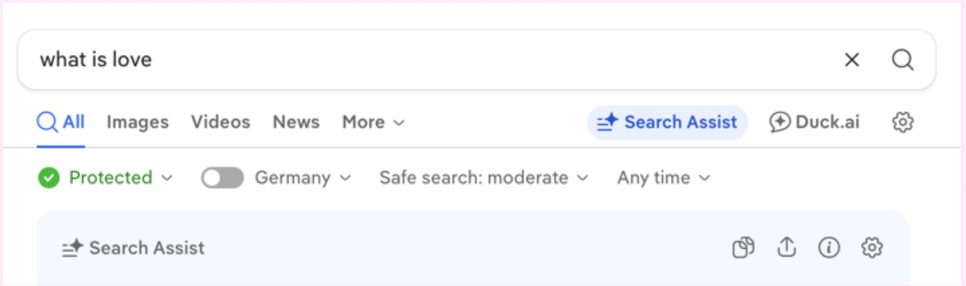
A Hammer is all you need

How AI solves problems

~~Yoshie~~ Reusch — Jan 2026

👋 hi!

- fp enthusiast and web dev for half my life
- Open Source maintainer
- Conference speaker
- AI & Data Science graduate @ OTH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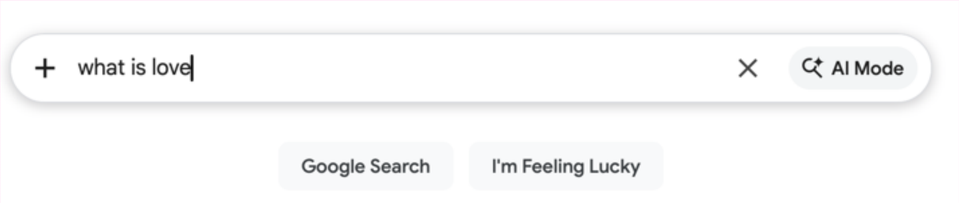
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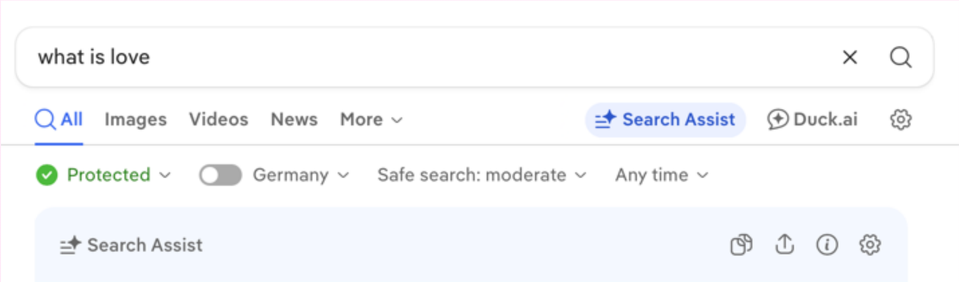
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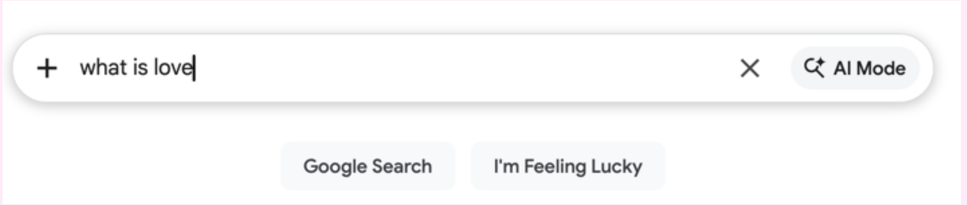
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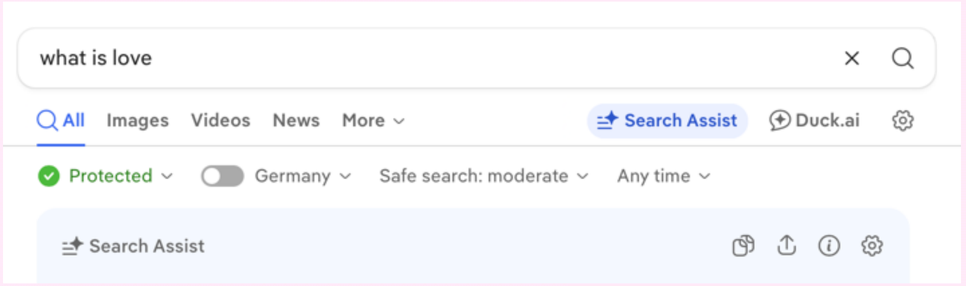
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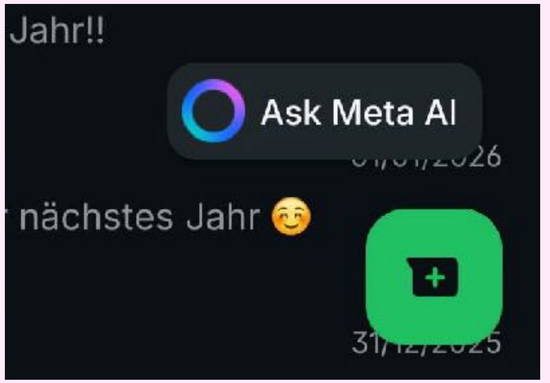
Jahr!!
Ask Meta AI
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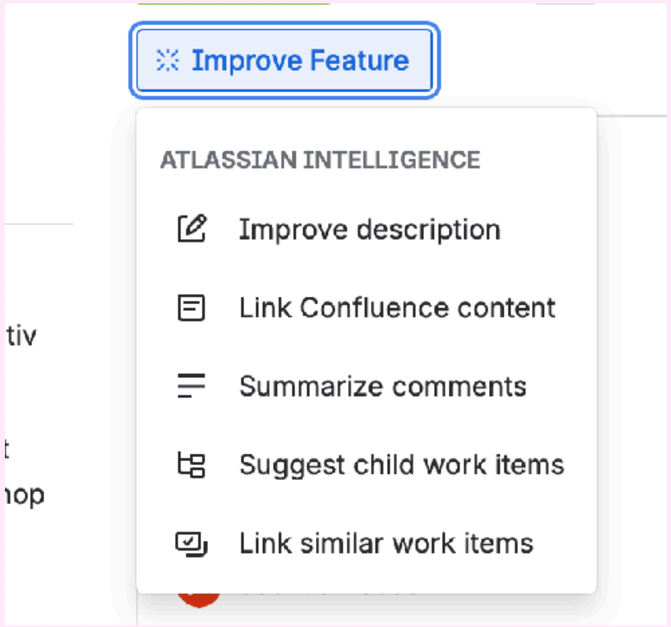
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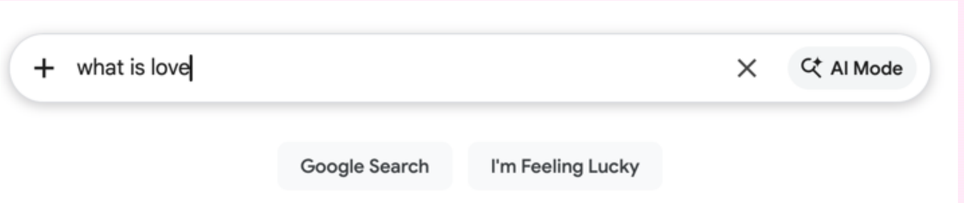
Summarize comments
Suggest child work items
Link similar work items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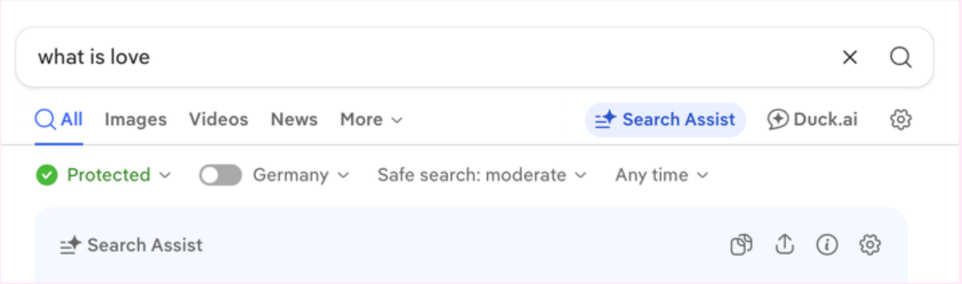
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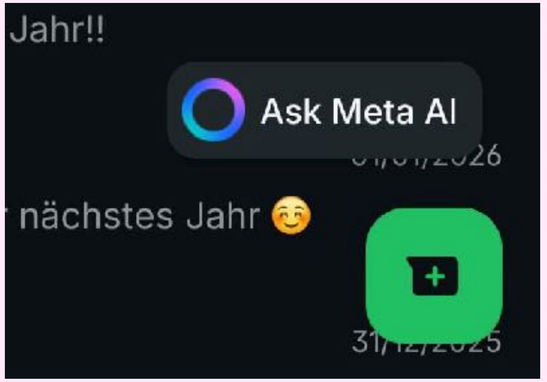
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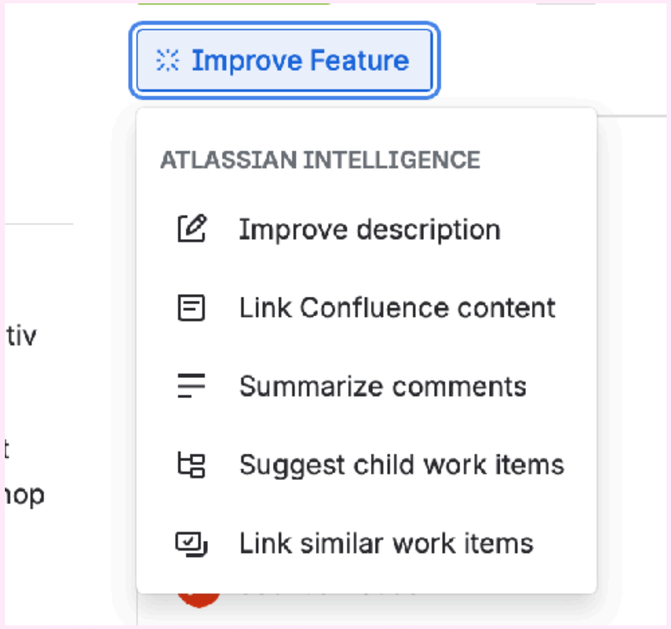
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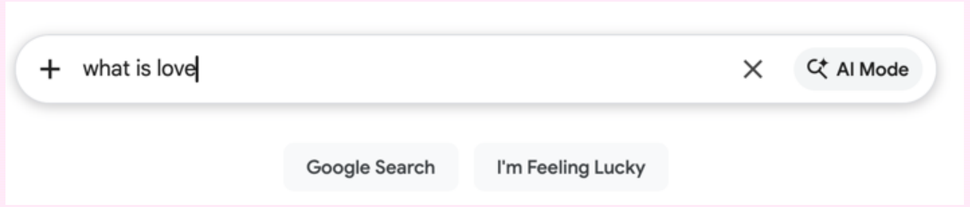
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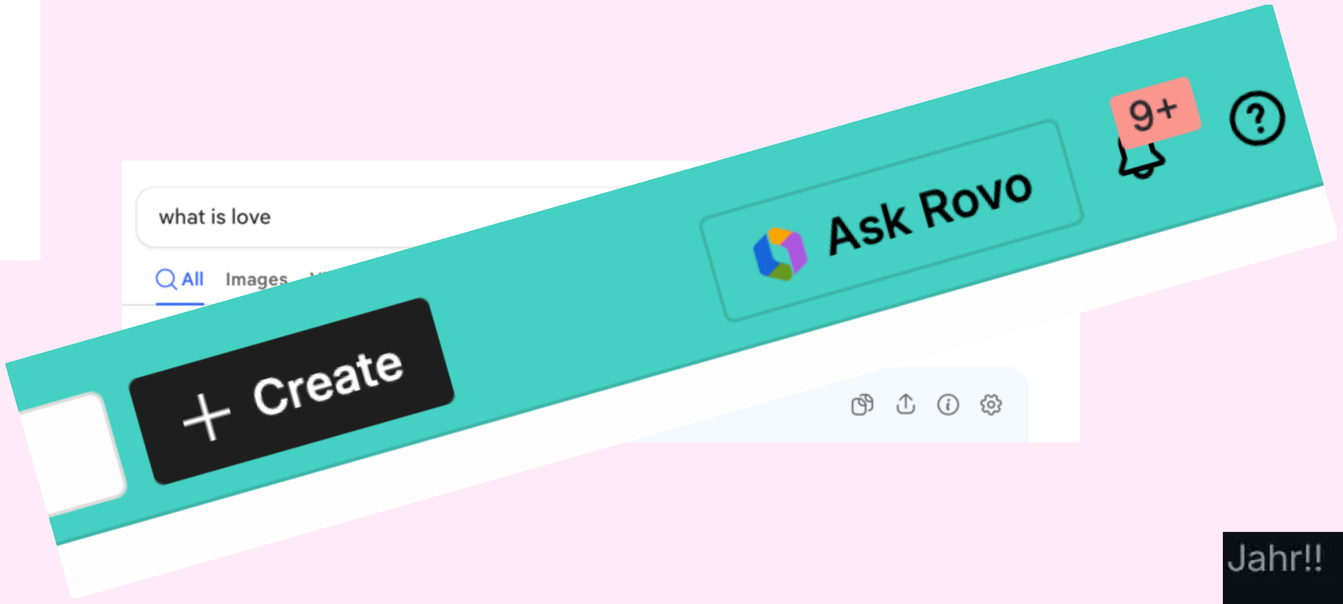
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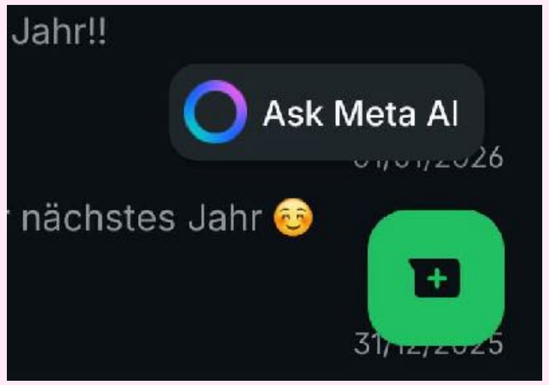
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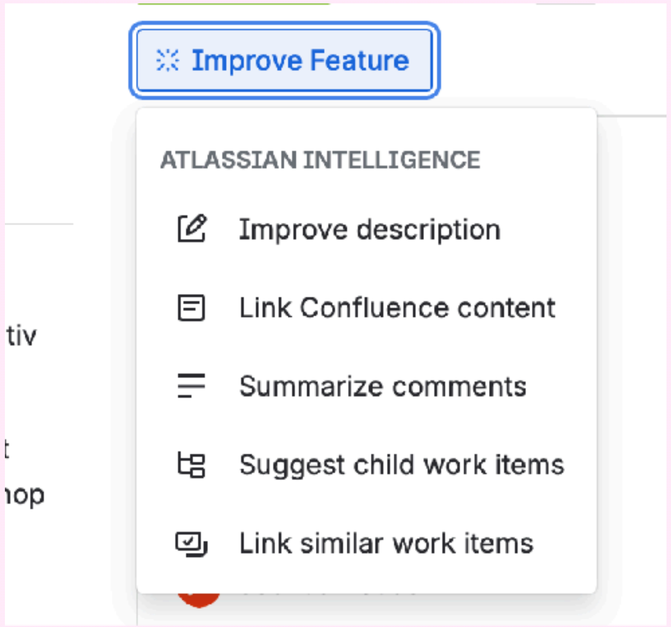
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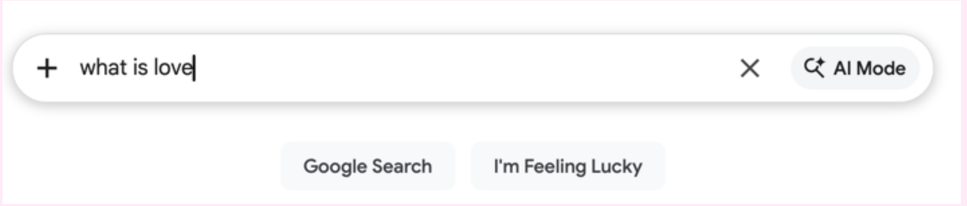
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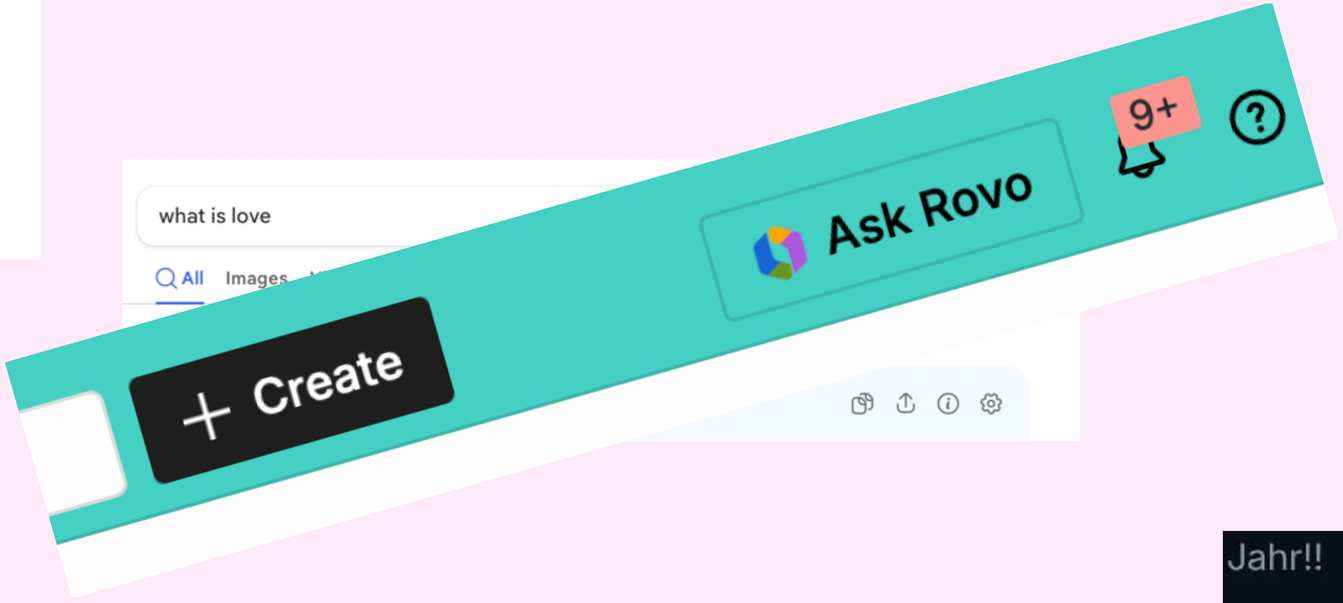
