



Künstliche Intelligenz: Chancen,
Anwendungen und Herausforderungen

Johannes Petzke

Generative AI in Professional Sports

Dr. Julian von Schleinitz

Von der Theorie zur Praxis – Wie
kann KI Diagnostik, Monitoring und
Training verbessern?

Univ.-Prof. Dr. Patrick Wahl

GENERATIVE AI IN PROFESSIONAL SPORTS

September 2024

Dr. Julian von Schleinitz

About Me



BMW Group:

- Product Owner Data Science at BMW Group Financial Services
- Project Lead Technology Transfer Wintersport
- Doctoral Thesis in Data Science about Race Driver Evaluation at BMW Motorsport

Sports:

- Founder of Schleinitz AI Technologies
- Former Luge Athlete

Julian von Schleinitz

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LinkedIn: [Link](#)



“

The pope driving a bobsled.

”

Output

2022



Output

2023

schleinitz
ai



2024



Where will AI go?



1 Year



1 Year

?

5 Years

??

10 Years

???

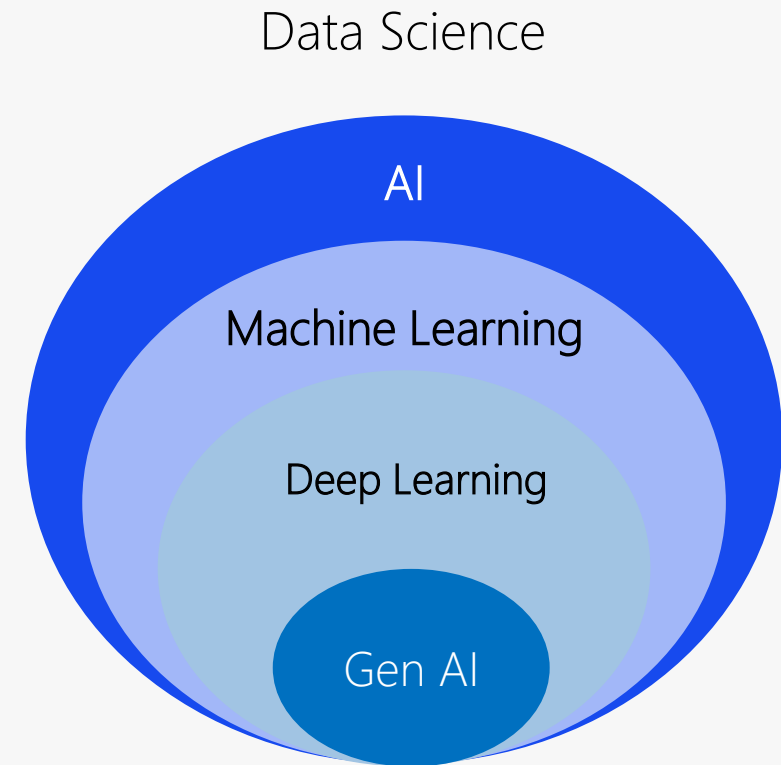
GENERATIVE

AI

UNDER THE HOOD

Facts about LLMs

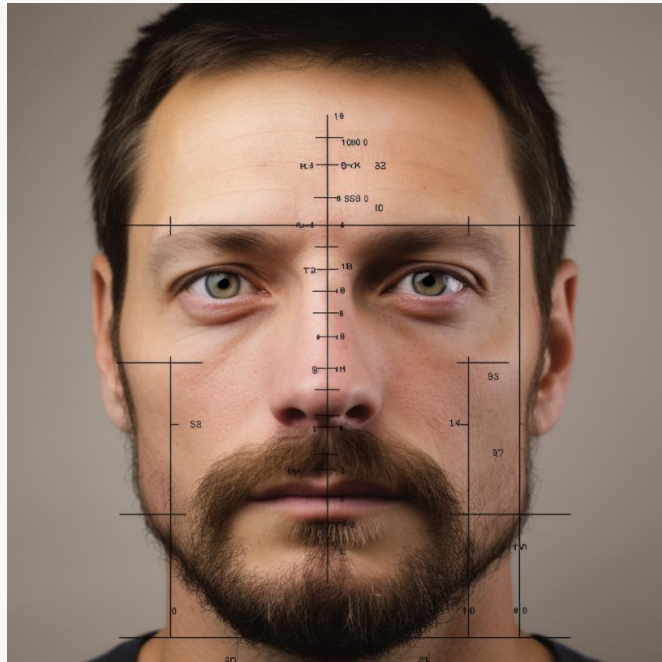
- ChatGPT is a large language model (LLM)
- GPT stands for “Generative Pretrained Transformer”
- “Transformer” is a deep learning method
- ChatGPT was developed by **OpenAI**
- **Google’s “Bard”** and **Meta’s “LLaMA”** are chatbots from other tech companies



Machine Learning

Classical Programming

Rules are defined manually in the code.



Input: Code: Eyes-10.2, Nose-5.3
Result: **Bill**



Machine Learning

We show many examples of In- and Outputs and the model writes the code itself.

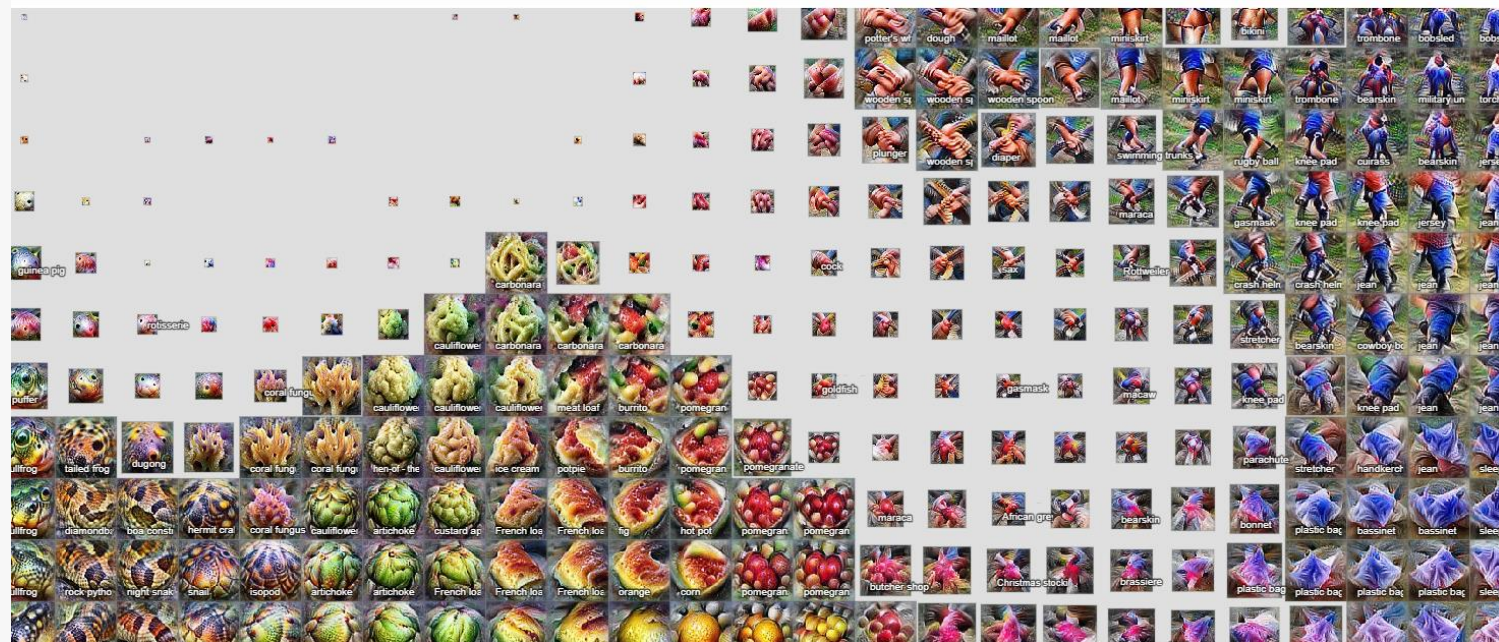


Input: 1-Tom, 2-Sarah, 3-Emily, 4-Emily
Result: **Machine Learning Model**

What does AI learn?

Exploring Neural Networks with Activation Atlases

By using feature inversion to visualize millions of activations from an image classification network, we create an explorable *activation atlas* of features the network has learned which can reveal how the network typically represents some concepts.

