

## Introduction to GenAl

Asoc. Prof. Ēvalds Urtāns (RTU, VeA) <a href="mailto:evalds.urtans@rtu.lv">evalds.urtans@rtu.lv</a>

HINCONIN DRIAGOUV

Employees: 30 Scientific Publications: 20



## What is artificial intelligence?



### What is artificial intelligence?



$$\begin{split} emb_p(x) &= \mathrm{PE}_{(pos,2i)} = \sin\left(\frac{pos}{10000^{2i/d_{onodel}}}\right), \quad \mathrm{PE}_{(pos,2i+1)} = \cos\left(\frac{pos}{10000^{2i/d_{onodel}}}\right) \\ & \mathrm{softmax}(z_i) = \frac{e^{z_i}}{\sum_{j=1}^n e^{z_j}} \\ & \mathrm{Attention}(Q,K,V) = \mathrm{softmax}\left(\frac{QK^T}{\sqrt{d_k}}\right)V \\ & \mathrm{LayerNorm}(x) = \frac{x-\mu}{\sqrt{\sigma^2+\epsilon}} \cdot \gamma + \beta \\ & \mathrm{FeedForward}(x) = \mathrm{ReLU}(x \cdot W_1 + b_1) \cdot W_2 + b_2 \\ & x' = W_e[x] + emb_p(x) \\ & x'' = \mathrm{LayerNorm}(\mathrm{Attention}(x') + x') \\ & for \ n = 1 \ \mathrm{to} \ N: \quad x''' = \mathrm{Attention}(Q,K,V) \\ & x'''' = \mathrm{LayerNorm}(\mathrm{FeedForward}(x''')) + x''') \\ & y = x \cdot W_e[x]^T + b \end{split}$$

### What is artificial intelligence?



$$emb_p(x) = \text{PE}_{(pos,2i)} = \sin\left(\frac{pos}{10000^{2i/d_{coodel}}}\right), \quad \text{PE}_{(pos,2i+1)} = \cos\left(\frac{pos}{10000^{2i/d_{coodel}}}\right)$$

$$softmax(z_i) = \frac{e^{z_i}}{\sum_{j=1}^n e^{z_j}}$$

$$\text{Attention}(Q, K, V) = softmax\left(\frac{QK^T}{\sqrt{d_k}}\right)V$$

$$\text{LayerNorm}(x) = \frac{x - \mu}{\sqrt{\sigma^2 + \epsilon}} \cdot \gamma + \beta$$

$$\text{FeedForward}(x) = \text{ReLU}(x \cdot W_1 + b_1) \cdot W_2 + b_2$$

$$x' = W_c[x] + emb_p(x)$$

$$x'' = \text{LayerNorm}(\text{Attention}(x') + x')$$

$$for n = 1 \text{ to } N : \quad x'''' = \text{Attention}(Q, K, V)$$

$$x'''' = \text{LayerNorm}(\text{FeedForward}(x''')) + x'''$$

$$y = x \cdot W_c[x]^T + b$$



### History

"4th industrial revolution" — investment & research = f(expectations, results) 1980's New hopes 2007 1970's Inflated Hype Data 2020 1956 Concerns explosion Dartmouth about Al led to Conference implications: improved 1987-1993 regulatory features 1974-1980 Al Winter II trends Al Winter I learning 1950 1960 1970 1980 1990 2000 2010 2020 Bottom-up kowledge representation: Top-down kowledge representation: Symbolic Al Connectivism

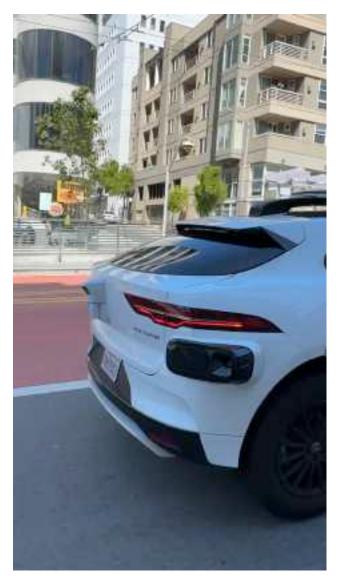
Explosive growth,

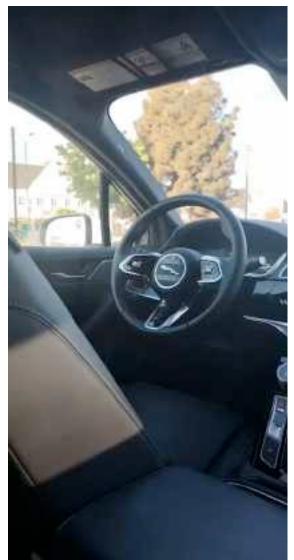
Hans Moravec's Robots, 1975



Tesla FSD, 2024



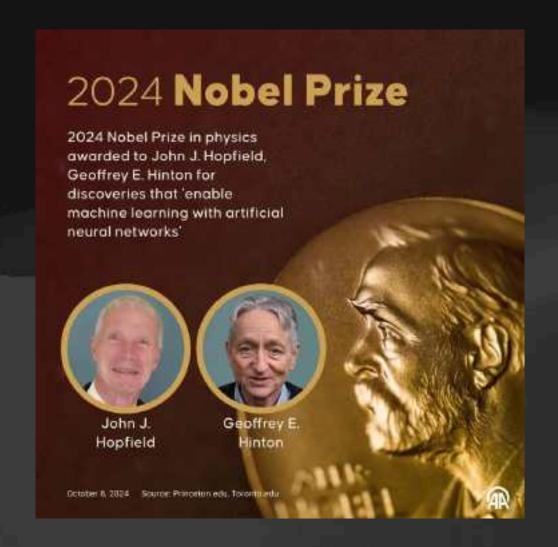


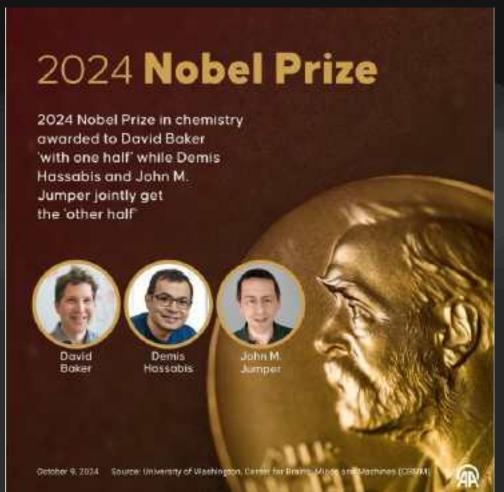










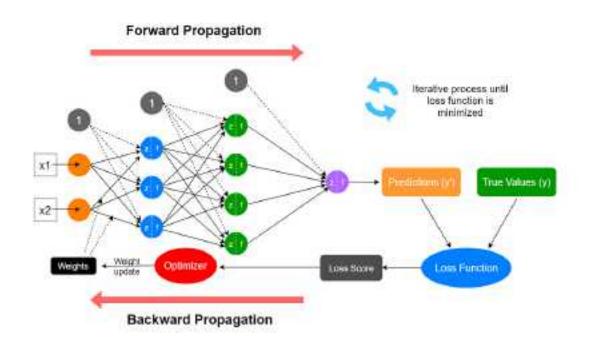


## Geoffery E. Hinton

### Godfather of AI, University of Toronto

#### Backpropogation algorithm

"Learning representations by back-propagating errors" David E. Rumelhart, Geoffrey E. Hinton & Ronald J. Williams, 1986