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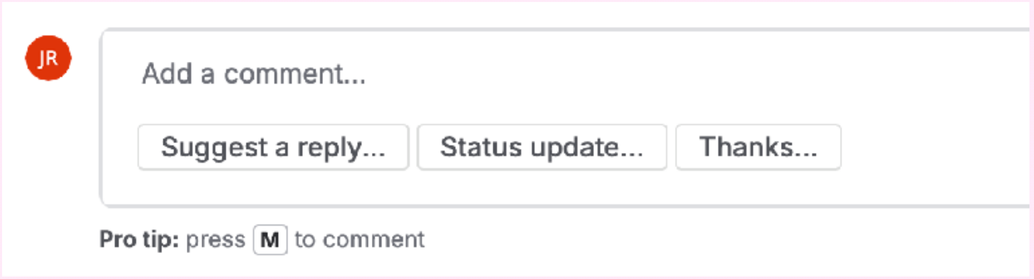
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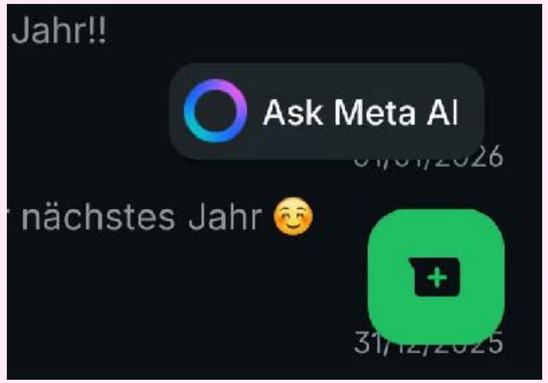
Suggest a reply...
Status update...
Thanks...
Pro tip: press M to comment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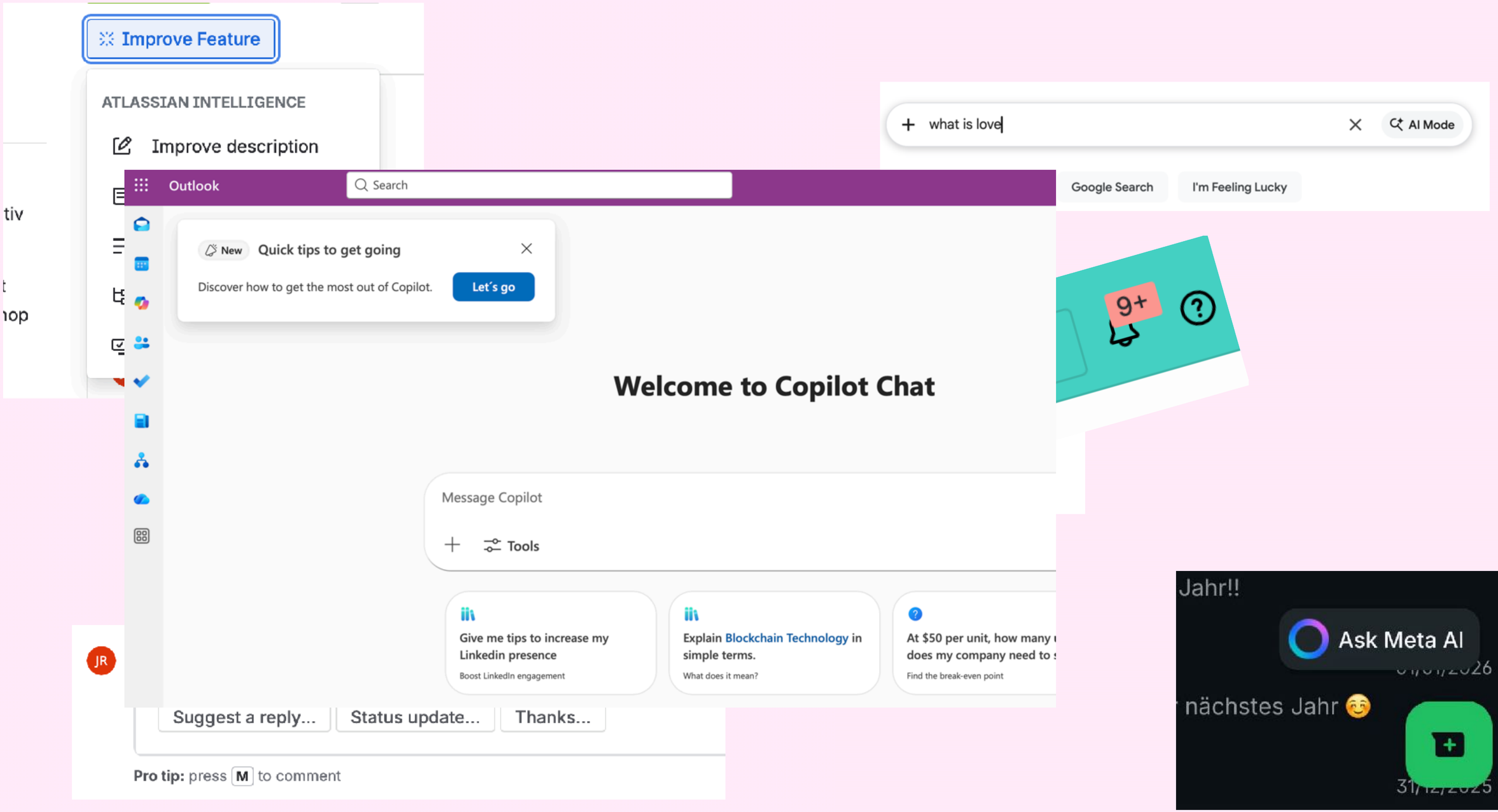
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Quick tips to get going
Discover how to get the most out of Copilot.
Let's go
9+
Welcome to Copilot Chat
Message Copilot
Tools
Give me tips to increase my Linkedin presence
Boost LinkedIn engagement
Explain Blockchain Technology in simple terms.
What does it mean?
At $50 per unit, how many
does my company need to
Find the break-even point
JR
Suggest a reply...
Status update...
Thanks...
Pro tip: press M to comment
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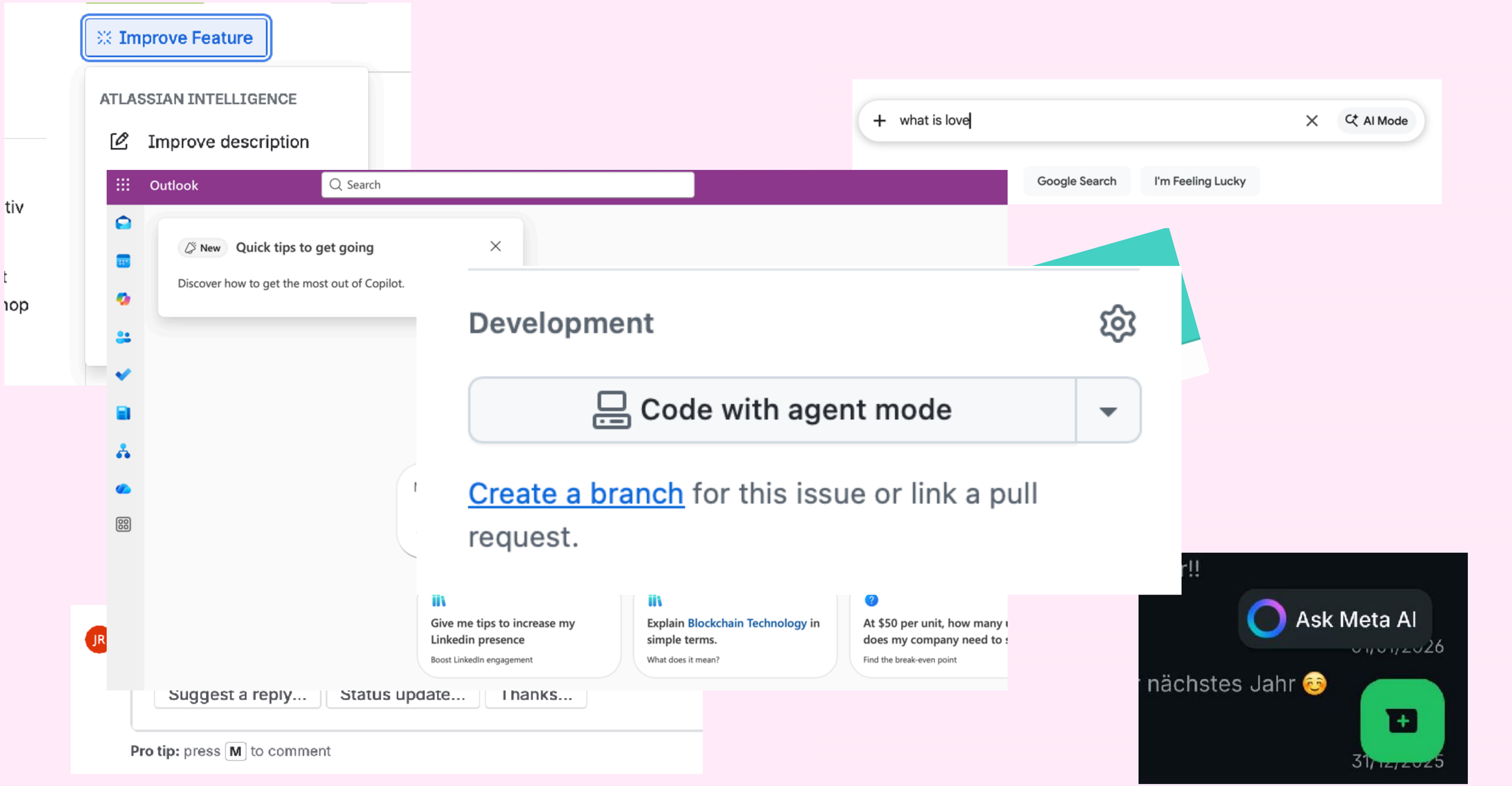
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Development
Code with agent mode
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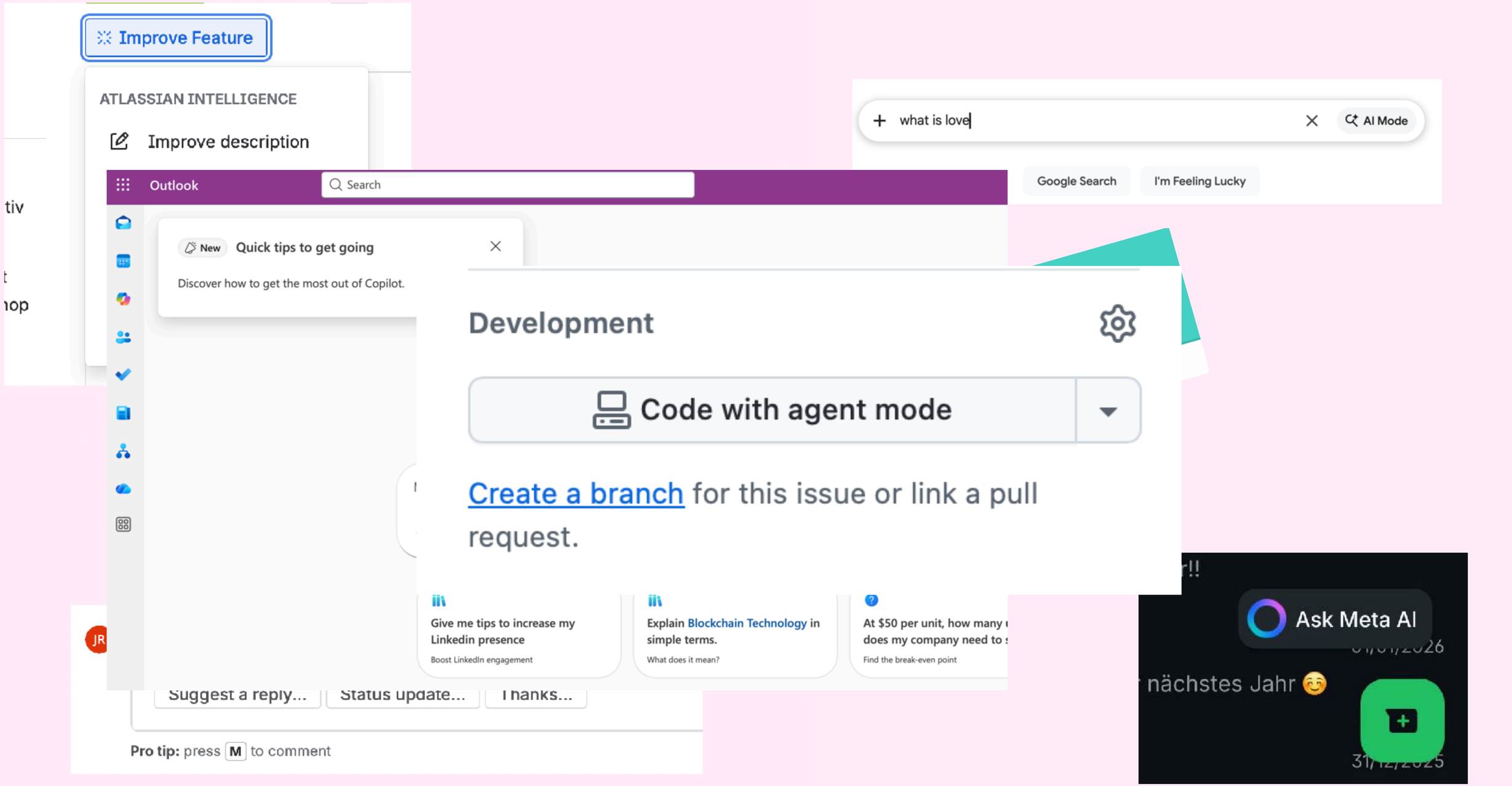
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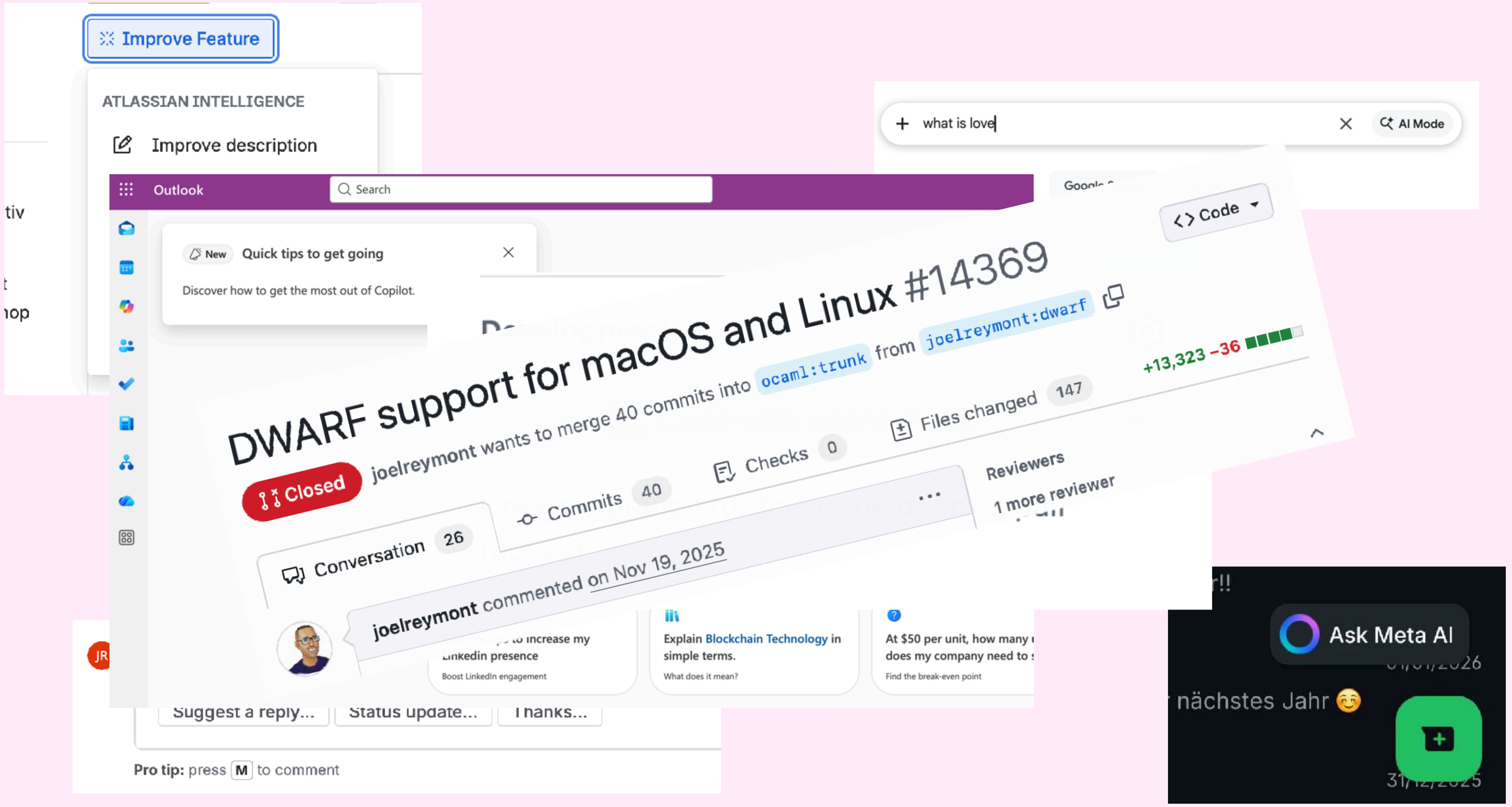
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New
Quick tips to get going
Discover how to get the most out of Copilot.
Code
DWARF support for macOS and Linux #14369
Closed
joelreymont wants to merge 40 commits into ocaml:trunk from joelreymont:dwarf
+13,323 −36
Conversation 26
Commits 40
Checks 0
Files changed 147
Reviewers
1 more reviewer
joelreymont commented on Nov 19, 2025
Explain Blockchain Technology in simple terms.
What does it mean?
Find the break-even point
Suggest a reply...
Status update...
Thanks...
Pro tip: press M to comment
Ask Meta AI
nächstes Jahr