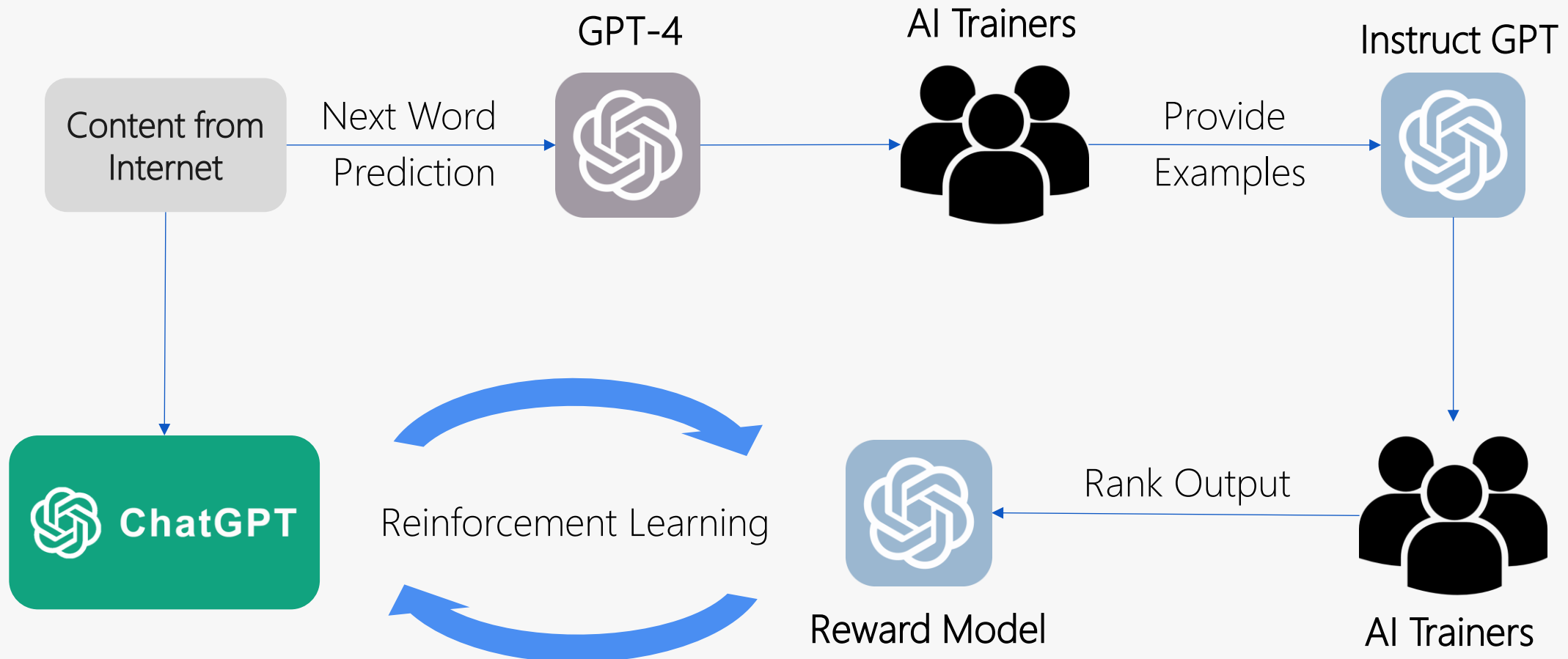


<https://distill.pub/2019/activation-atlas/index.html>

WHAT IS BEHIND LLMs?

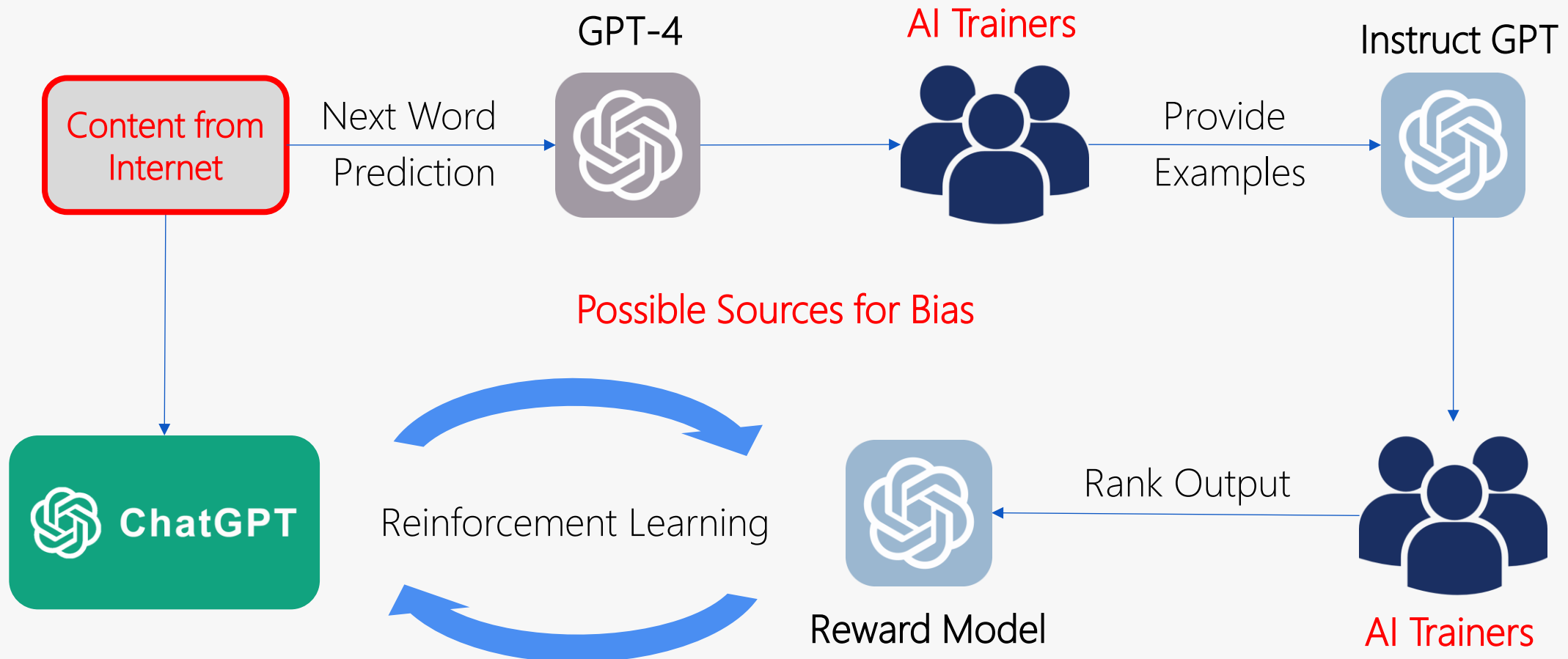
Alignment is key for a LLM to be useful.

RLHF (Reinforcement learning from human feedback)

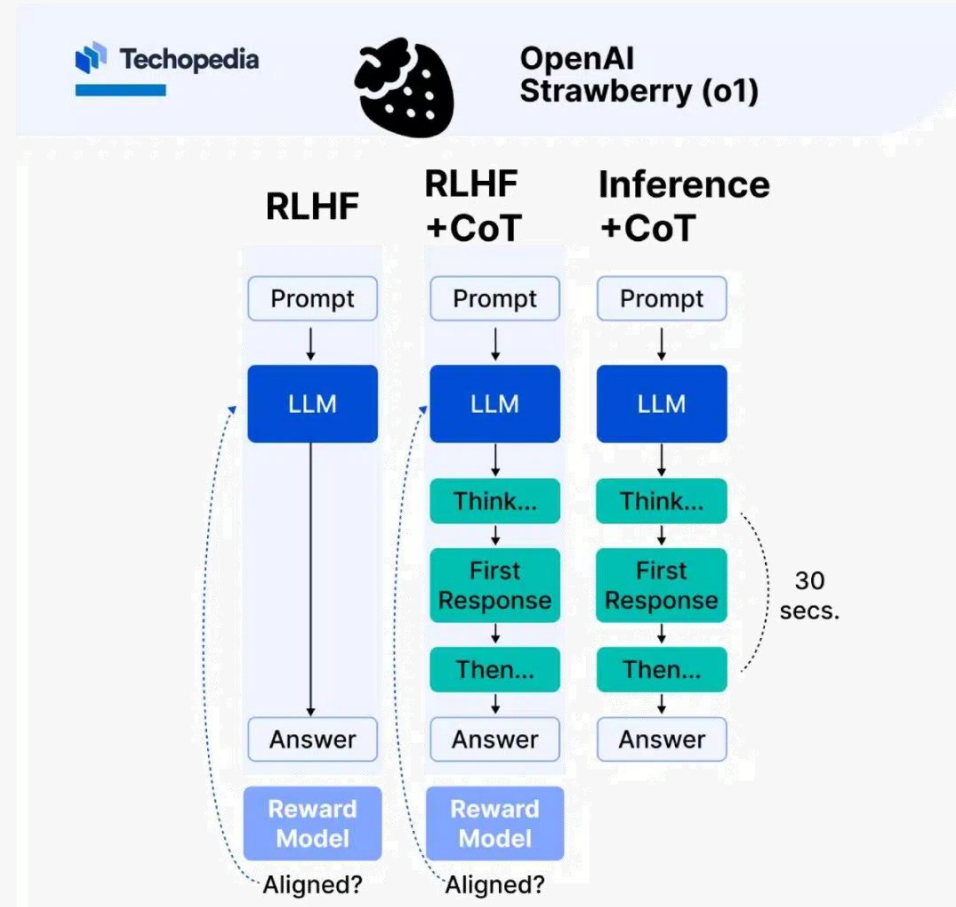


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RLHF (Reinforcement learning from human feedback)



