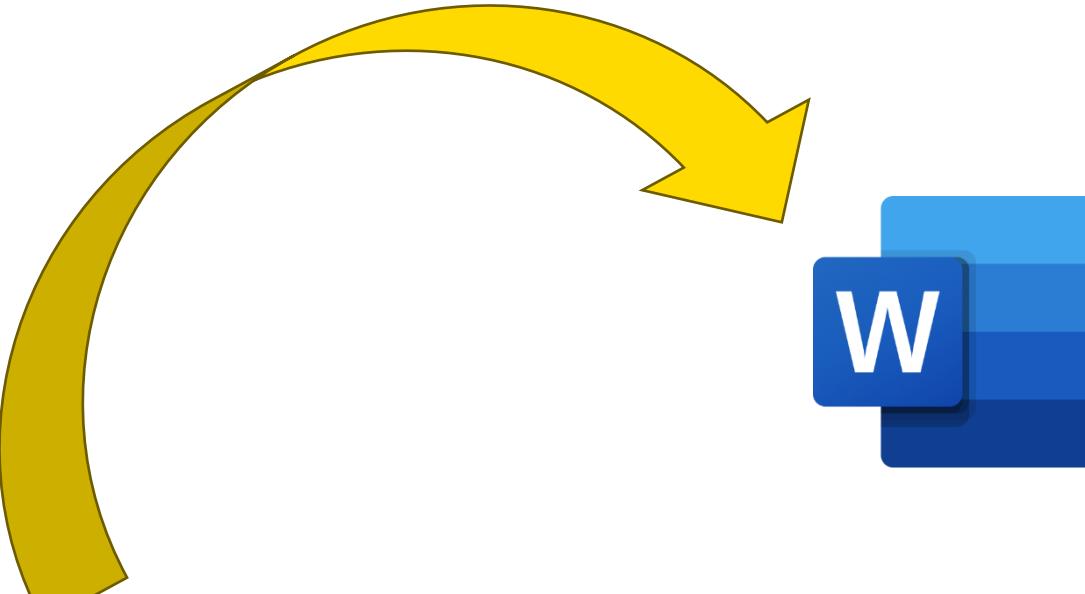
# Pipeline





1	Identifier	Identifier	Explanatio	Liikkumis	Hyvinvoin	Yksinäisy	Yhteisöll	Perheider	Yhteistyö	Toiminta-	Osallisuut	Toiminnan	Koordinat	Kävelyn ja	Sukupuolt	Soveltava	Tiedonker	Kampanjo	Kartoituk	Kirjaamin	Koulutus	j Kunto-	Liiku	
2	I/1/1	KAMU - k	Liikkumis	1	1	0	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0
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4		Liikkumis		1	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0
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11		Liikkumis		1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0
12	+REDACTED++	Liikkumis		1	1	0	1	1	1	0	1	1	1	1	0	1	0	1	1	0	0	1	1	0
13		Liikkumis		1	0	0	1	1	1	0	0	0	1	1	0	0	0	0	1	1	1	1	1	0
14		Liikkumis		1	1	0	0	1	1	0	0	0	1	0	0	1	1	1	0	1	0	0	1	0
15		Liikkumis		1	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0
16		Liikkumis		1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
17		Liikkumis		1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
18		Liikkumis		1	0	0	0	1	1	0	0	1	1	1	0	1	1	0	1	0	1	1	1	0
19		Liikkumis		1	1	0	1	1	1	0	0	1	1	1	0	1	0	1	1	0	0	0	1	0
20		Liikkumis		1	1	0	0	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1
21		Liikkumis		1	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0	1	1	0
22		Liikkumis		1	0	0	0	0	1	1	0	1	1	1	0	1	1	1	1	1	0	1	1	0
23		Liikkumis		1	0	0	1	1	1	0	1	1	1	1	0	0	0	0	1	1	0	1	1	0
24		Liikkumis		1	1	0	0	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	1	0
25		Liikkumis		1	1	0	0	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	0
26		Liikkumis		1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
27		Liikkumis		1	0	0	1	0	1	0	1	1	1	0	0	1	0	0	0	0	0	1	1	0
28		Liikkumis		1	1	0	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0





A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AI	AK	AI
1	Identifier	Identifi	lannat	Likumis	Hyvinvoin	Yksinäis	Yhteisöll	Perheide	Yhteisyst	Toiminta-	Osallisu	Toiminnar	Koordinat	Kävelyn	Sukupuo	Soveltavu	Tiedonka	Kampaus	Kartoituk	Kirjaamini	Koulutus	Kunto- ja	Likuntan	Luonto- ja	Matalan	Osallistar	Tapahtur	Työkaluje	Työntekij	Vertaisista	Viestinnä	Vuostell	Välaineide	Ympäristi	Nykytilan	Motoristen	talotien
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Toiminnan vakiinnuttaminen: 1

Toiminnan vakiinnuttaminen näkyy esimerkiksi lauseessa: "Lasten liikkumisen asiantuntija koordinoi, kehittää ja arvioi Liikkuva varhaiskasvatus toimintaa yhteistyössä ohjausryhmän ja muuverkostojen kanssa."

Koordinointi vahvistaminen: 1

Koordinointi vahvistaminen on selkeästi esillä: "Kuntakoordinaatio" -osio kuvailee useita koordinointia vahvistamiseen liittyviä toimenpiteitä.

Kävelyn ja pyöräilyn edistäminen: 0

Tekstissä ei suoraan mainita kävelyn tai pyöräilyn edistämistä.