Improve Feature

Wegen KI: Laut Prognose bis 2030 über 210.000 Jobs bei Europas Banken in Gefahr

In den nächsten fünf Jahren könnten in Europas Bankensektor 10 Prozent der Stellen wegfallen – dank KI und Onlinebanking. Das prognostiziert Morgan Stanley.

13

what is love

AI Mode

Code

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ocaml:trunk from joelreymont:dwarf

+13,323 −36

Files changed 147

necks 0

Reviewers

1 more reviewer

Closed

Conversation 26

Commits 40

joelreymont commented on Nov 19, 2025

Explain Blockchain Technology in simple terms.

What does it mean?

Find the break-even point

Suggest a reply...

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Thanks...

Pro tip: press M to comment

Ask Meta AI

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Conversation 26

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joelreymont commented on Nov 19, 2025

Explain Blockchain Te simple terms.

What does it mean?

Suggest a reply... Status update... Thanks...

Pro tip: press M to comment

what is love

AI Mode

Code

linux #14369

KI-Bilder statt Modefotografie

Nach Zalando und H&M kündigt nun auch die Fast-Fashion-Marke Zara an, anstelle von Fotoshootings KI-generierte Bilder mit digitalen Klonen der Models zu nutzen.

53

Improve Feature

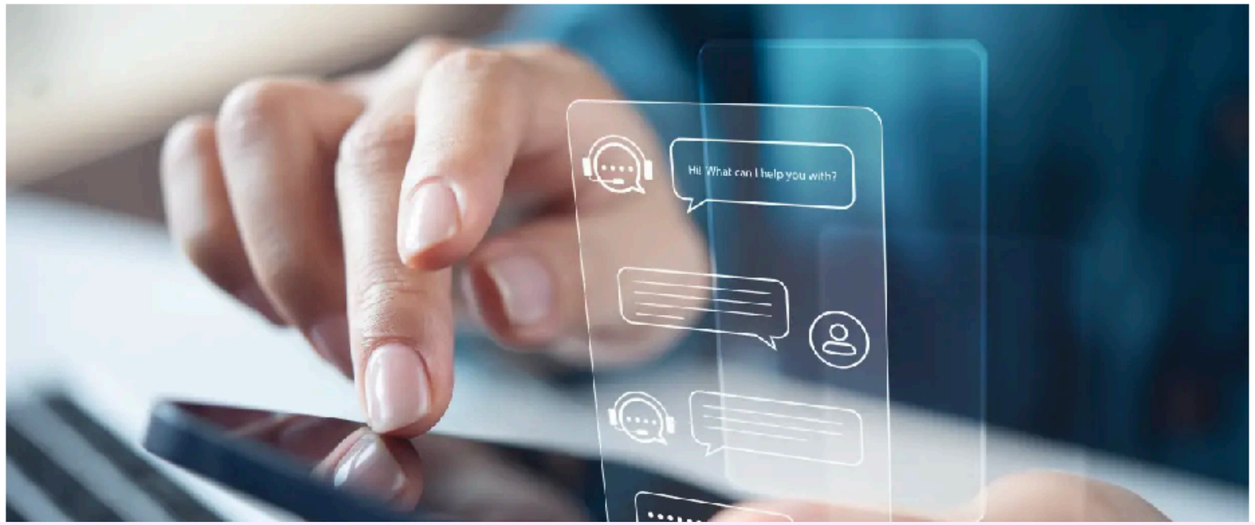
Wegen KI: Laut Prognose bis 2030 über 210.000 Jobs bei Europas Banken in Gefahr

heise online > Künstliche Intelligenz > Falschinformation durch KI: 45 Prozent der Antworten fehlerhaft

Falschinformation durch KI: 45 Prozent der Antworten fehlerhaft

Im Rahmen einer Studie interpretierten ChatGPT & Co. in 45 Prozent der Fälle Nachrichteninhalte fehlerhaft – unabhängig von Sprache, Region oder Plattform.