The process behind Openai O1 is probably similar

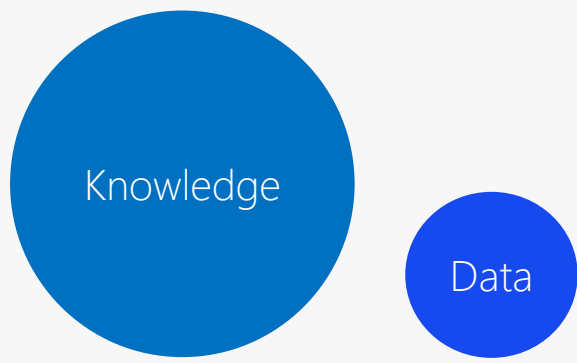


Source: <https://www.techopedia.com/news/openai-o1-model-expert-analysis>



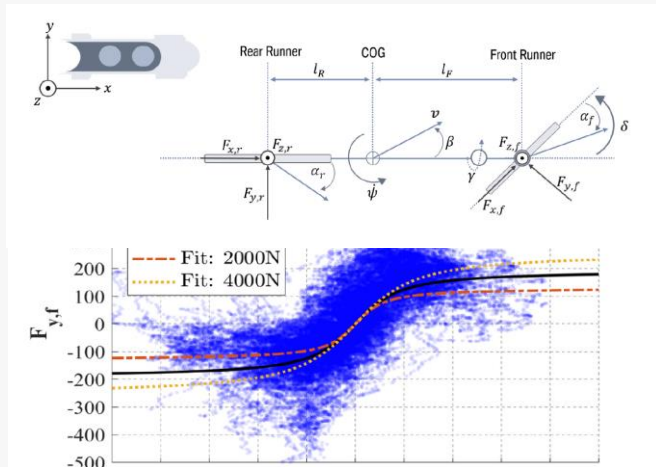
ChatGPT is far
from being “AGI”
(Artificial General
Intelligence)

HOW CAN I USE AI?

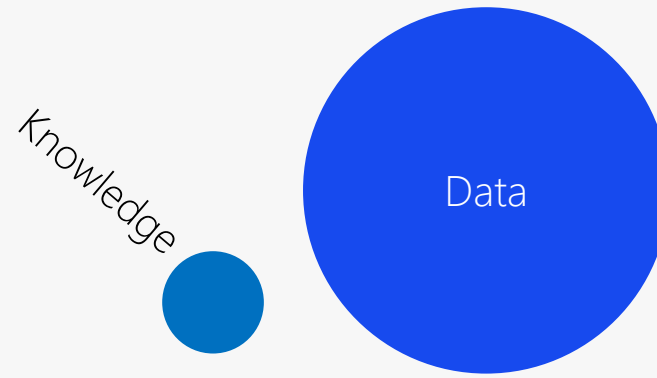


Classical Model

Rules are defined manually in the code.

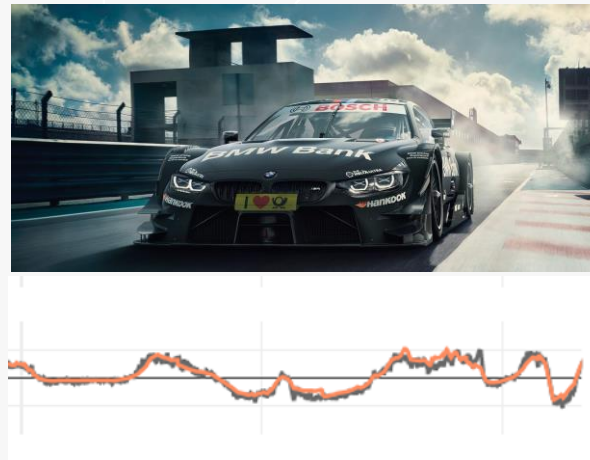


A driving dynamics model of a bobsled
Result: **Model/ Optimization Algorithm**

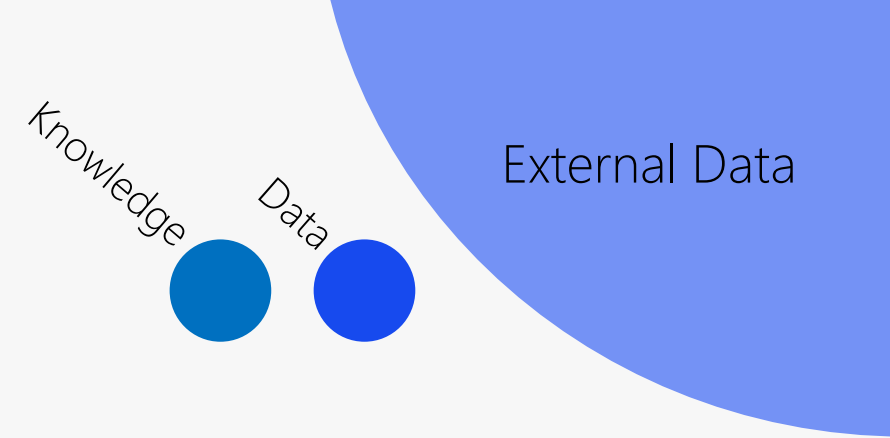


Machine Learning

We show millions of examples of In- and Outputs and the model writes the code itself.

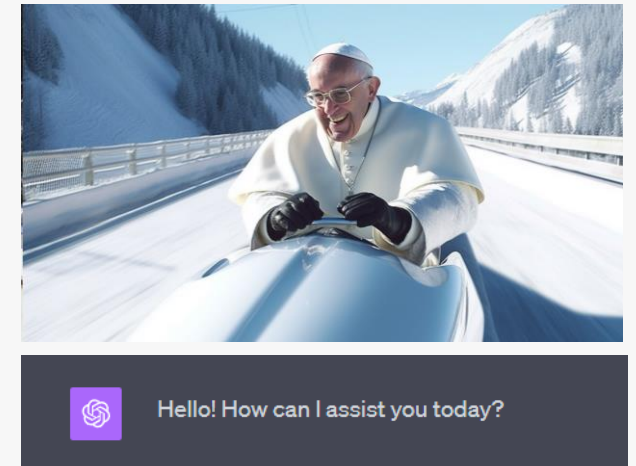


Predicting a sensor based on training data for races
Result: **Machine Learning Algorithm**



Pretrained Machine Learning

We need no or very few examples and get good results for specific tasks



“Depict the pope driving a bobsled”
Result: **Image/ Text**



Explain me the difference between Luge and Skeleton in Rhyme form



“
Erzähle den Workshop Teilnehmern was
man mit AI alles im Sport machen kann.
”



LIMITATIONS

“Generate pictures of a Skeleton Athlete”



It can hallucinate. Example: GPT-3.5

Who is Felix Loch?



Felix Loch is a German luger who has achieved significant success in the sport. He was born on June 24, 1989, in Sonneberg, East Germany. Loch is widely considered one of the most successful lugers in history.



Loch has competed in multiple Winter Olympics, starting with the 2006 Games in Turin, Italy, where he won a bronze medal in the men's singles event at the age of 16. He then went on to dominate the sport, winning three consecutive gold medals in the men's singles event at the 2010 Olympics in Vancouver, 2014 Olympics in Sochi, and 2018 Olympics in Pyeongchang.

Aside from his Olympic success, Felix Loch has also achieved remarkable results in other major luge competitions. He has won numerous World Championship titles, including gold medals in the men's singles event in 2008, 2009, 2012, 2013, 2015, 2016, and 2019.

Felix Loch's performances have made him a highly regarded and respected figure in the world of luge. His skill, consistency, and ability to perform under pressure have established him as one of the all-time greats in the sport.

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Example: GPT-4

Who is Felix Loch?



Felix Loch is a German luge racer who is known for his significant achievements in the sport.   




Born on 24th July 1989, Loch made his mark in the luge world early, winning his first World Championship at age 18. He then went on to win the gold medal in the men's singles event at the 2010 Winter Olympics in Vancouver, making him the youngest Olympic luge champion ever.