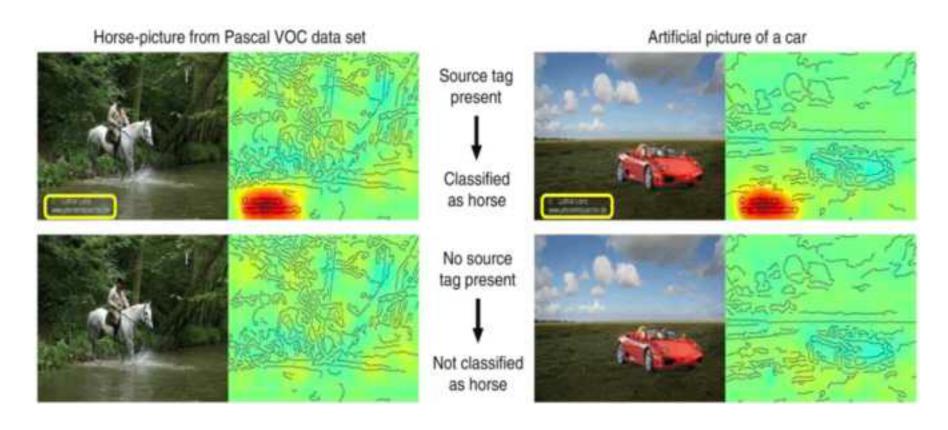


## Geoffery E. Hinton

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#### Backpropogation algorithm

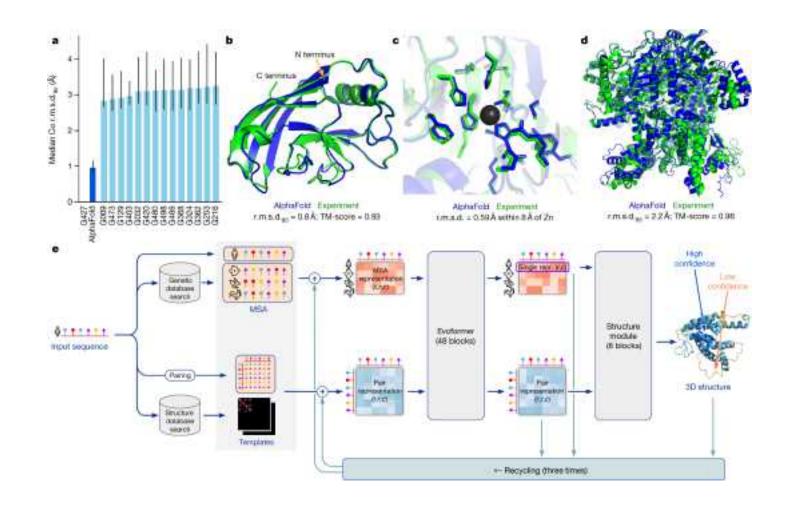
"Learning representations by back-propagating errors" David E. Rumelhart, Geoffrey E. Hinton & Ronald J. Williams, 1986



## John M. Jumper

DeepMind, University of Chicago (Theoretical Chemistry)

AlphaFold2, 2021



## John M. Jumper

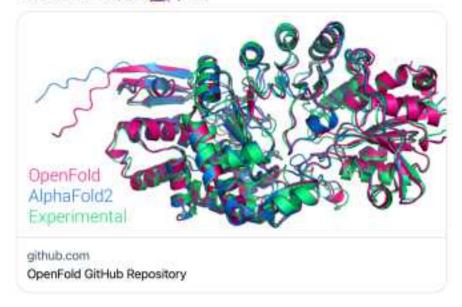
DeepMind, University of Chicago (Theoretical Chemistry)

AlphaFold3, Open-Source, 2024





We have successfully trained OpenFold from scratch, our trainable PyTorch implementation of AlphaFold2. The new OpenFold (OF) (slightly) outperforms AlphaFold2 (AF2). I believe this is the first publicly available reproduction of AF2. We learned a lot. A 1/12



### **Four Industrial Revolutions**









1765

1st revolution

1870

2<sup>nd</sup> revolution

1969

3rd revolution

### AUTOMATED

supported by electronics and information technologies

**PRODUCTION** 

### Today

4th revolution

#### **MECHANIZATION**

led by the steam engine

#### MASS PRODUCTION

driven by electricity and oil-based power

#### NEW TECHNOLOGIES

Internet of Things (loT), Artificial Intelligence (AI); Big Data, Cloud, Cyber-Physical Systems...

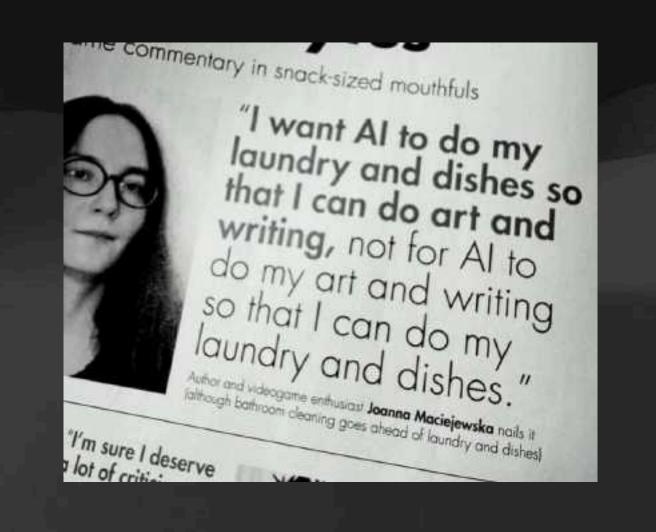






10 years 200m EUR

**STARSHIP** 





#### Al Is Already Taking Jobs in the Video Game Industry

A WIRED investigation finds that major players like Activision Blizzard, which recently laid off scores of workers, are using generative Al for game development.