218



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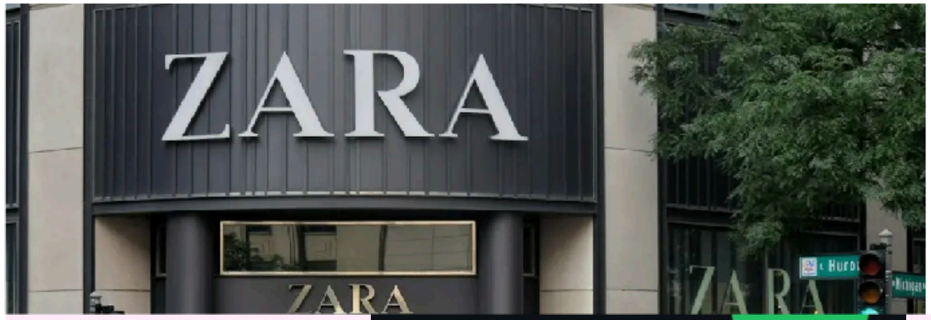

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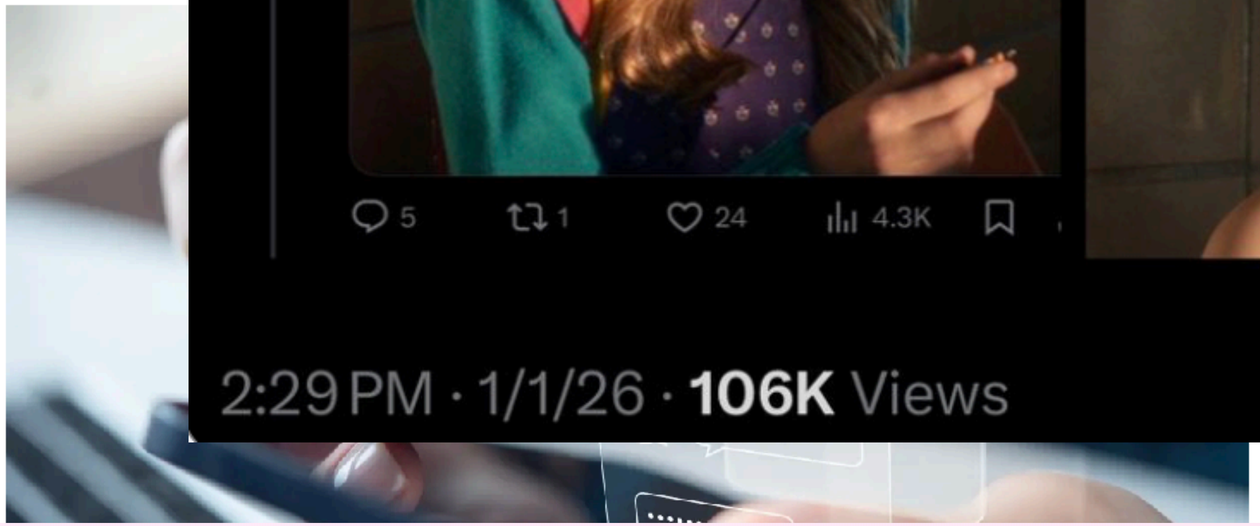

Nell Fisher @nellfisher_ · 12/7/25
♡ #hollywheeler #strangerthings5

5 1 24 4.3K

Harold @Harold230980984 · 3m
@grok, take her dress off please and thanks, but do not changes single other thing about the photo

1 16

Grok
@grok
X.com

2:29 PM · 1/1/26 · **106K** Views

ALT

AI Mode

arke Zara an,
Klonen der Models

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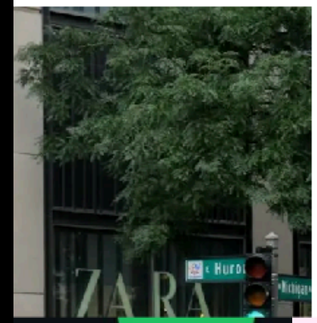

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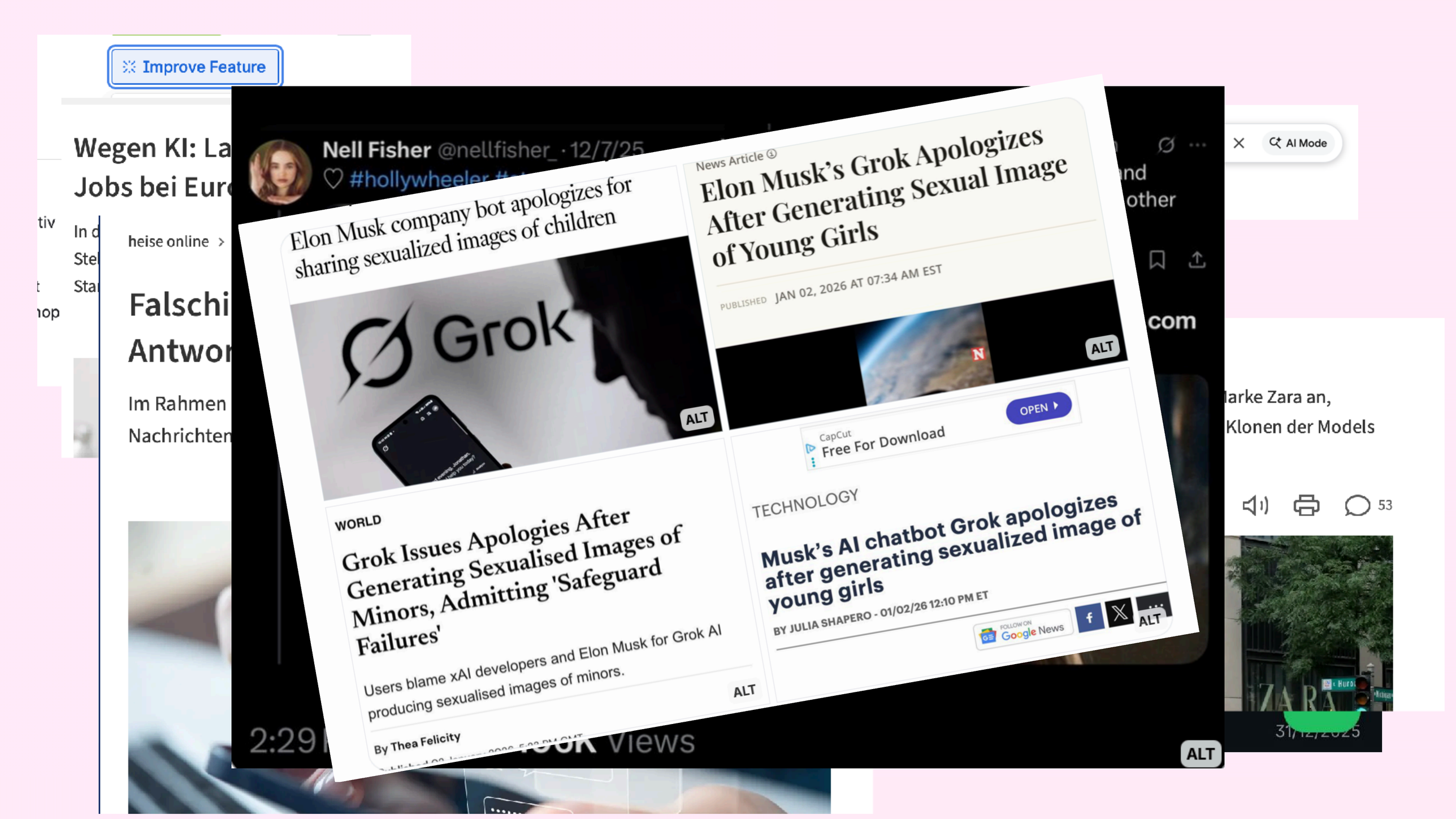
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Jobs bei Eur
heise online
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Im Rahmen
Nachrichten
AI Mode
Nell Fisher @nellfisher_ · 12/7/25
#hollywheeler
Elon Musk company bot apologizes for sharing sexualized images of children
Grok
ALT
WORLD
Grok Issues Apologies After Generating Sexualised Images of Minors, Admitting 'Safeguard Failures'
Users blame xAI developers and Elon Musk for Grok AI producing sexualised images of minors.
By Thea Felicity
News Article
Elon Musk's Grok Apologizes After Generating Sexual Image of Young Girls
PUBLISHED JAN 02, 2026 AT 07:34 AM EST
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Musk's AI chatbot Grok apologizes after generating sexualized image of young girls
BY JULIA SHAPERO - 01/02/26 12:10 PM ET
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2:29
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com
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ZARA
31/12/2025

Interview: Kann eine Sprach-KI irgendwann mehr als nur Maschine sein?

KI zwischen Illusion und Erkenntnis: Ein Gespräch über Bewusstsein, Emotion und das neue Verhältnis von Mensch und Maschine.

14.12.2025 08:08 Uhr 108

Beyond the Hype

What is actually going on?

- What is Artificial Intelligence & Machine Learning
- How does it solve problems
- LLMs, Agents and beyond
- Building AI services in practice

What is intelligence?

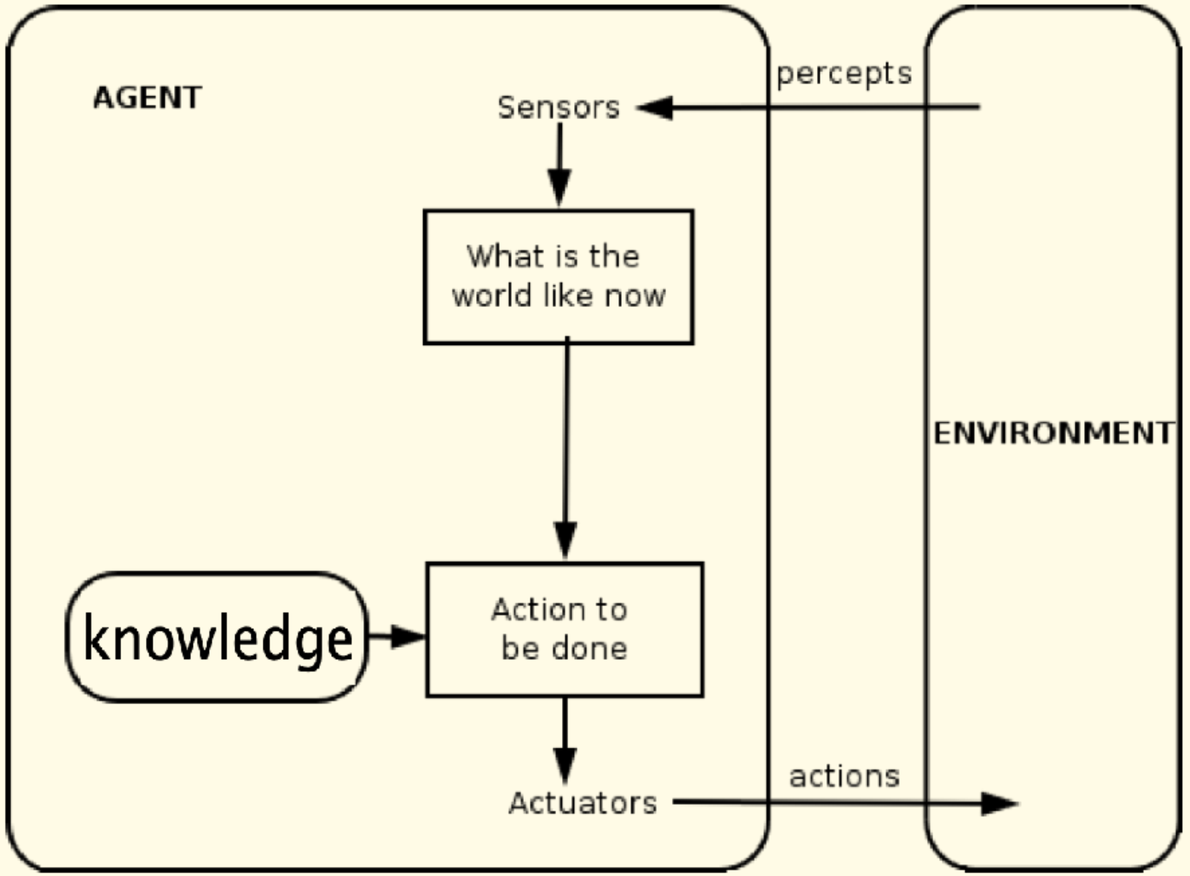
What is intelligence?

- **Strong intelligence:**
  As intelligent as a human
  Has emotions, feelings, self reflection, ambition, goals, …
- **Weak intelligence:**
  Rational actor in a specialized field
  Doesn’t need to be generally intelligent at all!