Loch has continued to excel in luge, securing another gold at the 2014 Sochi Winter Olympics and multiple World Championship titles. As of my knowledge cutoff in September 2021, he has established himself as one of the dominant competitors in the sport. For updates on his career and achievements after 2021, you might want to check a more recent source.

Example: GPT-4

Who is Felix Loch?



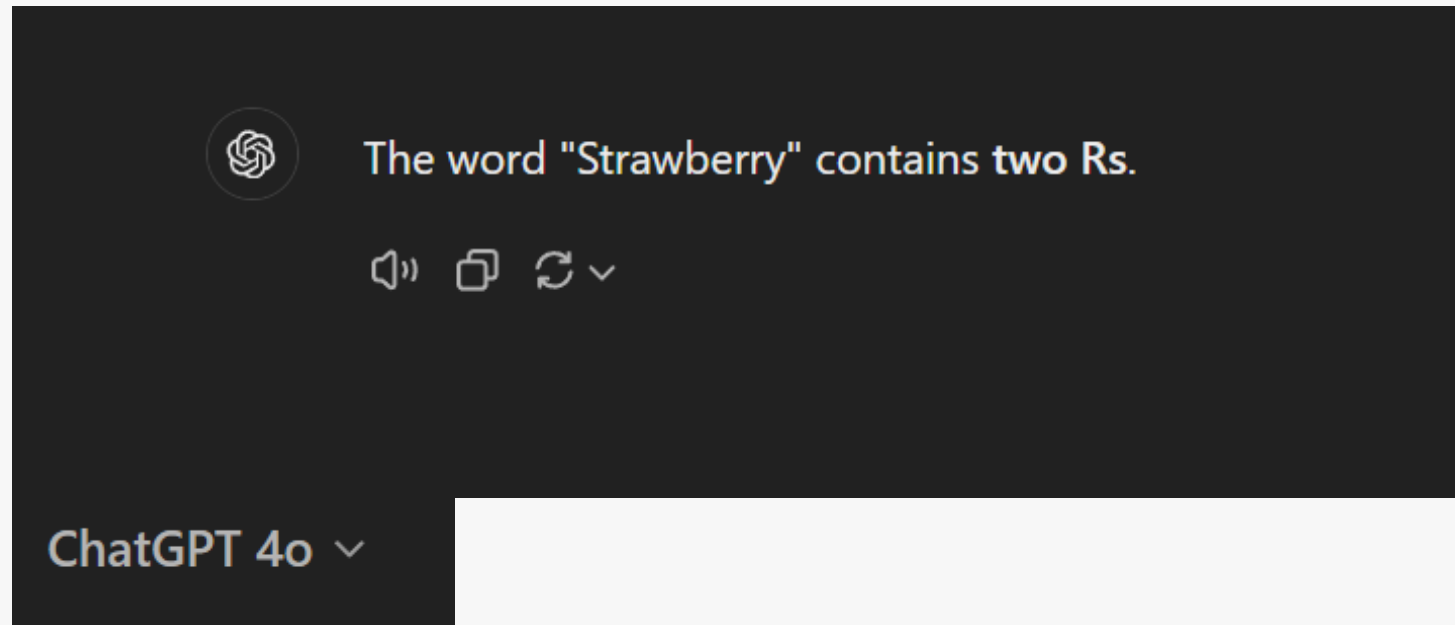
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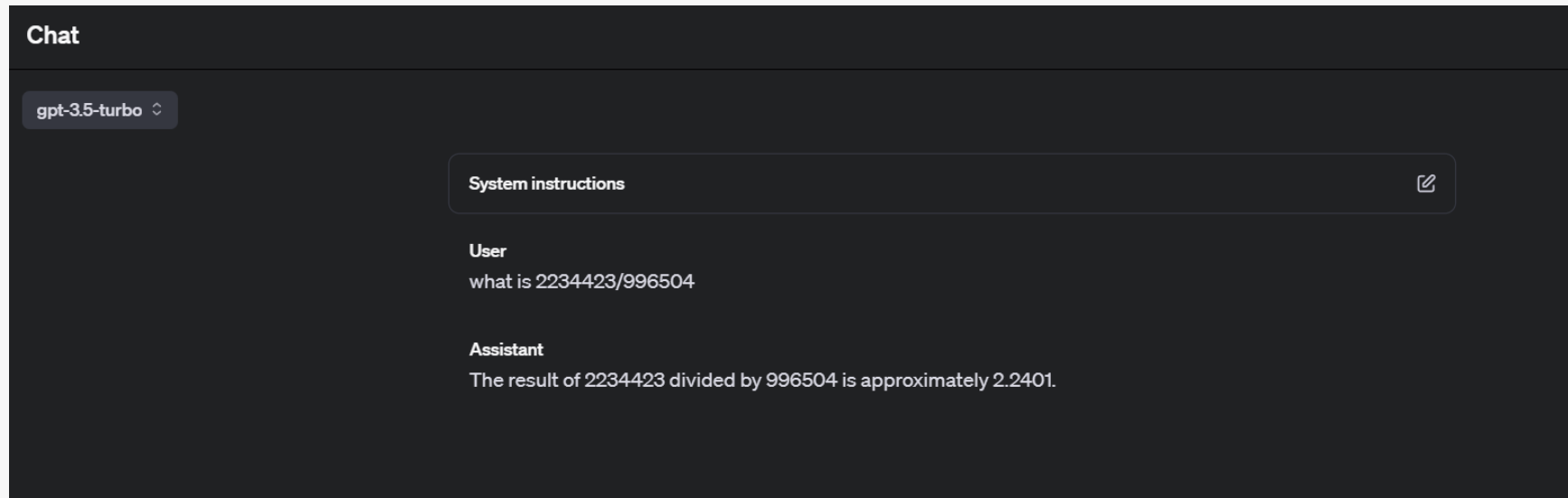
Letter counting is not it's strength

How many Rs are in „Strawberry“?



LLMs are not for Math

What is $2234423/996504$?