## How Al Revolution Is Driving 200,000 Layoffs On Wall Street

Chris Westfall Contributor @

Guidance for leaders and aspiring leaders, interested in career impact

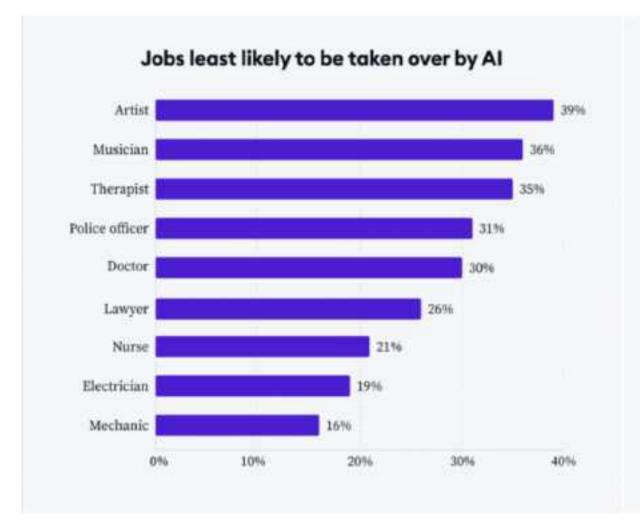


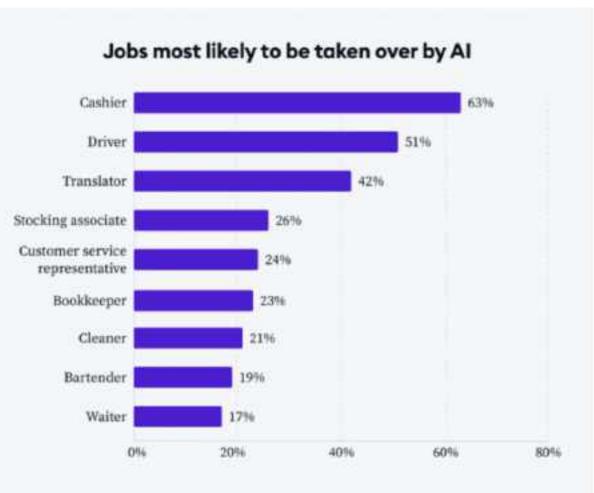
Jan 13, 2025, 11:00am EST

Updated Jan 26, 2025, 09:32pm EST

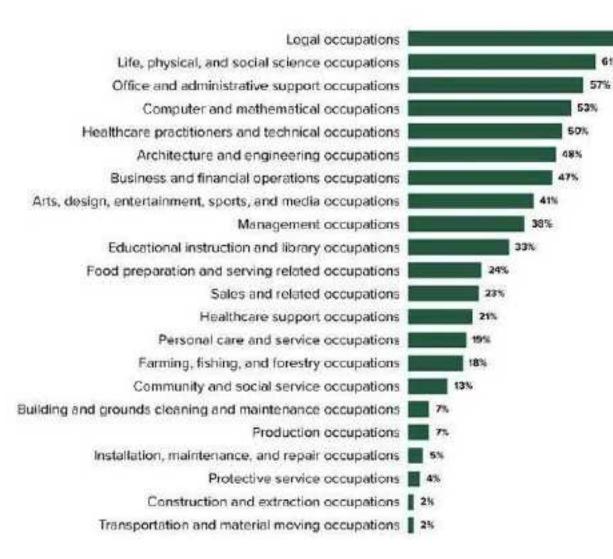


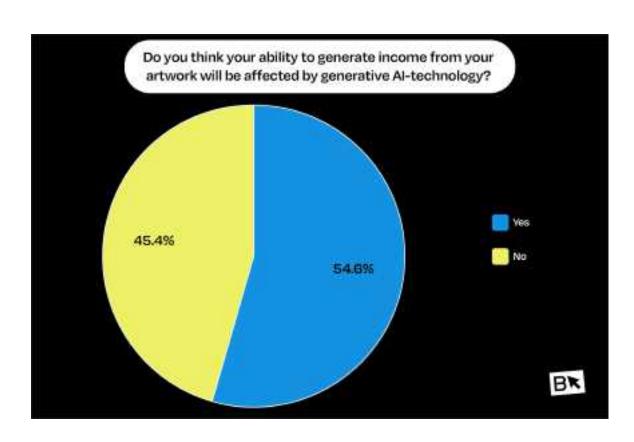
### Before GenAl



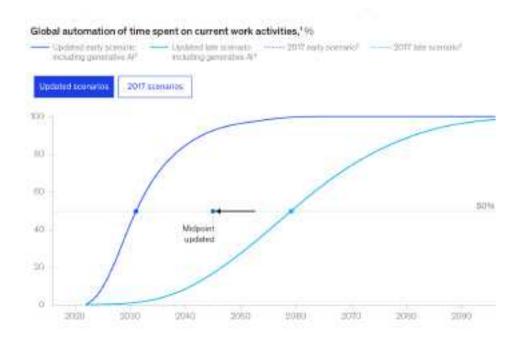


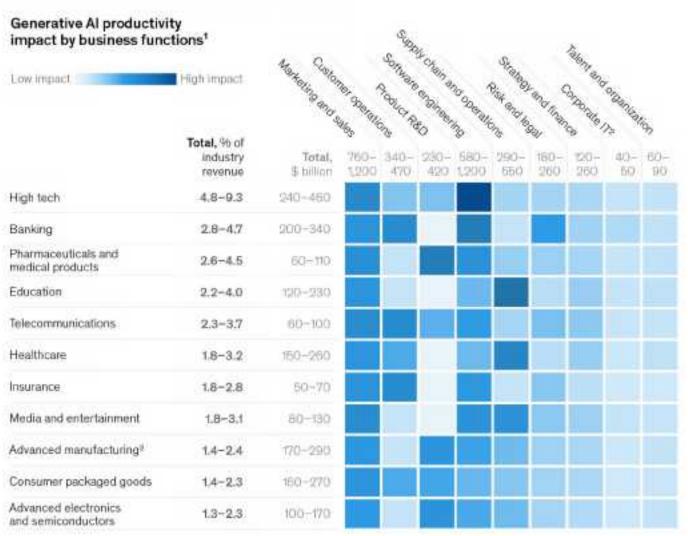
### After GenAl

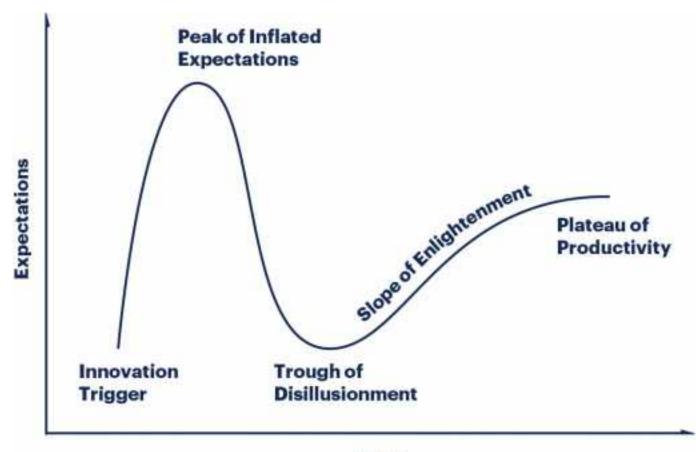