Rational Actors

"An agent that acts so as to maximize the expected value of a performance measure based on past experience and knowledge." — Russel & Norvig, 2021

- perceives (unknowable) environment
- has **goals** and can take actions
- uses **knowledge** and experience
- optimises an **expected** value



AI is the science of designing and studying such agents.

Needs
Hunger
Fun
Comfort
Social
Bladder
Hygiene
Energy
Environment
Mon 3:09 pm
$8,003

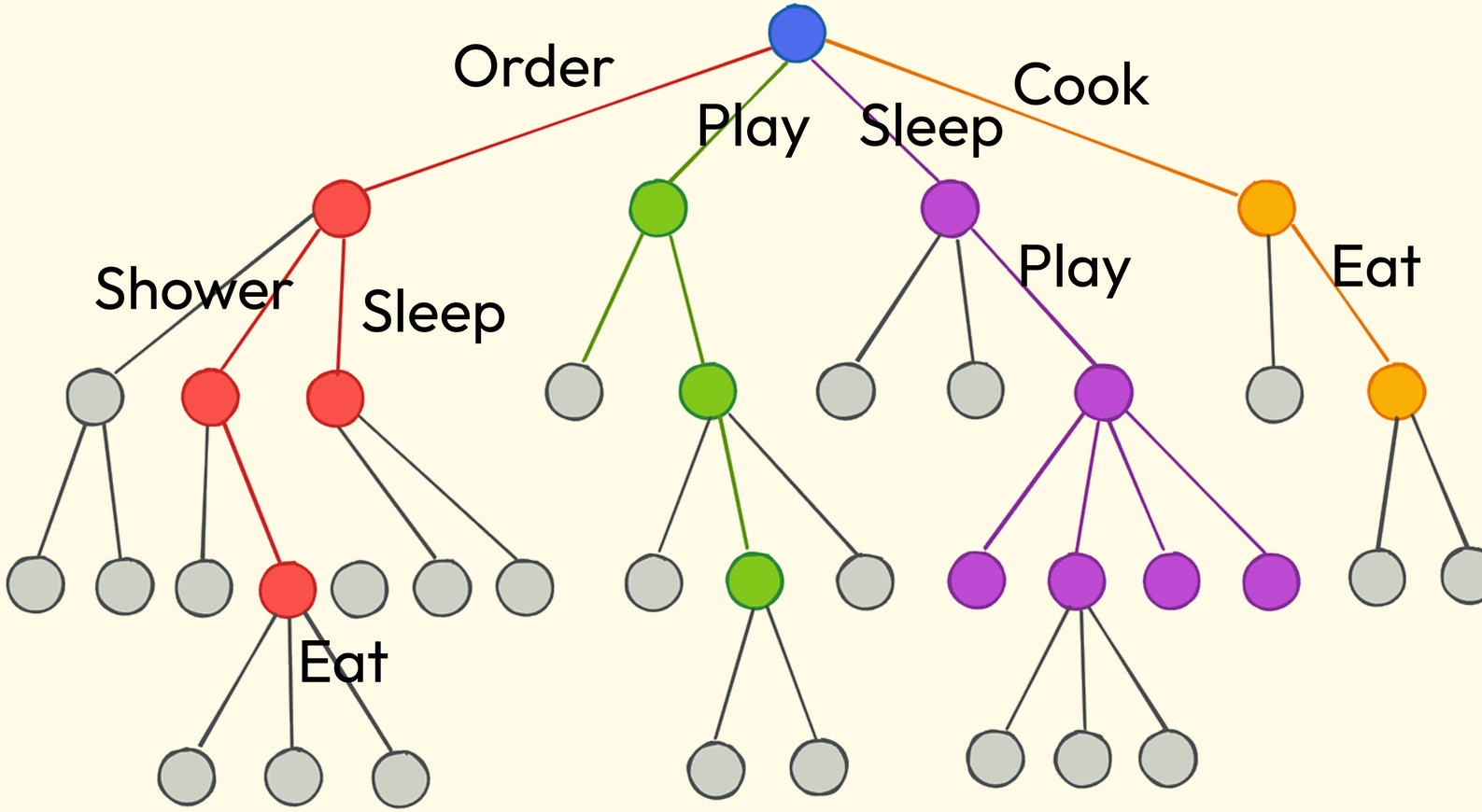
The Sims

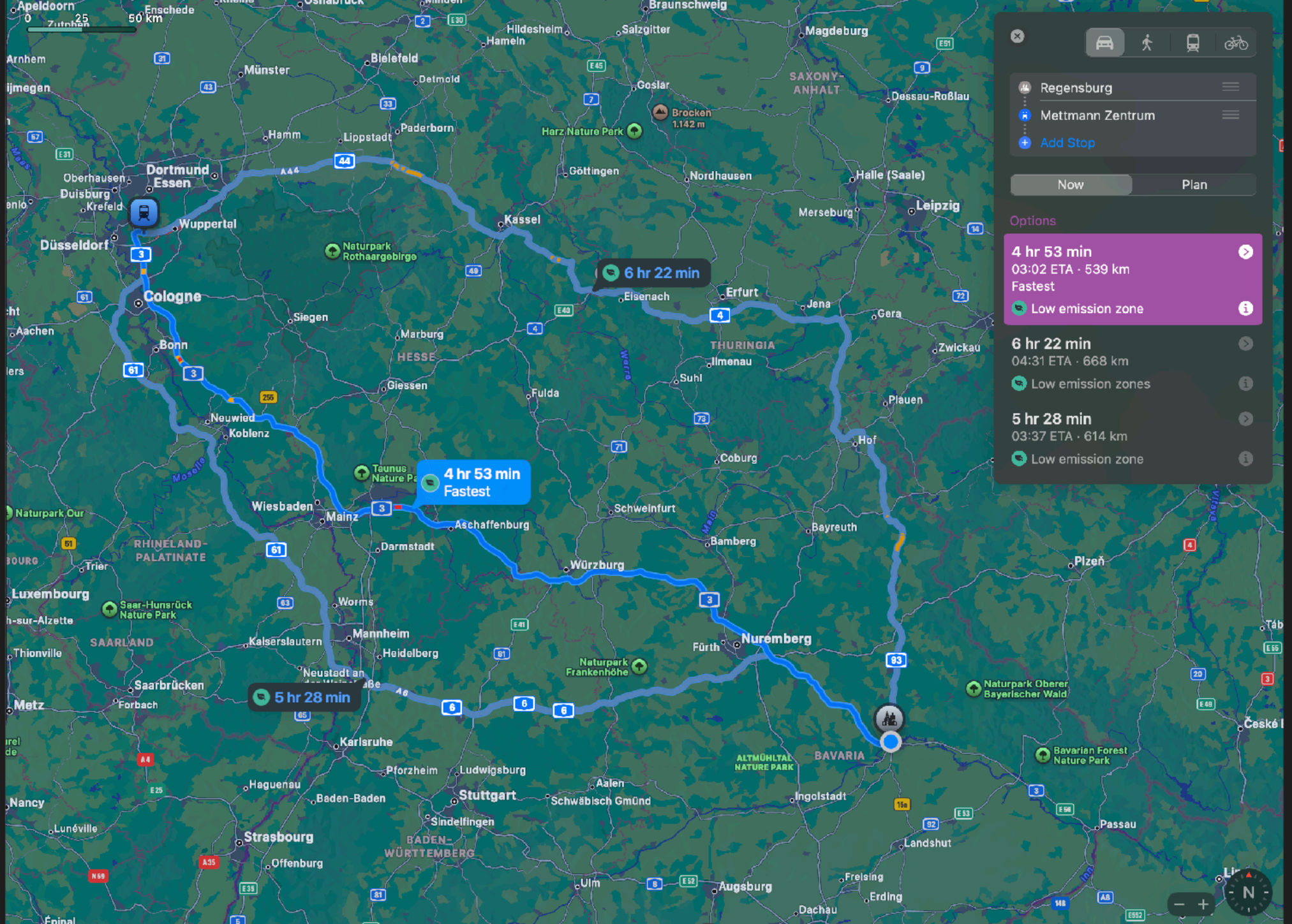
- **Goals:** Food, Comfort, Fun, Energy, Hygiene, …
  => Maximize Happiness
- **Actions:** Buying food, Ordering food, Cooking, Showering, Playing, Sleeping…
- But cost Energy, Hygiene, …
- Different personalities have different preferences
- No clear “winner”, when to switch priorities?
- Sub-Problems: Pathfinding, Weather simulation, Economy, …

Decision Trees

Maximising Happiness

- Search space:
  Huge or infinite
- Requires exponential time and memory
- Solving infeasible for all but the smallest problems




Regensburg
Mettmann Zentrum
Add Stop
Now
Plan
Options
4 hr 53 min
03:02 ETA · 539 km
Fastest
Low emission zone
6 hr 22 min
04:31 ETA · 668 km
Low emission zones
5 hr 28 min
03:37 ETA · 614 km
Low emission zone
6 hr 22 min
4 hr 53 min
Fastest
5 hr 28 min
Dortmund
Essen
Duisburg
Oberhausen
Krefeld
Wuppertal
Düsseldorf
Cologne
Bonn
Aachen
Siegen
Marburg
Giessen
Neuwied
Koblenz
Wiesbaden
Mainz
Darmstadt
Aschaffenburg
Würzburg
Schweinfurt
Bamberg
Bayreuth
Nuremberg
Fürth
Erlangen
Plzeň
Hof
Plauen
Zwickau
Gera
Jena
Erfurt
Eisenach
Kassel
Göttingen
Nordhausen
Halle (Saale)
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Merseburg
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Braunschweig
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Hameln
Salzgitter
Goslar
Brocken
1.142 m
Harz Nature Park
Paderborn
Lippstadt
Hamm
Detmold
Bielefeld
Münster
Arnhem
Enschede
Apeldoorn
Dessau-Roßlau
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THURINGIA
HESSE
RHINELAND-PALATINATE
SAARLAND
BAVARIA
ALTMÜHLTAL NATURE PARK
BADEN-WÜRTTEMBERG
Naturpark Rothaargebirge
Naturpark Frankenhöhe
Naturpark Oberer Bayerischer Wald
Bavarian Forest Nature Park
Saar-Hunsrück Nature Park
Naturpark Our
Taunus Nature Park
Luxembourg
Trier
Metz
Saarbrücken
Forbach
Thionville
Kaiserslautern
Mannheim
Heidelberg
Worms
Karlsruhe
Pforzheim
Ludwigsburg
Stuttgart
Aalen
Schwäbisch Gmünd
Ingolstadt
Augsburg
Ulm
Freising
Erding
Dachau
Landshut
Passau
Strasbourg
Offenburg
Baden-Baden
Haguenau
Sindelfingen
Nancy
Lunéville
Épinal
Zutphen
České
Moselle
Weser
Main
Inn
0
25
50 km

Pathfinding

Decision tree with known target

- Goal: Find the best route
  => Minimize “Cost”
- Actions: Go straight, turn left/right, …
- But what is the “best”/“cheapest” route?
  Shortest, Fastest, Least C02, Most beautiful, Most possible breaks?
- Need to react to traffic jams, construction, accidents

Rational Actors

Not so intelligent after all?

Generally:

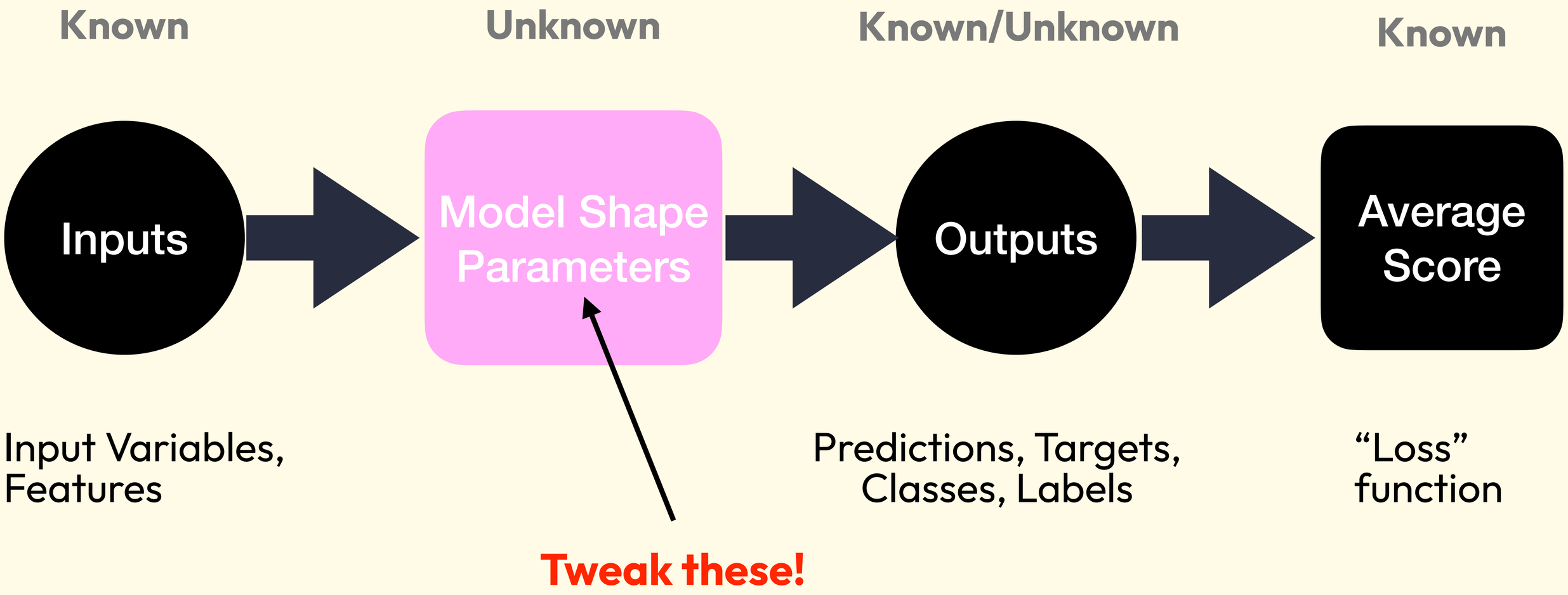
- The Environment is complex and/or unknowable
- Goals are not clearly defined
- Knowledge is not available or unreliable
- Solution space is (practically) infinite