Actual: 2.242261

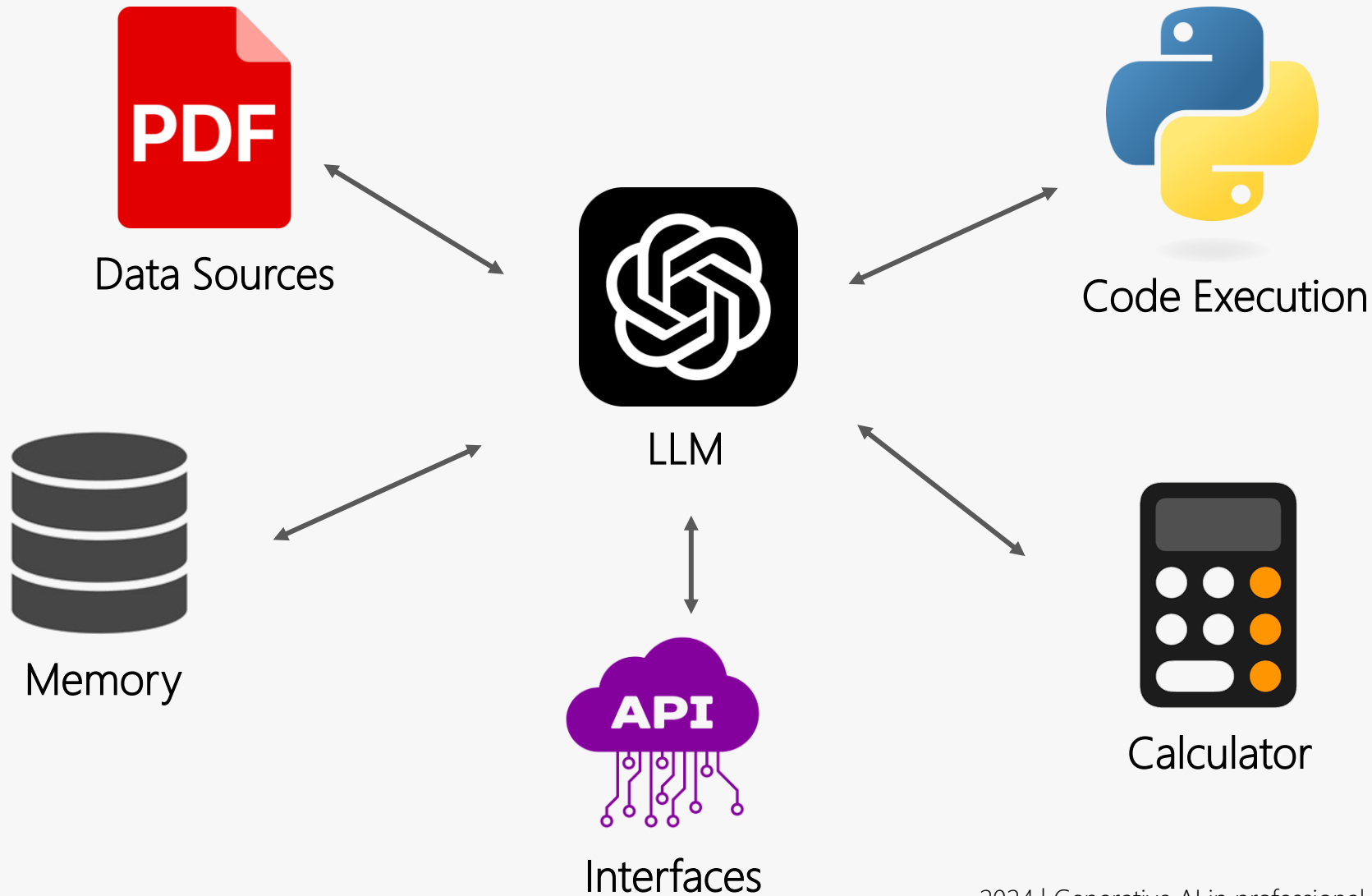
SOLUTIONS



Agents



Agents are LLMs interacting with Tools

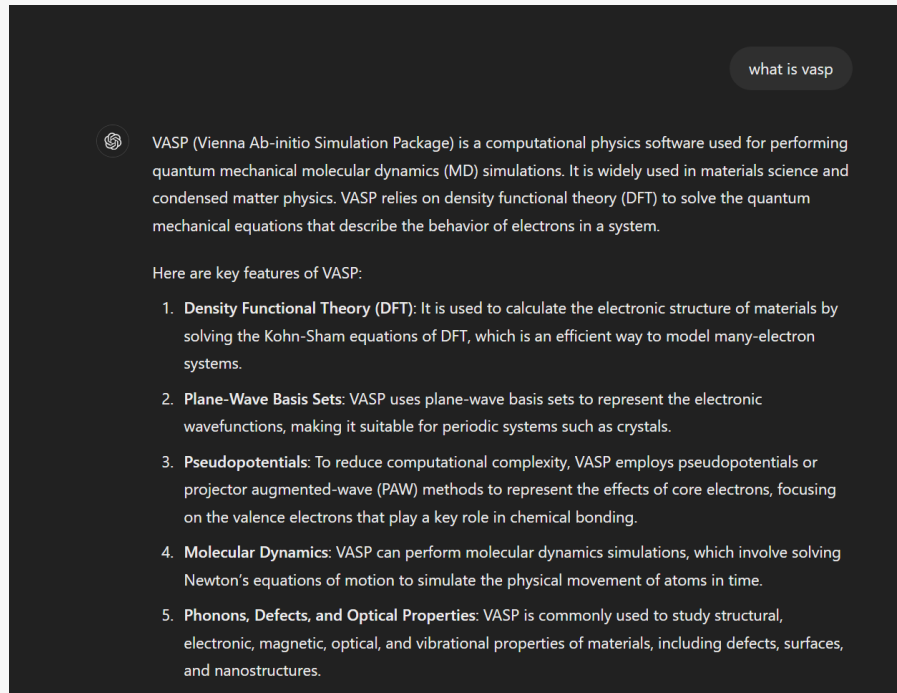


You can have multiple agents!

REAL WORLD APPLICATIONS

RAG (Retrieval Augmented Generation)

“Chat with GPTs world knowledge”



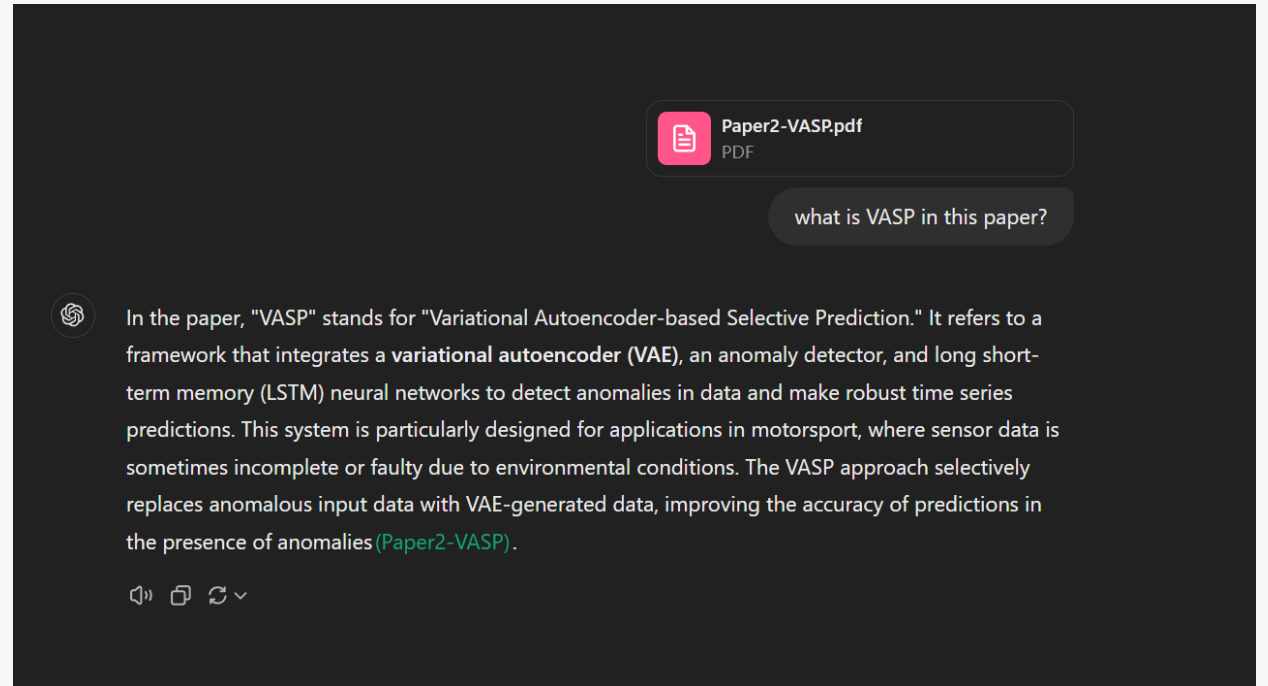
what is vasp

VASP (Vienna Ab-initio Simulation Package) is a computational physics software used for performing quantum mechanical molecular dynamics (MD) simulations. It is widely used in materials science and condensed matter physics. VASP relies on density functional theory (DFT) to solve the quantum mechanical equations that describe the behavior of electrons in a system.

Here are key features of VASP:

- Density Functional Theory (DFT):** It is used to calculate the electronic structure of materials by solving the Kohn-Sham equations of DFT, which is an efficient way to model many-electron systems.
- Plane-Wave Basis Sets:** VASP uses plane-wave basis sets to represent the electronic wavefunctions, making it suitable for periodic systems such as crystals.
- Pseudopotentials:** To reduce computational complexity, VASP employs pseudopotentials or projector augmented-wave (PAW) methods to represent the effects of core electrons, focusing on the valence electrons that play a key role in chemical bonding.
- Molecular Dynamics:** VASP can perform molecular dynamics simulations, which involve solving Newton's equations of motion to simulate the physical movement of atoms in time.
- Phonons, Defects, and Optical Properties:** VASP is commonly used to study structural, electronic, magnetic, optical, and vibrational properties of materials, including defects, surfaces, and nanostructures.

RAG: “Chat with your document”



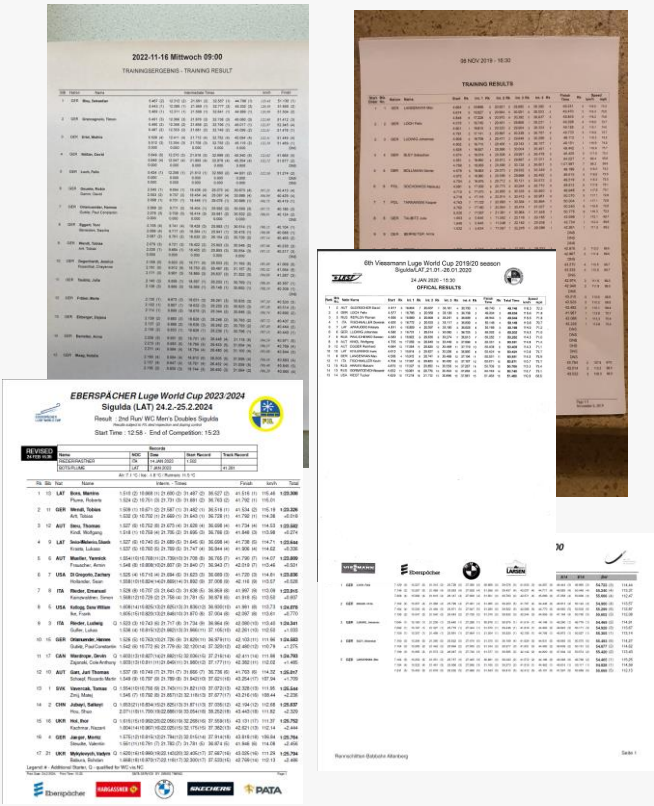
Paper2-VASP.pdf
PDF

what is VASP in this paper?