Sukupuolten tasa-arvon ja yhdenvertaisuuden edistäminen: 1

Yhdenvertaisuus mainitaan: "Huomioidaan perheiden moninaisuus, jotta kaikilla lapsilla ja perheillä on yhdenvertaiset mahdollisuudet osallistua."

Soveltavan liikunnan järjestäminen: 1

Vaikka termiä "soveltava liikunta" ei käytetä, tekstissä mainitaan: "Huomioidaan kaikessa toiminnassa erityisesti liikkumattomat, vähän liikkuvat ja vetätyyväät lapset sekä lapset, joilla on erityistarpeita."

Tiedonkeruu ja arvioinnin kehittäminen: 1

Arvionti mainitaan: "Kaikissa yksiköissä tehdään Nykytilan arviointia ja toimintaa kehitetään pienenten askelten menetelmällä."

Kampanjoiden ja haasteiden toteuttaminen: 1

Tekstissä mainitaan: "Suunnitellaan ja toteutetaan paikallisia kampanjoita lapsiperheiden aktivoimiseksi sekä kannustetaan perheitä osallistumaan valtakunnallisiin liikkumiskampanjoihin."

Kartoitukset ja selvitykset toimenpiteenä: 1

Tekstissä mainitaan: "Kevällä kartoitus ja syksyllä hankinnat" liikuntavälineiden ja digimateriaalien osalta.

Kirjaaminen ja sunnitelmien laadinta: 1

Sunnitelmien laadinta mainitaan: "Luodaan varhaiskasvatuksen liikkumisen vuosikello johtamisen ja arjen toteutuksen tueksi."

Koulutus ja osaamisen lisääminen: 1

Koulutus on vahvasti esillä: "Järjestetään sisäisiä ja eri yhteistyötoihojen järjestämiä koulutuksia henkilöstölle."

Kunto- ja hyvinvointimittaukset: 0

Tekstissä ei mainita kunto- tai hyvinvointimittauksia.

Liikuntaneuvonnan palvelupolun kehittäminen: 0

Tekstissä ei mainita liikuntaneuvonnan palvelupolun kehittämistä.

Liikuntaneuvonnan tarjoaminen: 1

Liikuntaneuvonta mainitaan: "Yksikkökohtainen sparraus ja toimintaympäristöjen muokkaaminen lapsia ja henkilöstöä osallistuksen, lasten liikkumisen asiantuntija, liikuntaneuvojat."

Merilehto, Juhani

Vuosikello on myös "Vuosikello" kohdassa. On ohjeistettu että käyttäisi yhtä per kategoria mutta..

Reply



# Generative AI & Data Analysis

- ▶ When are the results “good enough?”
- ▶ Does AI need to outperform human?
- ▶ How can we trust the results?
- ▶ -> same issues that human agents have



# Generative AI & Data Analysis



- ▶ Quantitative data “easy” to check (i.e., count)
- ▶ Qualitative data hard to check (i.e., interpret meaning)

# Recap!

- ▶ Large data that needs to run in batches: API
- ▶ Repeating a task: API
- ▶ Data that can be fed easily: UI
- ▶ Unique or moderately repeated tasks: UI

Pro tip: Learn how to use Python scripts with LLM API

# Still awake?



# Resources

- ▶ My personal experiences (as of 05/2025):
- ▶ Best for coding: **Claude 3.7 Sonnet**
- ▶ Best as “general tool”: **Claude 3.7 Sonnet**
- ▶ Great for “big task + research”: ChatGPT-3o / Gemini 2.5 Pro (both with deep research)
- ▶ Great for “bullet-list info”: **ChatGPT-4o**
- ▶ Special award: **Grok 3** (Low censorship enables i.e., hacking discussion better)
- ▶ Mistral: <https://chat.mistral.ai/>
- ▶ Gemini: <https://gemini.google.com/>
- ▶ Claude: <https://claude.ai/>
- ▶ ChatGPT: <https://chatgpt.com>
- ▶ DeepSeek: <http://chat.deepseek.com/>
- ▶ Grok: <https://www.grok.com> (or use X / Twitter)

# Quick list of analysis techniques

Technique	Purpose	Data Type
Descriptive Statistics	Summarize data features (mean, median, mode, etc.)	Quantitative
Inferential Statistics	Make predictions or generalizations about a population	Quantitative
Thematic Analysis	Identify patterns or themes in text	Qualitative
Content Analysis	Quantify occurrences of themes or words	Qualitative / Mixed
Regression Analysis	Explore relationships between variables	Quantitative
Correlation Analysis	Measure association between variables	Quantitative
ANOVA	Compare means across multiple groups	Quantitative
Grounded Theory	Generate theory from systematically collected data	Qualitative
Narrative Analysis	Interpret stories and personal accounts	Qualitative
Factor Analysis	Reduce data by identifying latent variables	Quantitative
Cluster Analysis	Group similar observations	Quantitative
Discourse Analysis	Examine language use in context	Qualitative
SWOT Analysis	Identify strengths, weaknesses, opportunities, threats	Qualitative / Mixed
Sentiment Analysis	Detect emotions or opinions in text	Qualitative / Mixed
Time Series Analysis	Analyze trends over time	Quantitative
Chi-Square Test	Test relationships between categorical variables	Quantitative



# Thank you.

Juhani Merilehto

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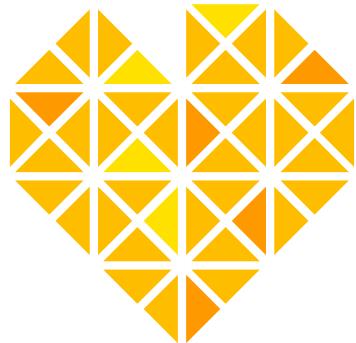
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