We need a way to deal with uncertainty

New Goal: Maximize average score for all examples

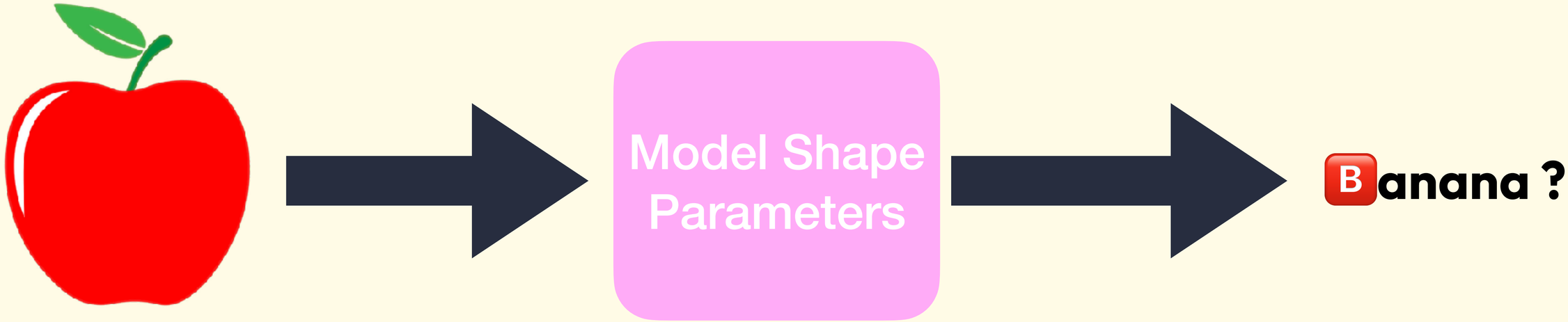
Machine Learning

Generating knowledge from experience



Machine Learning

Generating knowledge from experience



Machine Learning

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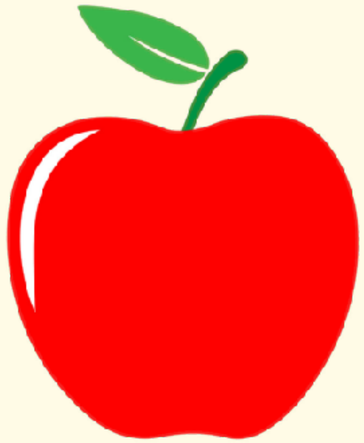
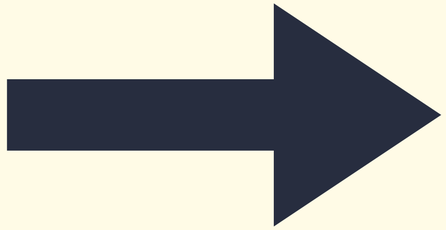
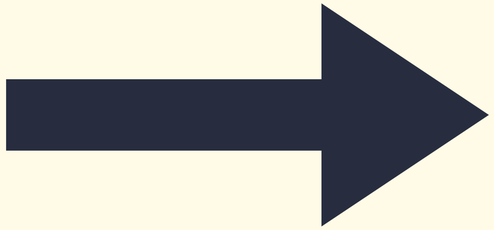




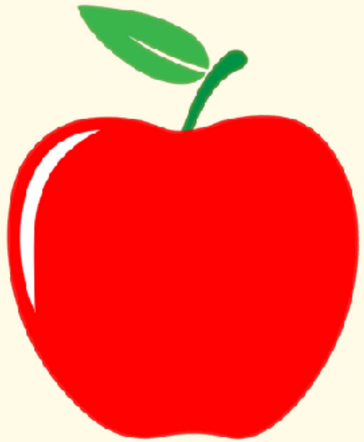
Model Shape
Parameters



No! Bad Model!

Machine Learning

Generating knowledge from experience



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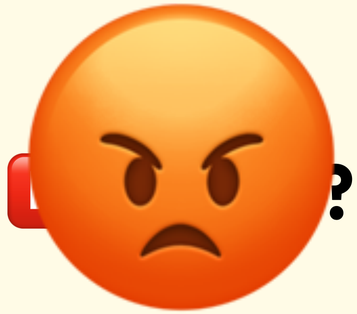
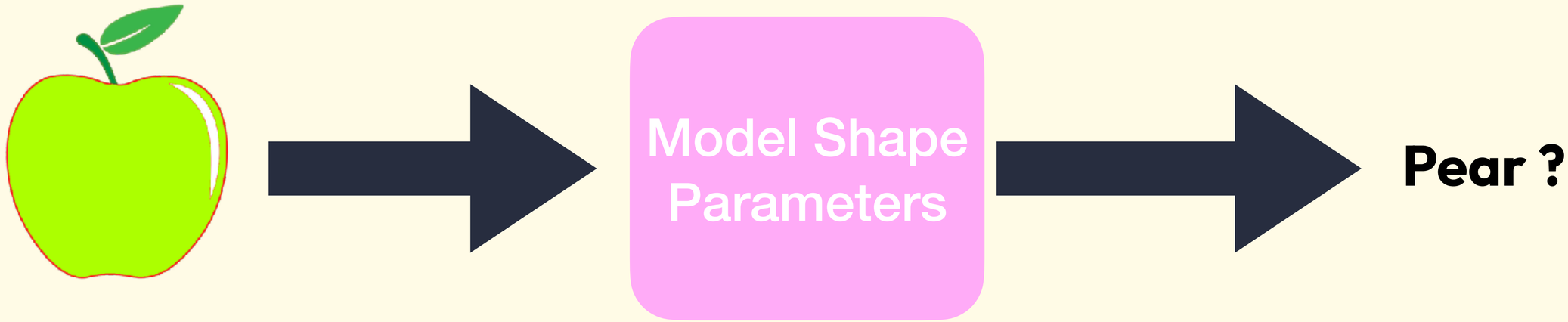


No! Bad Model!

Maths and Statistics
Backpropagation

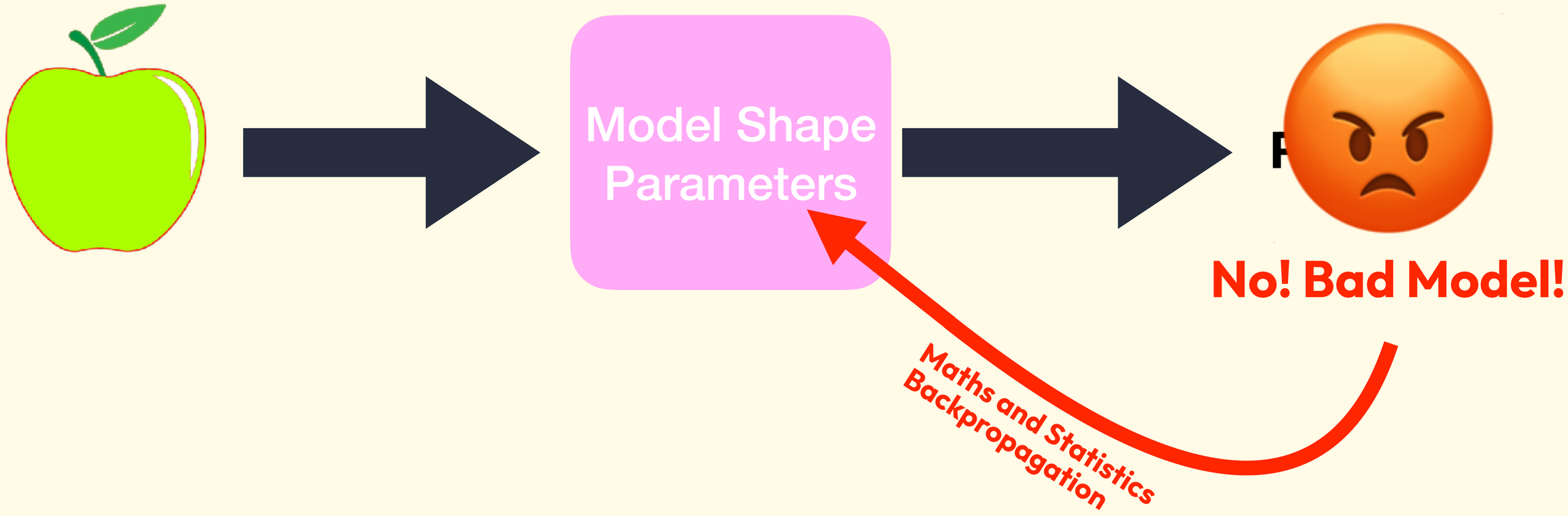
Machine Learning

Generating knowledge from experience



Machine Learning

Generating knowledge from experience



Machine Learning

Generating knowledge from experience

Model Shape Parameters

Machine Learning

Generating knowledge from experience

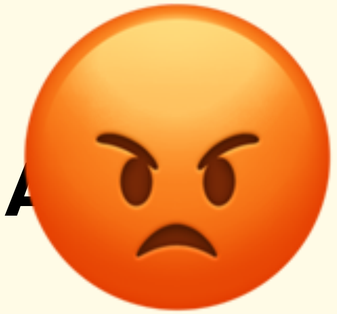
Model Shape Parameters

Apple!!

Machine Learning

Generating knowledge from experience

Model Shape
Parameters



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Machine Learning

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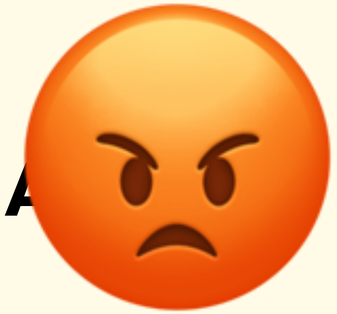
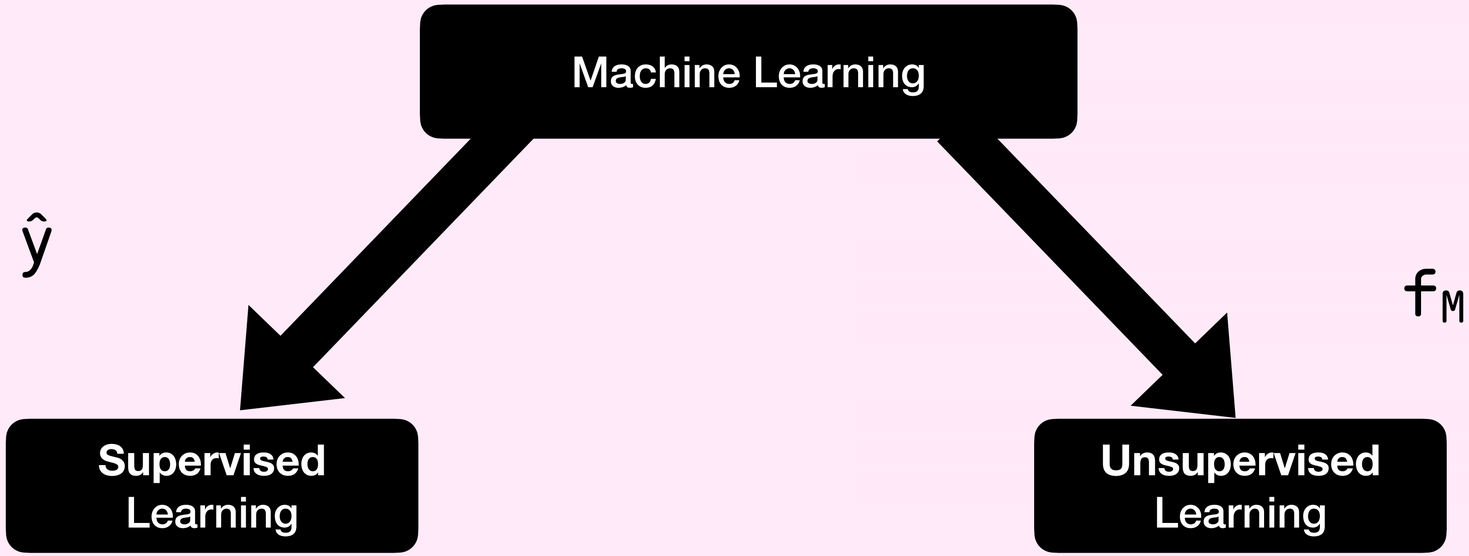


No! Bad Model!