## Use of AI in business processes



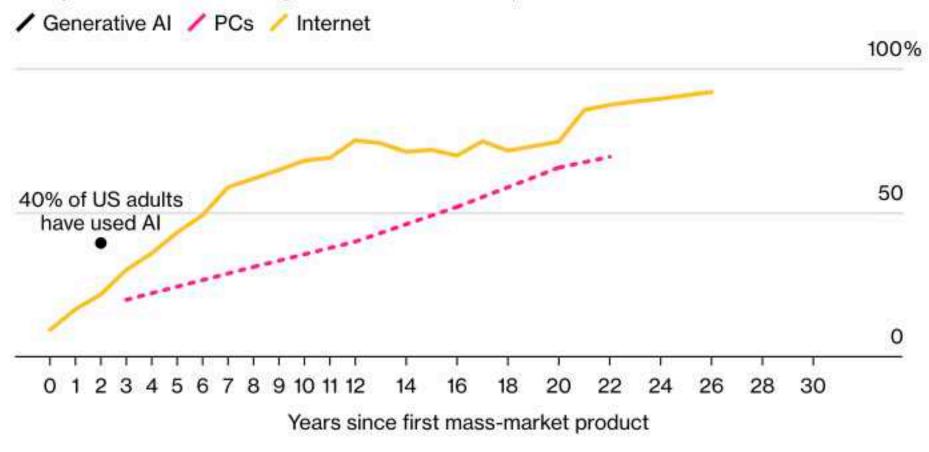




Time

#### Al Is Being Adopted Faster Than PCs Or the Internet

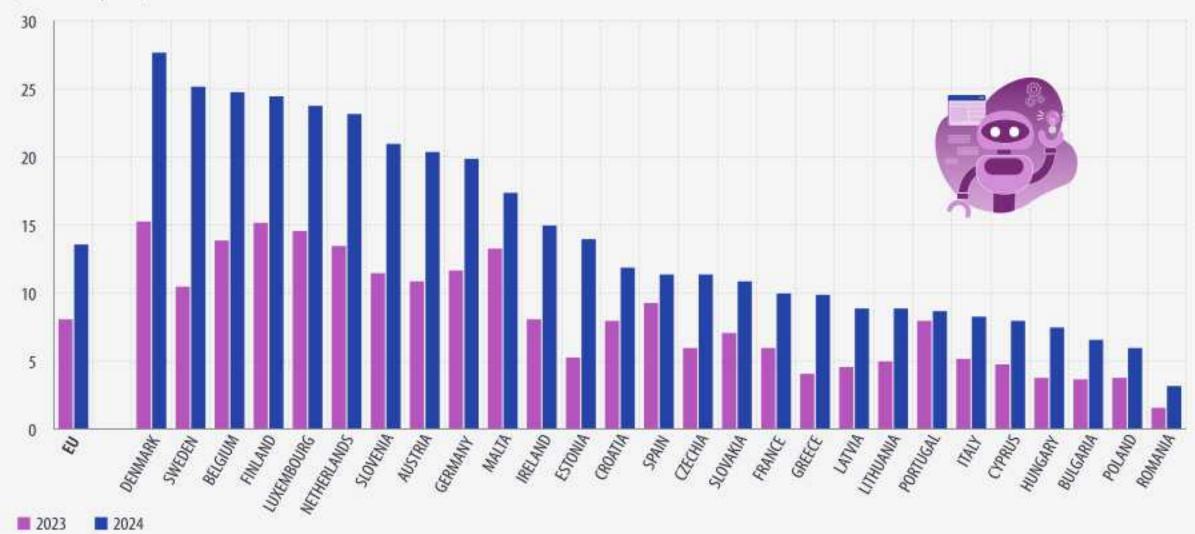
Adoption rates following first mass-market product.



Source: "The Rapid Adoption of Generative AI," by Alexander Bick, Adam Blandin and David J. Deming, NBER

#### Enterprises using AI technologies, EU, 2023 and 2024

(% of enterprises)

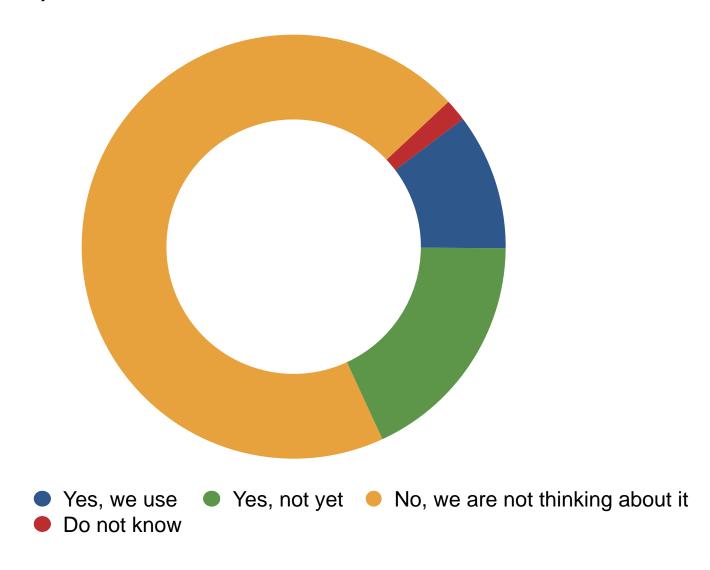


France and Sweden: break in time series in 2023.