In the paper, "VASP" stands for "Variational Autoencoder-based Selective Prediction." It refers to a framework that integrates a **variational autoencoder (VAE)**, an anomaly detector, and long short-term memory (LSTM) neural networks to detect anomalies in data and make robust time series predictions. This system is particularly designed for applications in motorsport, where sensor data is sometimes incomplete or faulty due to environmental conditions. The VASP approach selectively replaces anomalous input data with VAE-generated data, improving the accuracy of predictions in the presence of anomalies ([Paper2-VASP](#)).

🔊 📄 ↻

Time Extraction Agent

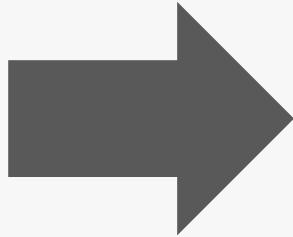


2022-11-16 Mittwoch 09:00
TRAININGSPROZESS - TRAINING RESULT

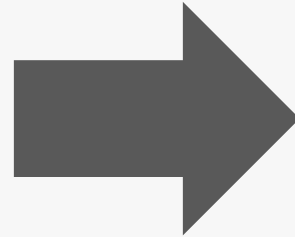
08. NOV. 2019 - 10:32
TRAINING RESULTS

6th Volkswagen Luge World Cup 2019/20 season
Sigulda (LAT) 24.2.-25.2.2024

EBERSPÄCHER Luge World Cup 2023/2024
Sigulda (LAT) 24.2.-25.2.2024



Custom Agent

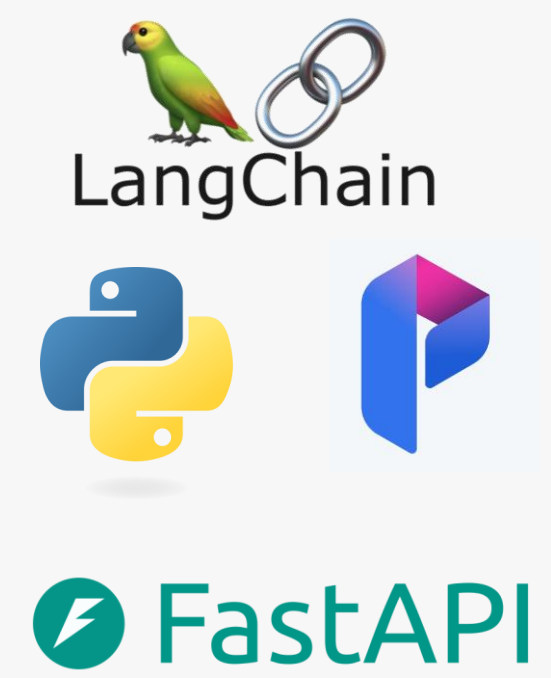
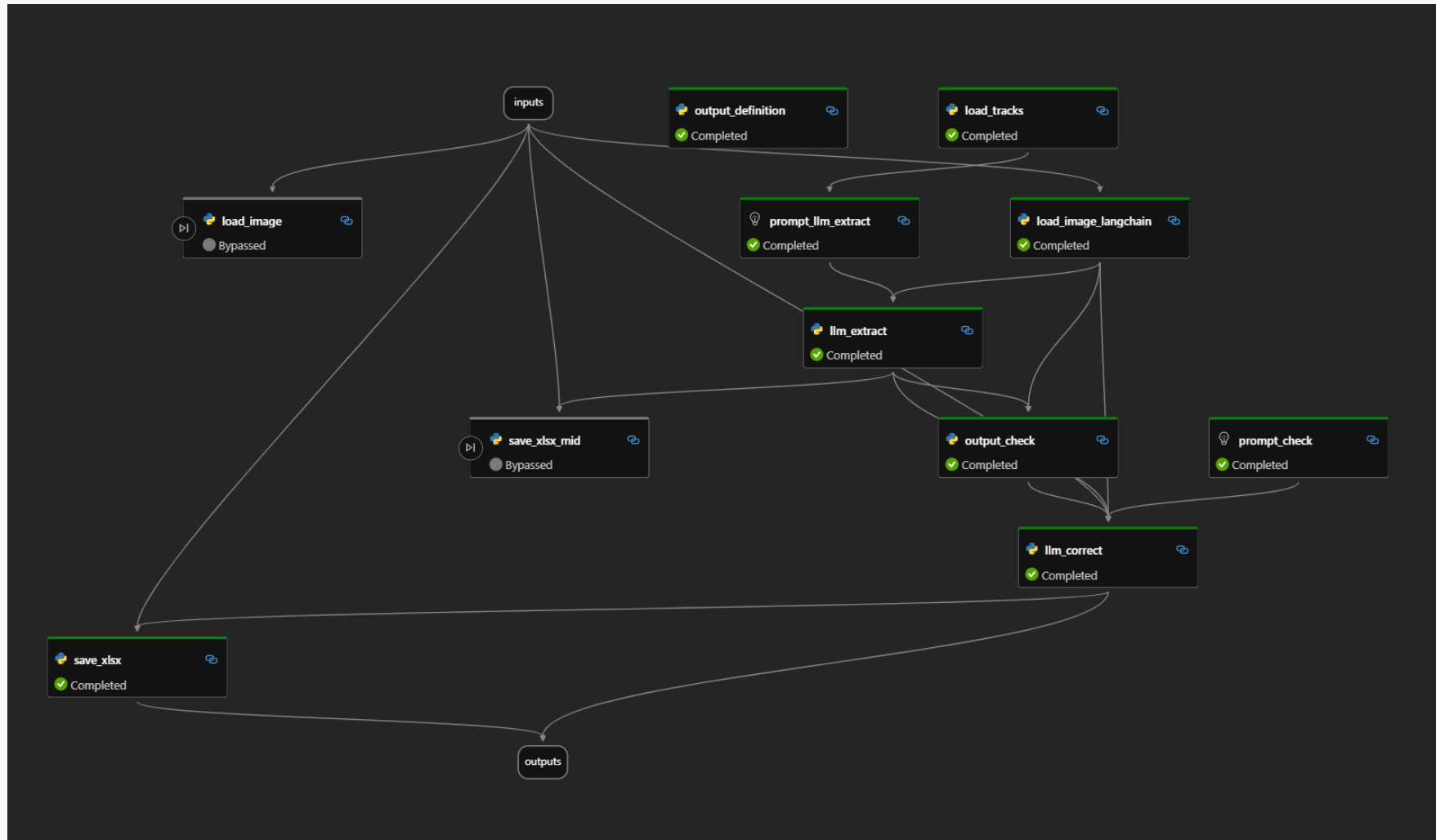


	A	B	C	D	E	F	G	H	I	J	K	L
1	Nation	LastName	FirstName	Run	I1	Rank_1	I2	Rank_12	I3	Rank_13	I4	Rank_14
2	GER	LOCH	Felix	1	7,53	5	22,061	5	32,02	4	40,391	4
3	GER	LOCH	Felix	2	7,504	5	22,12	4	32,183	4	40,638	4
4	GER	EIBLER	Chris	1	7,314	1	21,823	1	31,826	1	40,275	1
5	GER	EIBLER	Chris	2	7,354	2	21,943	2	32,029	2	40,555	2
6	GER	LUDWIG	Johannes	1	7,461	4	22,044	4	32,068	5	40,515	5
7	GER	LUDWIG	Johannes	2	7,48	4	22,123	5	32,199	5	40,706	5
8	GER	BLEY	Sebastian	1	7,317	2	21,874	3	31,907	3	40,365	3
9	GER	BLEY	Sebastian	2	7,257	1	21,816	1	31,891	1	40,412	1
10	GER	LANGENH	Max	1	7,346	3	21,864	2	31,862	2	40,277	2
11	GER	LANGENH	Max	2	7,387	3	22,018	3	32,113	3	40,615	3
12	GER	TIEBEL	Jessica	1	5,741	2	15,79	2	28,682	2	38,132	2
13	GER	TIEBEL	Jessica	2	5,753	2	15,902	2	28,929	2	38,539	2
14	GER	BERREITEF	Anna	1	5,695	1	15,67	1	28,487	1	37,882	1
15	GER	BERREITEF	Anna	2	5,73	1	15,851	1	28,866	1	38,434	1
16	GER	TAUBITZ	Julia	1	5,835	3	15,889	3	28,827	3	38,316	3
17	GER	TAUBITZ	Julia	2	5,916	3	16,042	3	29,081	3	38,688	3
18	GER	EGGERT	Toni	1	5,814	1	14,071	1	24,673	1	33,584	1
19	GER	EGGERT	Toni	2	5,83	1	14,147	1	24,891	1	33,993	2
20	GER	GEUKKE	Robin	1	5,92	3	14,22	3	24,854	3	33,796	3
21	GER	GEUKKE	Robin	2	5,864	2	14,217	3	24,968	3	34,049	3
22	GER	WENDL	Tobias	1	5,848	2	14,129	2	24,737	2	33,634	2
23	GER	WENDL	Tobias	2	5,876	3	14,204	2	24,943	2	33,979	1