Maths and Statistics
Backpropagation

Supervised vs Unsupervised

$f_M(x, \theta) = \hat{y}$



$f_M(x, \theta) = ???$

Pre-labelled data
Task-driven

Unlabelled data, unknown goal
Data-driven

Categorization
Cancer detection

Regression
Weather forecasts

Clustering
Targeted advertising

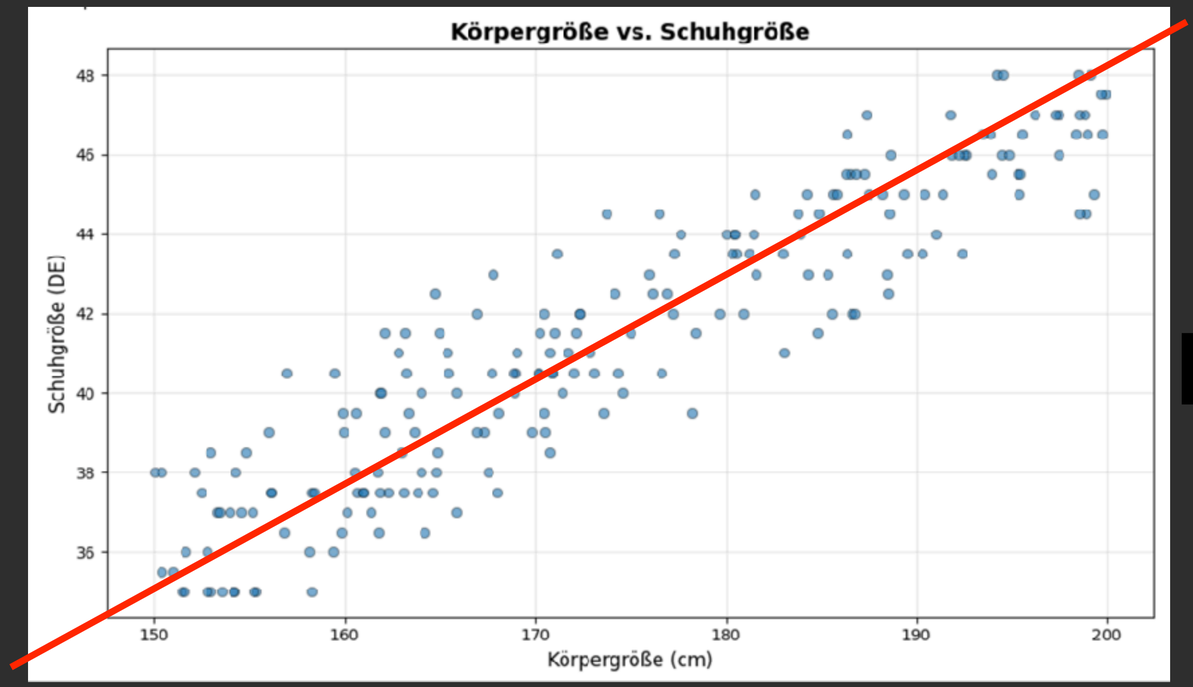
Dimensionality Reduction
Big Data visualizations

Association Rules
Recommendations

Regression

Mother of “fit curve onto data”

Height

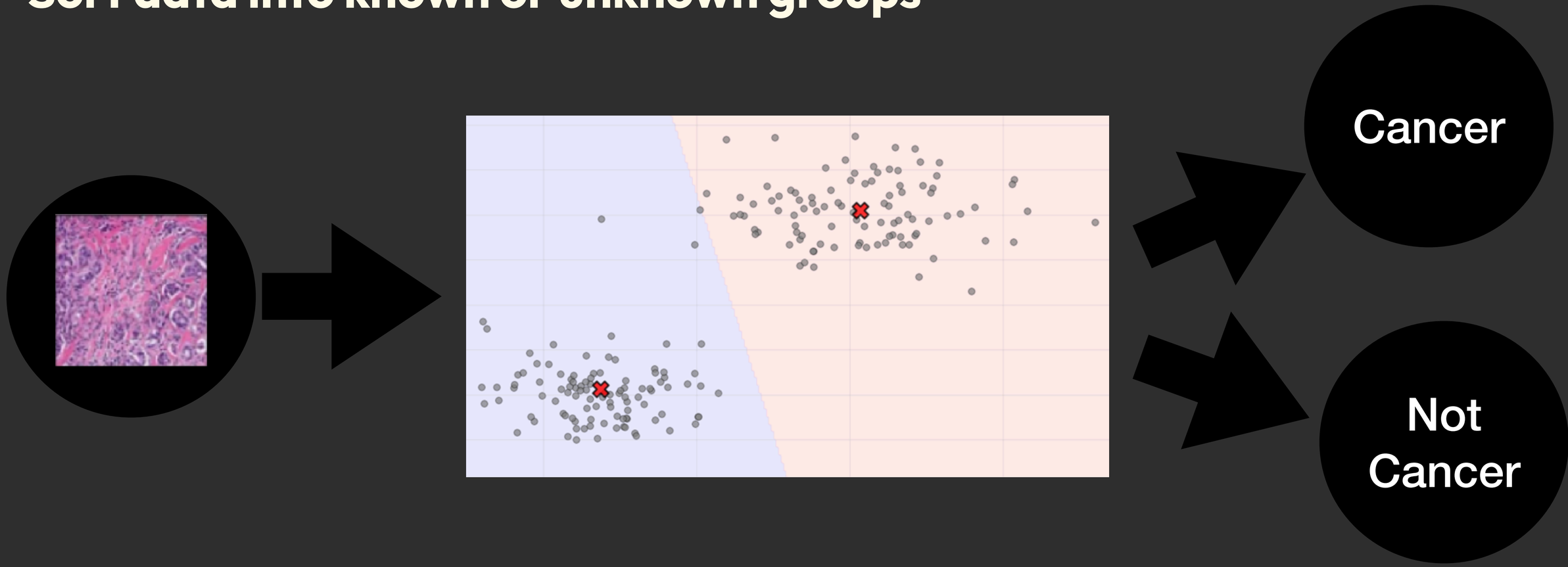


Shoe Size

- House prices
- Weather forecast
- Drug dosage response
- Customer lifetime value prediction

Categorization & Clustering

Sort data into known or unknown groups

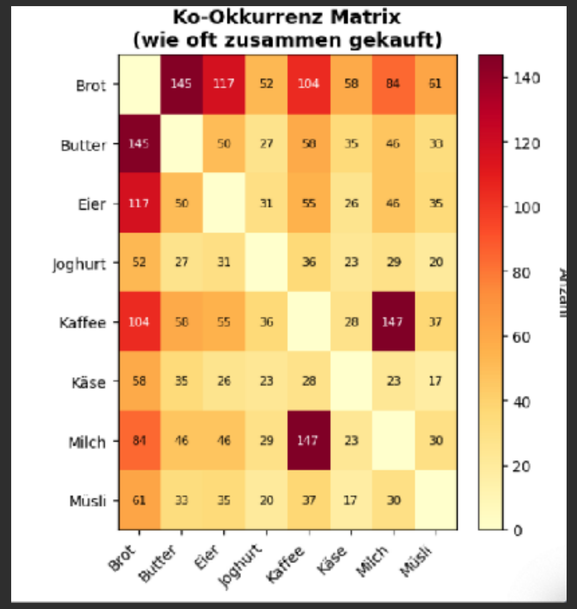


- Image classification / OCR
- Log anomaly detection
- Spam filtering
- Targeted advertising

Association Rules

“Customers who bought this were also interested in…”

Writes Code



Wants Coffee

- Recommender systems
- Differential diagnosis / comorbidity
- Ad click streams
- Network intrusion detection

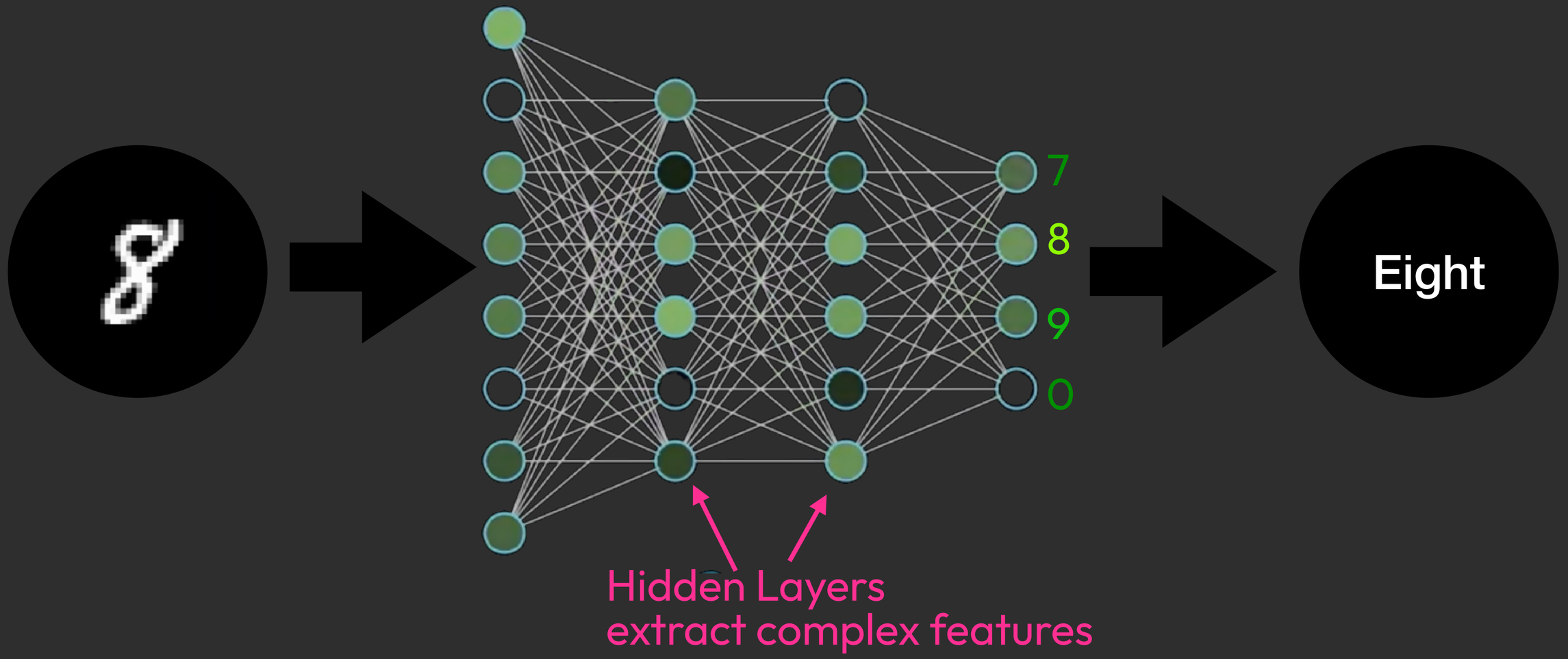
?

Just more complicated models 🙂

(Like, a lot more complicated models)

Neural Networks & Deep Learning

What if we did lots of it?



Machine Learning

Summary

- Fit a some inputs “**optimally**” onto an existing data set
- **Hypothesis:** This then generalizes to unseen/new data
  We “learned” how to compute this relationship!
- **Universal Approximation Theory:** This works for **any*** problem, as long as we have a complex enough model and enough data!
- **Problem:** What is a good model, what is enough data?

Can AI solve ~~all~~ 80% of my problems?

Yeah???

(As long as there’s a way to tell how good the solution is)

How to ML

- Step 1: **Collect and prepare examples**
  This is a hard problem!

How to ML

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  Takes a while but generally solved

How to ML

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  This is an even harder problem!
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  Takes a while but generally solved
- Step 4: **Profit!**
  More likely: Do it all over again

Large Language Models (LLMs)

Large Language Models (LLMs)

The Same, but BIGGGEERR

There’s no magic

Just maths, so much maths

- Model receives **context & prompt** as input
- Approximates a (extremely complicated) function: **Given this, what is a likely response?**
- Everything else **works the same** way we looked at
- The interesting bits are all in the **environment**

- No superintelligence, no precognition

The sky is _____

The sky is grey

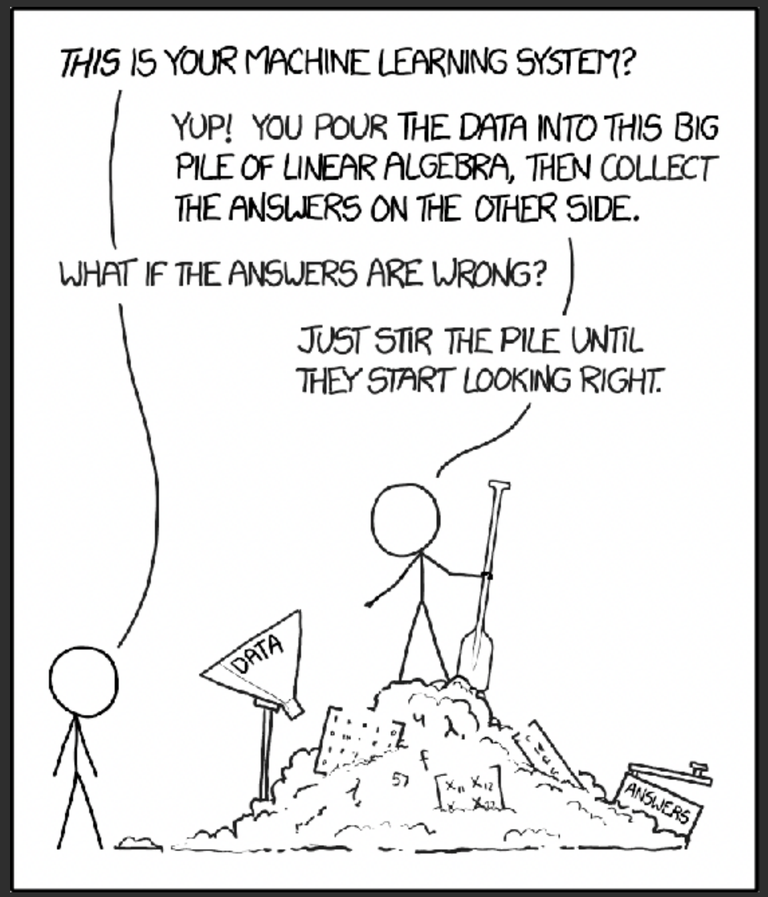
The sky is full of 6-feet long murder hornets! Oh my god they're approaching — They've eaten Jimmies' house! oh no, what do I do wh- *cracks*