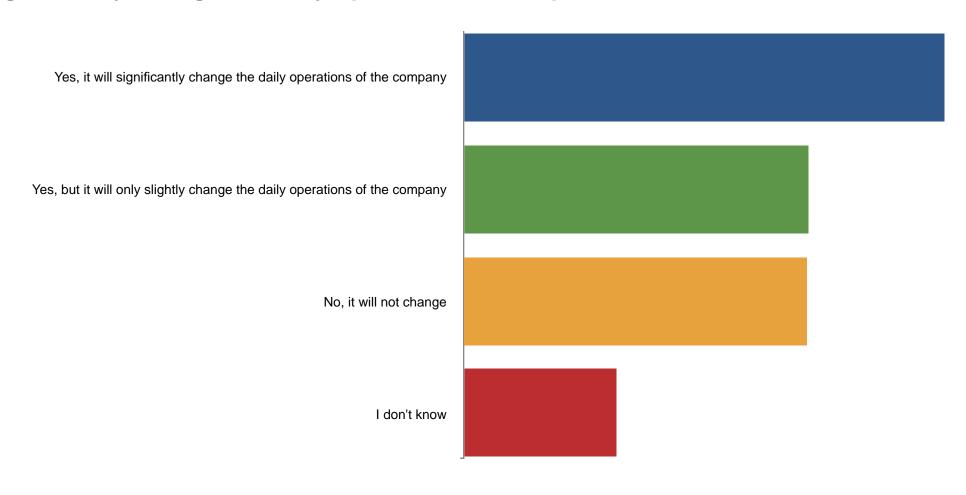




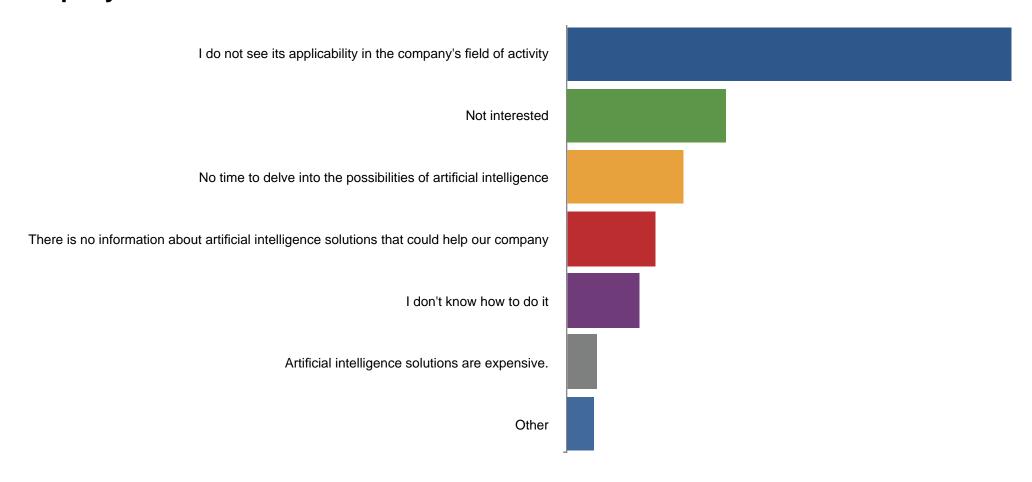
Have you considered implementing artificial intelligence solutions in the daily operations of your company? (n=800 2024 Nov)



### In your opinion, is the current hype around artificial intelligence justified, and will it really significantly change the daily operations of companies?

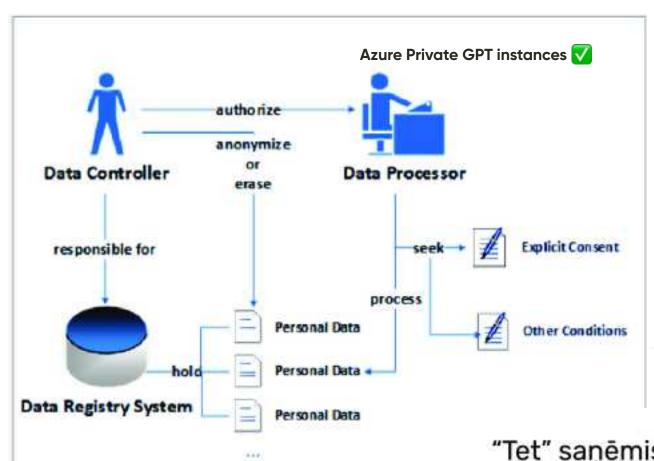


### Why have you not considered implementing artificial intelligence solutions in the daily operations of the company?



		T I	1 1	1 1 1	1: 1:
finanšu resursi (līdzekļu trūkums attīstībai un ieviešanai);	8%	10%	26%	53%	49
drošība (riski, kas saistīti ar personas datu aizsardzību/kiberdrošību u. tml.)	3%	18%	20%	53%	591
vadlīnijas (ar izstrādi vai ieviešanu saistītu vadlīniju trūkums)	10%	16%	22%	46%	694
juridiskie jautājumi (neizpratne par juridiskajiem jautājumiem / normatīvo regulējumu, izmantojot MI)	129	6 18%	26%		19% 5%
vīzija (MI izmantošanas vīzijas neesamība);	1196	20%	289	36	3496 696
infrastruktūra (nepietiekama infrastruktūra, lai ieviestu MI risinājumus)	5%	28%	249	96. 33	3% 1059
nformētība (nepietiekama informācija par iespējām, kas saistītas ar MI izmantošanu)	5%	22%	359	%	33% 49
odarbināto (darbinieku) prasmes (problēmas ar atbilstoša personāla pieņemšanu darbā vai esošo apmācību darbā ar MI)	8%	24%	3	3%	30% 5%
precizitāte (neprecīzu vai neuzticamu rezultātu risks)	4%	25%	33	96	29% 9%

### GDPR law



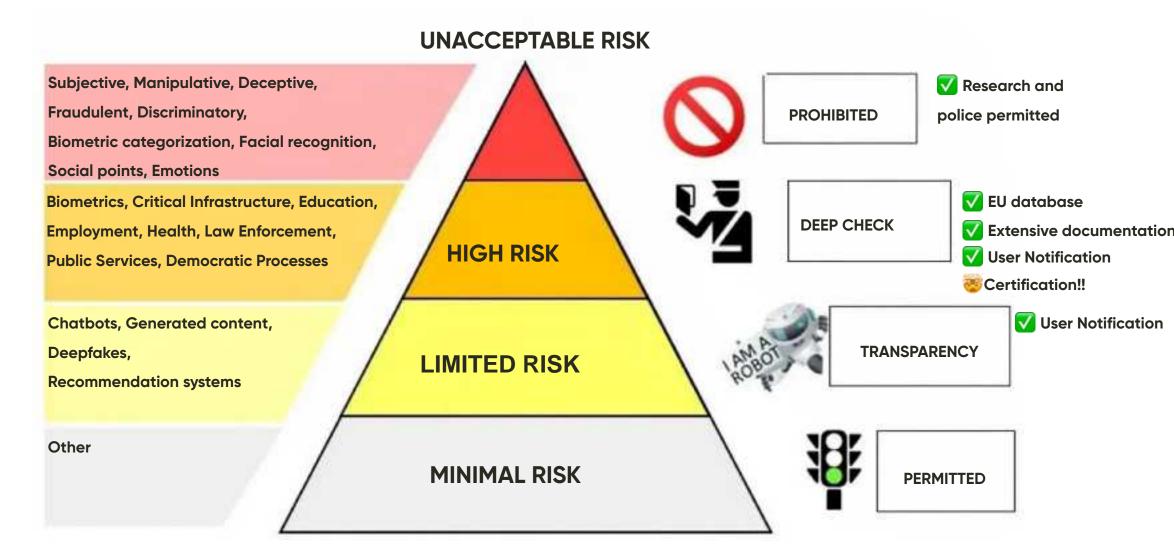
#### Short Version of Consumer Digital Privacy Protections in the EU, Canada and the US