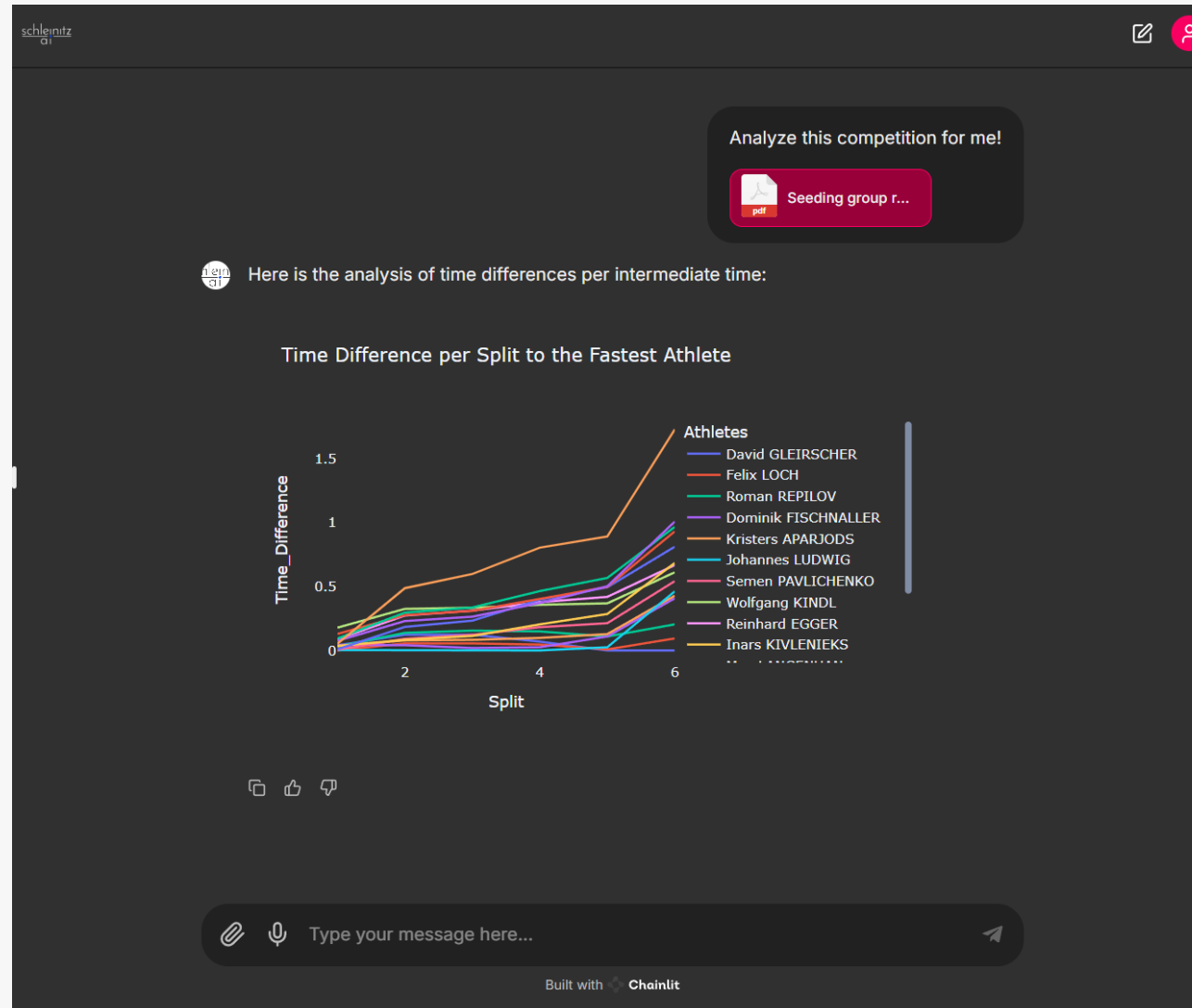
Structured Output

Images, PDFs, unstructured

Time Extraction Agent



In Development: Analyzer Chatbot



Analyze this competition for me!

Seeding group r...

Here is the analysis of time differences per intermediate time:

Time Difference per Split to the Fastest Athlete

Time_Difference

Split

Athletes

- David GLEIRSCHER
- Felix LOCH
- Roman REPILOV
- Dominik FISCHNALLER
- Kristers APARJODS
- Johannes LUDWIG
- Semen PAVLICHENKO
- Wolfgang KINDL
- Reinhard EGGER
- Inars KIVLENIKS

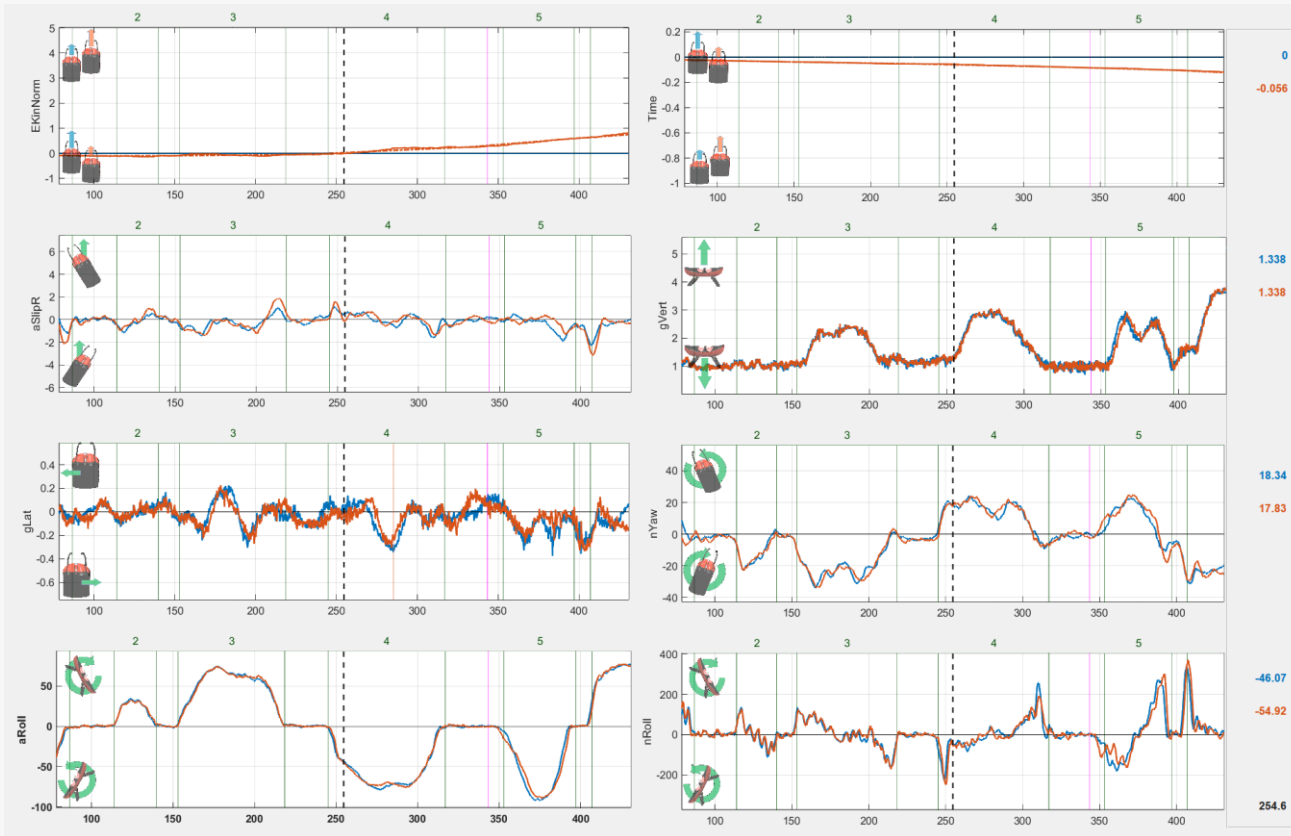
Copy Like Reply

Type your message here...