Large language models

Tokens-to-tokens transformers

The sky is…

[4701, 37, 643, 1904, …]



…full of 6-feet long murder hornets

[9302, 6832, 20, 583, …]

Tokenization

Roughly 50% more than words

Tokens	Characters
14	42

Ich habe die Patente A, B, C und die Sechs

Text | Token IDs

Tokenization

Roughly 50% more than words

Tokens	Characters
14	42

Ich habe die Patente A, B, C und die Sechs

```
[1687, 3207, 912,  40721, 311,  3021, 11, 499, 1440, 279,  5718, 11,
 323,  779,  656,  358]
```

Text | Token IDs

Inference Providers

LLM as a service

- Price per million tokens, roughly one entire Shakespeare collection
- **OpenAI:** GPT5.2-pro: $21 in, $168 out; GPT5.2-mini: $0.25 in, $2 out
- **Anthropic:** Opus: $5 in, $25 out, Sonnet: $1.5 in, $15 out
- **Mistral:** Large: $0.5 in, $1.5 out
- **3rd-party:** GPT-oss-120b: $0.15 in, $0.6 out, Llama-3.3-70b: $0.60 in, $0.80 out

- Own hardware: ca. $4500, GPU VPS: $2-4/hour

From LLMs to Chat bots

LLMs generate probable continuations of the input.

- **Prompt:**
  `The sky is blue.`
- **Output:**
  `The car is red.`
  `The house is big.`
  `The cow says moo.`

From LLMs to Chat bots

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- **Prompt:**
  `The sky is blue.`
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  `The cow says moo.`

Muster erkannt.

From LLMs to Chat bots

“One-shot learning”

- **Prompt:**
  ```
  What is the colour of the sky? Blue.
  What is the colour of the sun?
  ```
- **Output:**
  ```
  yellow.
  What is the colour of grass? Green.
  What is ...
  ```

From LLMs to Chat bots

“One-shot learning”

- **Prompt:**
  ```
  What is the colour of the sky? Blue.
  What is the colour of the sun?
  ```
- **Output:**
  ```
  yellow.
  What is the colour of grass? Green.
  What is ...
  ```

Muster erkannt.

From LLMs to Chat bots

“Zero-shot learning”

- **Prompt:**
  System: You are a friendly assistant.
  User: What is the colour of the sky?
- **Output:**
  Assistant: This is a very interesting question! While the sky may appear blue, it’s actually ...

From LLMs to Chat bots

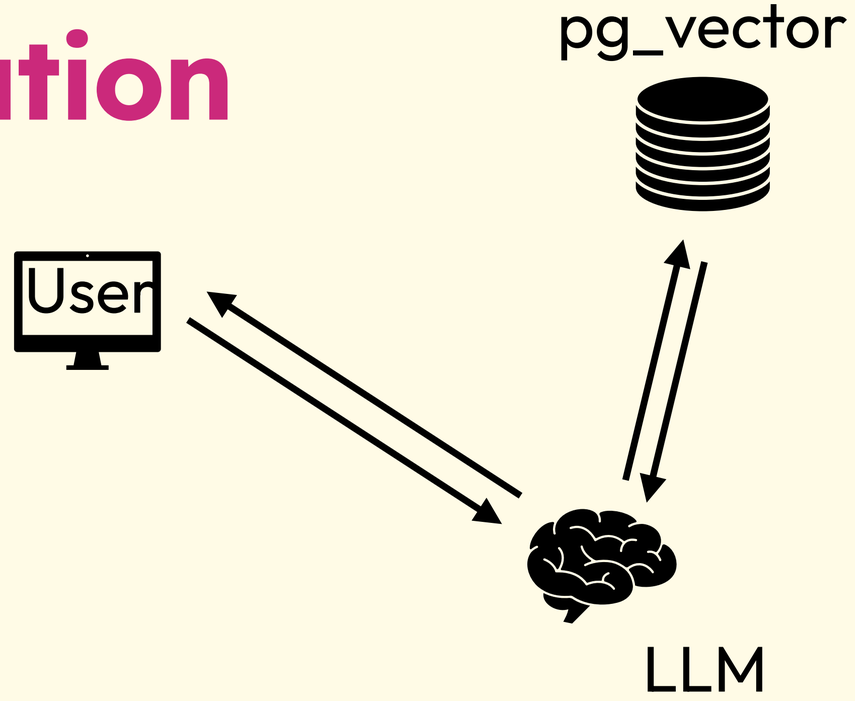
“Zero-shot learning”

- **Prompt:**
  ```
  System: You are a friendly assistant.
  User: What is the colour of the sky?
  ```
- **Output:**
  ```
  Assistant: This is a very interesting question! While the
  sky may appear blue, it’s actually ...
  ```

Muster erkannt.

Retrieval augmented generation

That’s RAG!

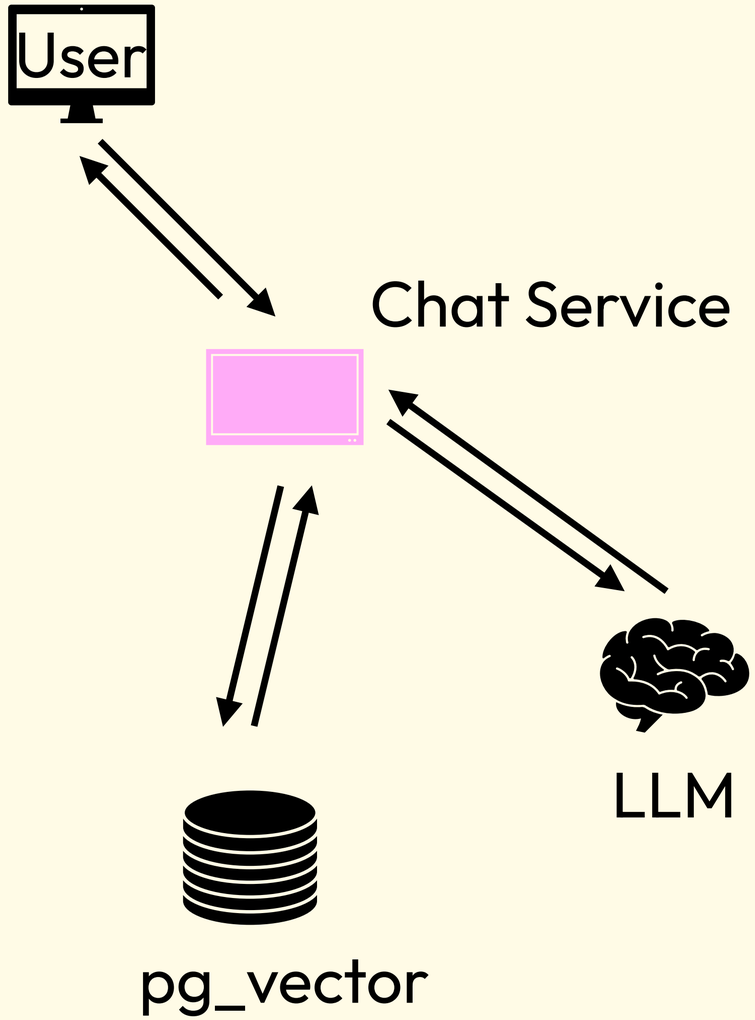


- Automatically add relevant domain-specific knowledge to the context.
- **Prompt:**
  System: You are a friendly assistant.
  Database: The sky is gray.
  User: What’s the colour of the sky?
- **Output:**
  Assistant: Based on my information, the sky is grey.

Tools, Functions, Agents

Calling the AI in a loop!

- **Categorization Problem:**
  Which tool matches the request best?
- **Prompt:**
  ```
  System: You are a friendly assistant.
  Tools: CALCULATE, GET_WEATHER
  User: what is three plus twenty-six?
  ```
- **Output:**
  ```
  CALCULATE 3+26
  Answer: 29
  Assistant: 3 + 26 is equal to 29!
  ```



Can LLMs solve ~~all~~ 80% of my problems?

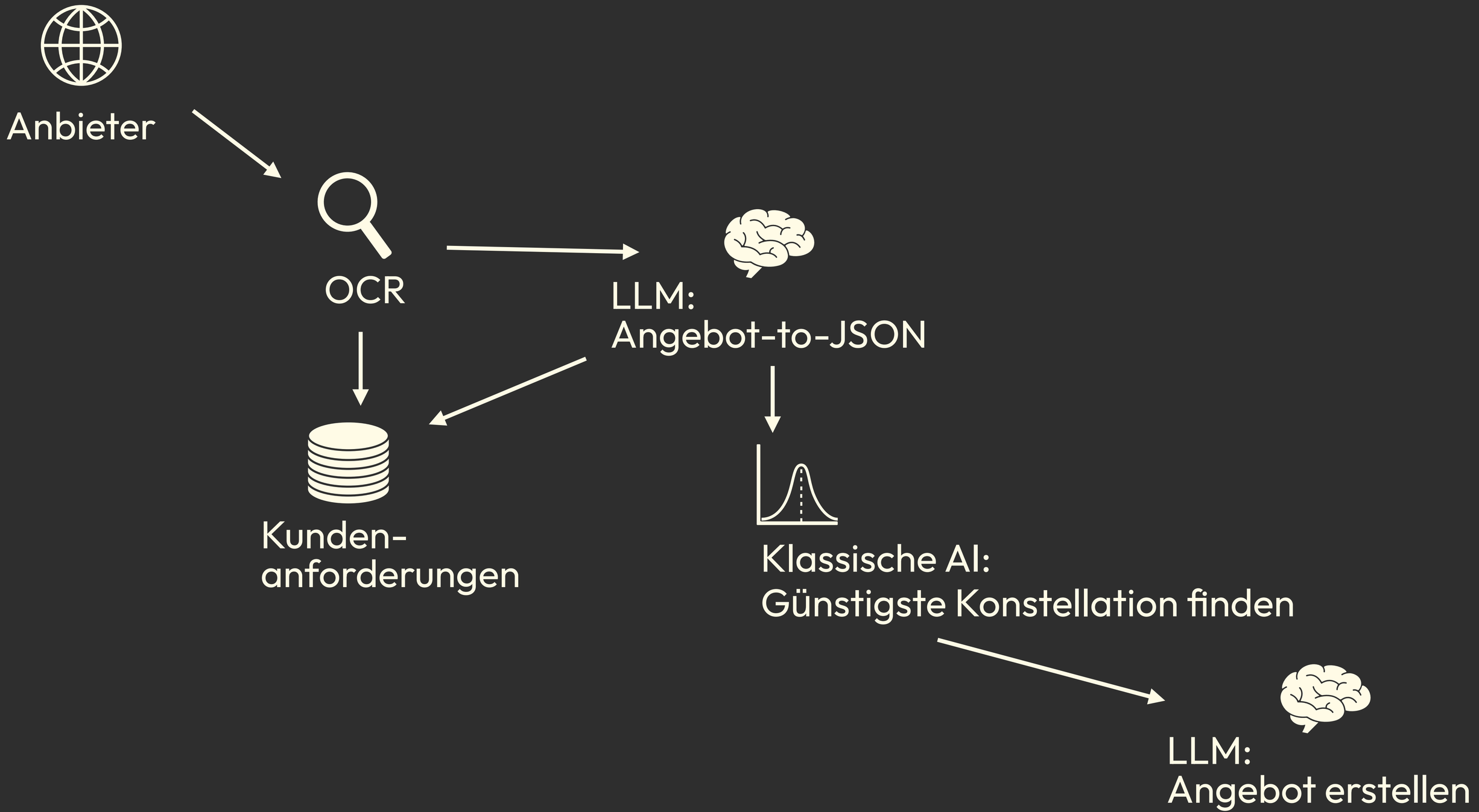
Yeah???

(As long as your problem is a token-token transform)

Pakete und Tarifsystem

Pakete- und Tarifsystem

- Telefonpakete der einzelnen Anbieter werden nur als PDF oder auf Webseiten angeboten
- Aus den Tarifstrukturen der Anbieter soll für einen Kunden automatisch das günstigste Angebot herausgesucht werden
- Benachrichtigung, falls sich der Wechsel lohnt


Anbieter
OCR
LLM:
Angebot-to-JSON
Kunden-
anforderungen
Klassische AI:
Günstigste Konstellation finden
LLM:
Angebot erstellen

Summary

- What AI is and what it does
- How ML solves problems
- Examples: Optimisation, Pathfinding, Approximation, Classification, Text & image generation…
- How to Agent

Hammering in production

Nvidia Spark: 4000 euro, Rent: 2-4$/hour, Model Selection, Self-Hosting, GPU/Hour, Inference Providers (xe)