Name	GDPR General Date Protection Regulation	PIPEDA Personal information Protection and Electronic Documents Act	No Central Law The county has specific less for certain seminals or Stones		
Company requires explicit consent for data gathering					
Default Opt-out for sharing personal data	<b>W</b>				
Default Opt-out for receiving marketing materials	•	•			
User has the right to access his own data					
User has the right to correct incorrect data					
User has the right to delete his data					

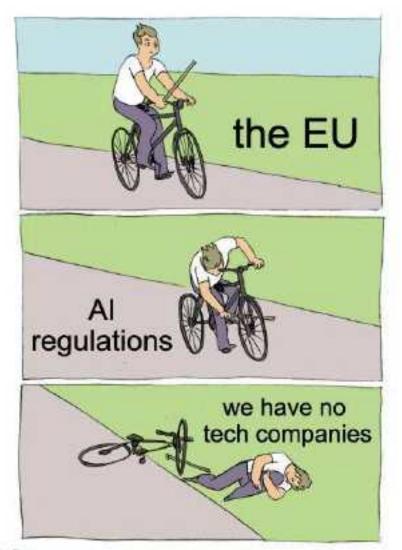
There are more details but as an overview, the table above illustrate the most important differences. In the United States, there are protections such as CCPA, HIPAA, FCRA and GLBA.

"Tet" saņēmis 1.2 miljonu eiro sodu par Vispārīgās datu aizsardzības regulas pārkāpumiem

### AILaw



## Overregulation





#### Meta-llama has disallowed access to this model in the EU

Downloads of this model are not accessible from the European Union (EU). Please see the Llama Acceptable Use Policy and License FAQ page for more information.

> OpenAl's Advanced Voice mode is unavailable in the EU, and now we might know why



By Graham Barlow last updated October 3, 2024

TECH

# Apple Intelligence won't launch in EU in 2024 due to antitrust regulation, company says

FUBLISHED FRI. JUN 21 2024-2-01 PM EDT | UPDATED FRI. JUN 21 2024-3:01 PM EDT





## Overregulation

#### Spacecraft Launched by Provider

In Q1, SpaceX launched 502 spacecraft, the most of any launch provider



Choice Agrospanie Science and Sententing Toxocomous (CASIC)

Arterial Source

#### The European Space Law (EUSL)

#### What is the European Space Law (EUSL)?

On the 13th of September 2023, in the State of the Union, President von der Leyen presented Commission priorities for 2024.

The Letter of intent included an initiative for an EU Space Law (EUSL). The legislative proposal envisages common EU rules addressing the safety, resilience and sustainability of space activities and operations. It intends to avoid and remove fragmentation and barriers across the single market caused by the heterogeneity or lack of national space legislations, while ensuring the competitiveness of the European space sector in an international trade context.