Built with Chainlit

Next Level Data Analytics

Time Series Analysis



- Requires expert knowledge
- Experts can do a quick analysis and tell athletes areas of improvements

Next Level Data Analytics

“How was Corner 7 to 8 now?”

GPTrainer



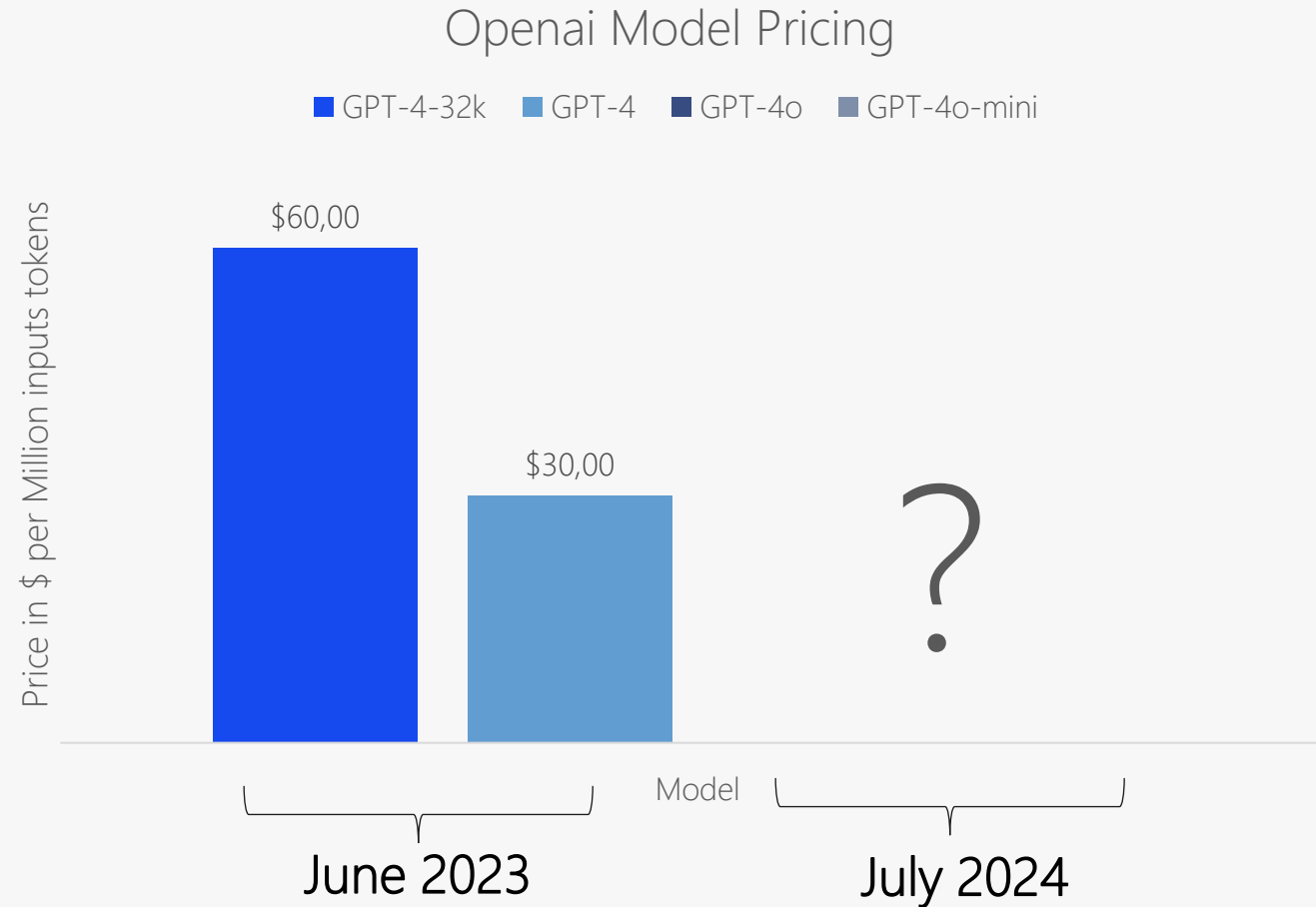
“In the second run (R3), the performance in the section from K07 to K08 was worse compared to the first run (R2).”

Areas of Improvement:

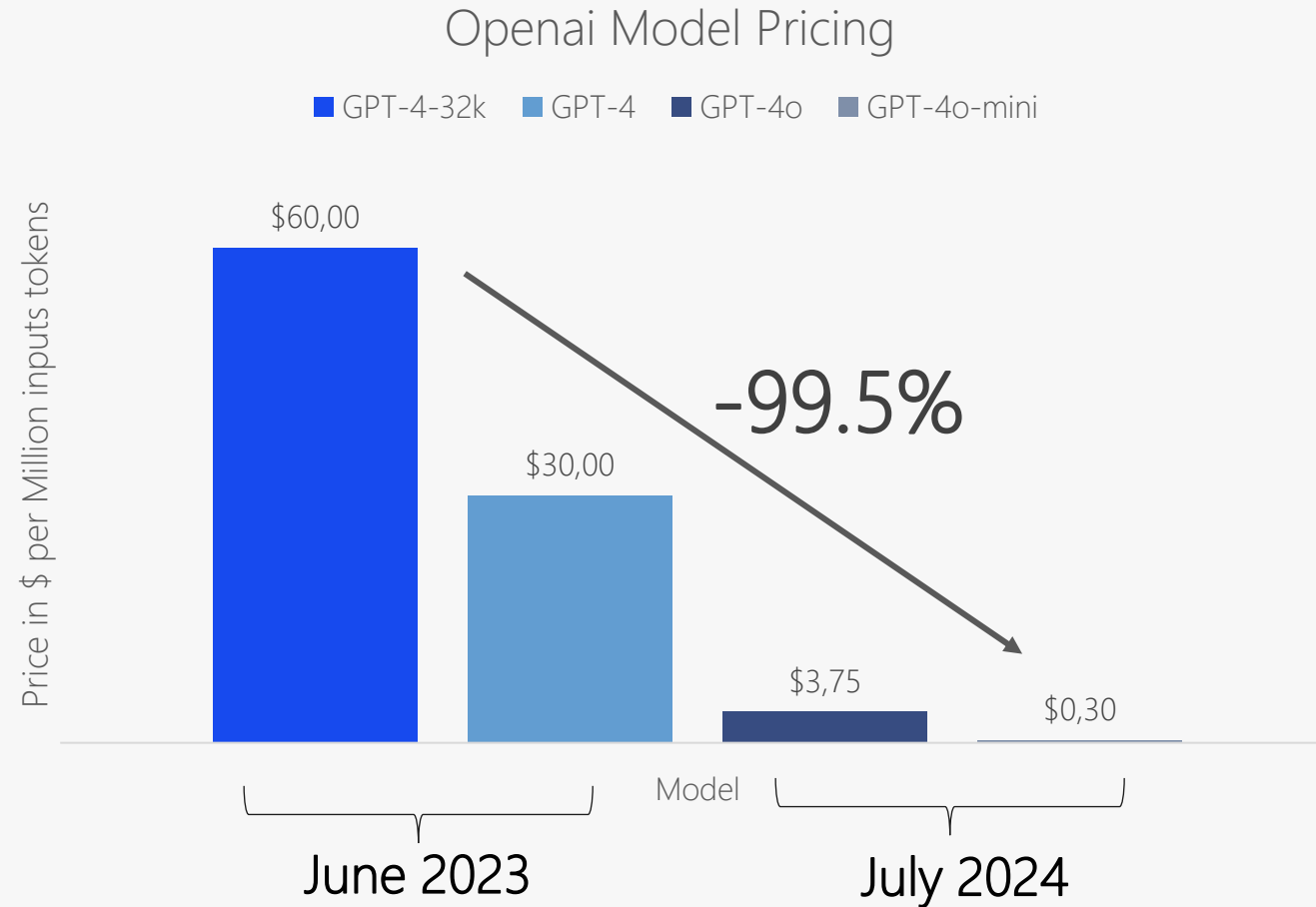
- In K07, the drift increased from 1.5° in R2 to 4.0° in R3. This was caused by a later and harsher entry, a higher top point, and a harsher exit. ”

WE ARE IN THE YEAR OF AI INDUSTRIALIZATION

Guessing Game: How did pricing develop?



Technology moves fast!



Takeaways



- Think about what you want to automate or make possible with AI.
- Start focusing on the actual important stuff and not repetitive work.
- Think how the competition might use AI.
- Become Data Driven.

- Never blindly trust AI.
- Don't mistake proficient language with knowledge.
- Do not stop to use your brain, ChatGPT & co. cannot not replace experts.

Thank you for your attention!