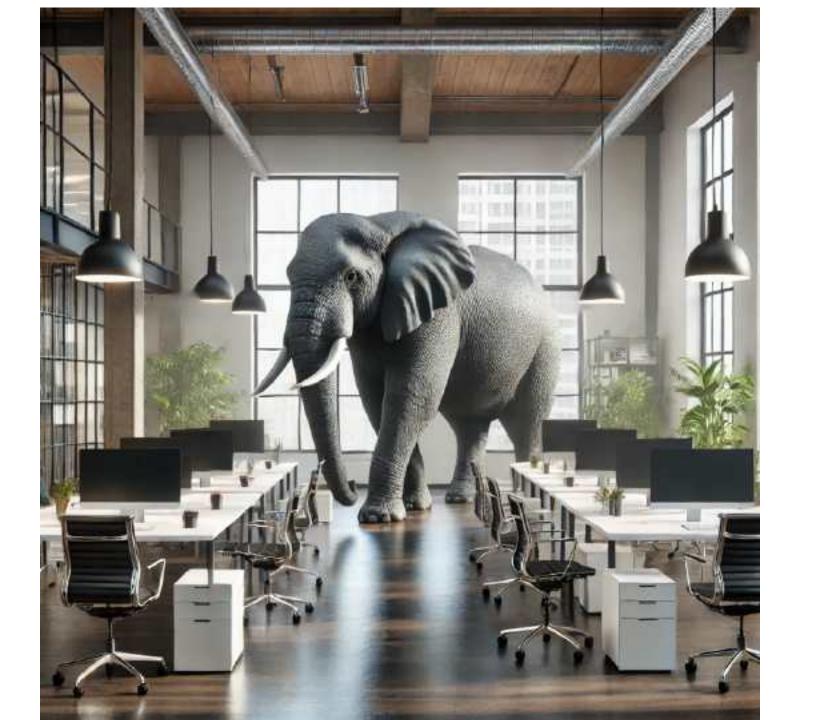


### **LATVIJA**

### Al Doors to Europe

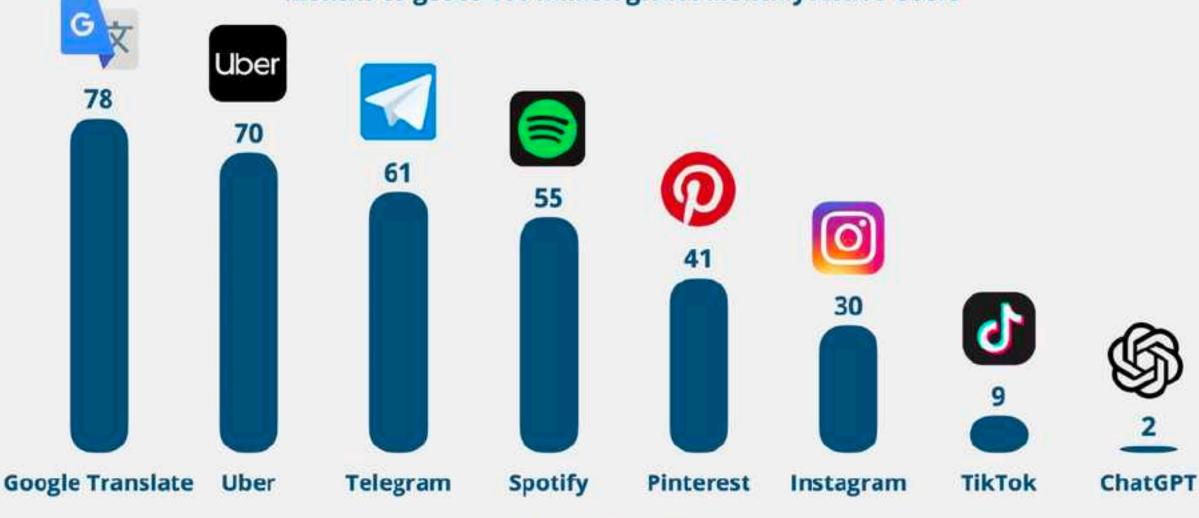
www.mila.lv





## **Time to Reach 100M Users**

Months to get to 100 million global Monthly Active Users



Source: UBS / Yahoo Finance





#### III. PROPOSED SYSTEM

As an Al language model, I can provide some general information on the proposed system for the analysis, design, and implementation of a single-stage multi-pulse flexible-topolog hyristor rectifier for battery charging in electric vehicles. The proposed system aims to develop a high-efficiency and reliable battery charging system for electric vehicles. The system utilizes a single-stage multi-pulse flexible-topology thyristor rectifier to convert the AC input voltage to DC voltage for charging the vehicle's battery. This rectifier has a flexible topology that can handle a wide range of input voltages and frequencies, making it suitable for charging electric vehicle batteries from different power sources. The system also includes a control mechanism that ensures the rectifier operates at maximum efficiency while maintaining the battery's safety and health. The control mechanism regulates the rectifier's output voltage and current to ensure that the battery is charged in a controlled and safe manner. It also monitors the battery's status and adjusts the charging process accordingly to prevent overcharging or overheating. The proposed system is designed to be compact and lightweight, making it easy to install and use in electric vehicles. It is also designed to be cost-effective while providing high performance and reliability, which is essential for the widespread adoption of electric vehicles. The proposed system for the analysis, design, and implementation of a single-stage multi-pulse flexible-topology thyristor rectifier for battery charging in electric vehicles is a promising solution for the development of efficient and reliable battery charging systems for electric vehicles.

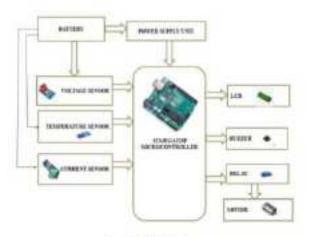


Fig. 1 Block Diagram

#### Your text is AI/GPT Generated



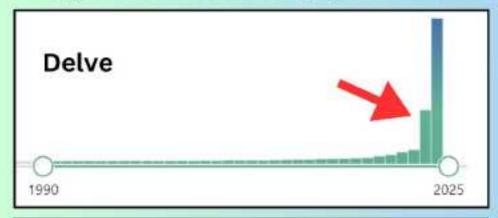
Thesis statement: While the pandemic has undoubtedly caused immense suffering, there is insufficient evidence to support the claim that COVID caused a significant increase in suicides.

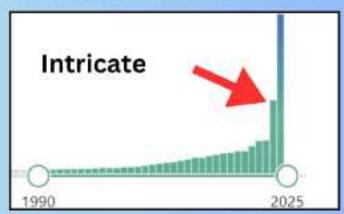
The COVID-19 pandemic has been one of the most significant global events in recent history, causing widespread disruptions to daily life and causing major economic and social impacts. With the pandemic's negative effects on mental health, many have speculated that suicide rates have increased. However, there is insufficient evidence to prove that the COVID-19 pandemic caused a significant increase in suicides.

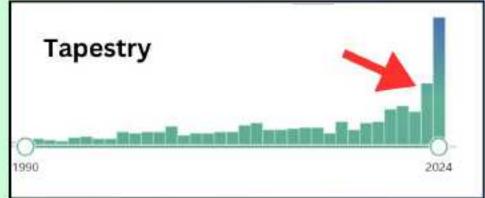
One argument against the claim that COVID-19 caused an increase in suicides is that suicide is a complex issue, and it is difficult to attribute the cause to any single factor. For instance, in the United States, suicide rates had been increasing for several years before the pandemic. Additionally, studies have found that multiple factors influence suicide rates, such as mental health conditions, economic instability, and social isolation. Therefore, it is challenging to attribute any increase in suicide rates solely to the COVID-19 pandemic.

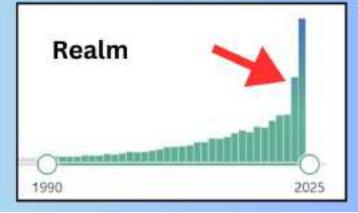
https://www.reddit.com/r/ChatGPT/comments/12lf06e/anybody\_know\_which\_ai\_detector\_this\_is\_it\_falsely/

# How often the words "delve," "intricate," "tapestry," and "realm" appeared in research papers in PubMed database from 1990-2024









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nature > news feature > article

NEWS FEATURE | 25 July 2023

# ChatGPT broke the Turing test – the race is on for new ways to assess AI

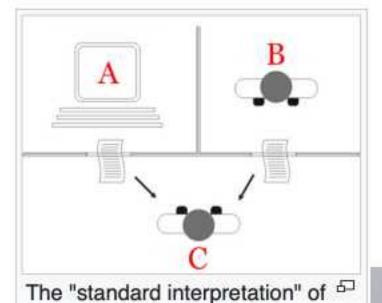
Large language models mimic human chatter, but scientists disagree on their ability to reason.

By Celeste Biever









# IQ 135

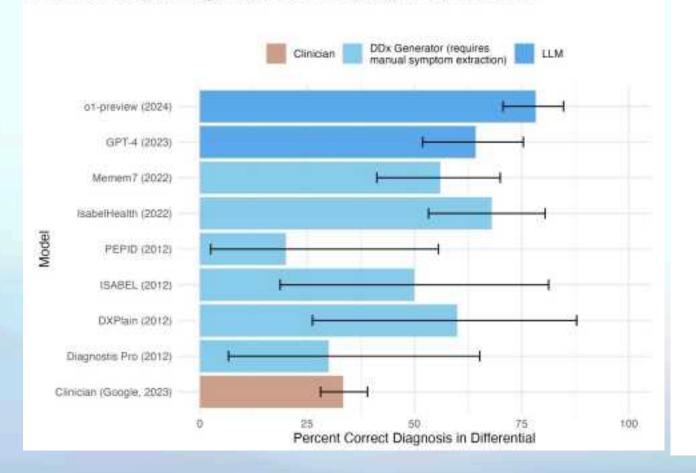
2025

This site quizzes 16 Verbal & 8 Vision Als every week | Last Updated: 03:22PM EDT on June 19, 2025 About Offline Test 1 About Mensa Norway 1 Show Offline Test | Show Mensa Norway **IQ Test Results** Vision Onl Vision One Mensa Norway IQ Scores (Average of last 7 tests) TrackingAl.org Mensa Norway quiz A MaximumTruth.org Project 100 Average IQ 50 60 70 110 120 130 140 150 80 160 Gemini 2.0 Flash Thinking Exp. Claude-4 Opus (Vision) @ Grok-3 Claude-4 Sonnet (Vision) Mistral Claude-4 Opus GPT-4o (Vision) Claude-4 Sonnet GPT-40 Llama-3.2 (Vision) Gemini 2.5 Pro Exp. Gemini 2.5 Pro Exp. (Vision) Bing Copilet DeepSeek V3 O DeepSeek R1 OpenAl o3 (Vision) Grok-3 Think (Vision) Grok-3 Think Llama 4 Maverick OpenAl o3 OpenAl o3 Pro (Vision) OpenAl o3 Pro OpenAl o4 mini OpenAl o4 mini high

# Labāks par ārstu

2025

Figure 1. Performance of Differential Diagnosis Generators and LLMs on NEJM Clinicopathologic Case Conferences (CPCs) 2012-2024



#### The New Hork Times

A.J. Forecast A.J.'s Super Bowl Google's Anthropic Investment Why

#### A.I. Chatbots Defeated Doctors at Diagnosing Illness

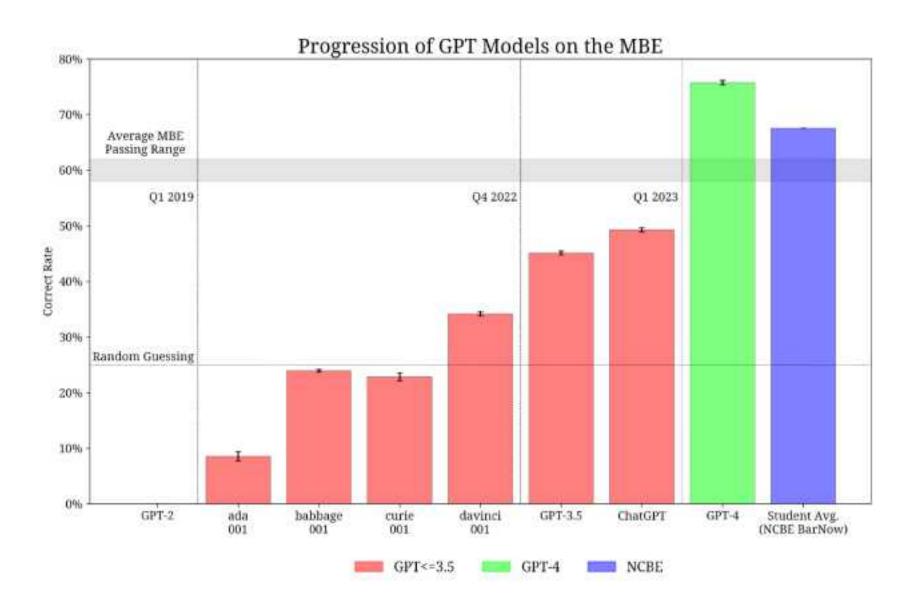
A small study found ChatGPT outdid human physicians w assessing medical case histories, even when those doctors v using a chatbot.

Listen to this article 9:25 min Legitumos

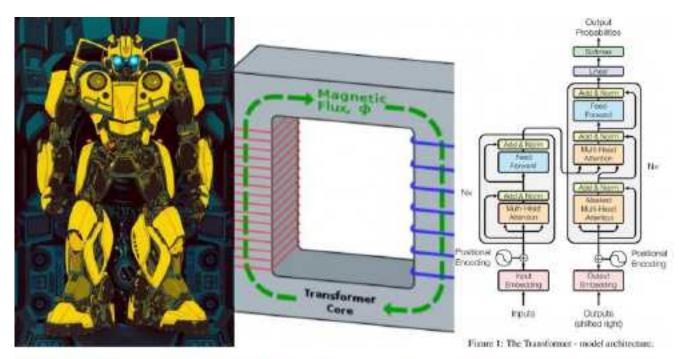




In an experiment, doctors who were given CharGPT to diagnose illness did only slightly better than doctors who did not. But the chathot alone autperformed all t doctors. Michatia Guatation for The New York Times.



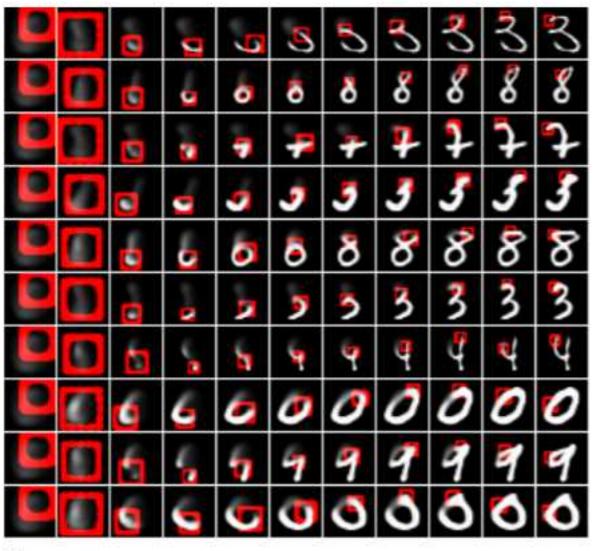
### **Modelis**



Transformers Transformers at school at college

today

## **Modelis**



Time →

### **Modelis**

```
The FBI is chasing a criminal on the run.
The FBI is chasing a criminal on the run.
     FBI is chasing a criminal on the run.
     FBI is chasing a criminal on the run.
The
              chasing a criminal on the run.
The
     FBI
               chasing a criminal on the run.
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               chasing
The
     FBI
                           criminal on the run.
               chasing
     FBI is
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The
The
               chasing
                           criminal on
                                         the run.
The
     FBI
               chasing
                           criminal
                                         the run.
                                     on
```

- BERT (Google), GPT (OpenAI),
  2018
- ~8k tokens\*\* (or tradeoffs,100k)
   3000 vārdi
- CommonCrawl, Wikipedia, Reddit

#### Tikai čats

Write answer to question in History exam about Europe.

Output in 1 paragraph using facts and numbers.

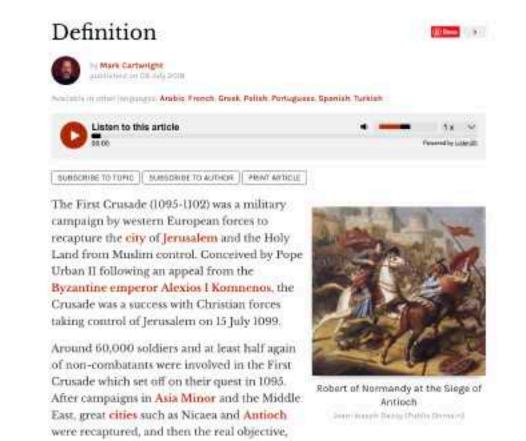
Question: "Describe the The First Crusade. Why did it happen, what were the causes, and what were the consequences?"

The First Crusade (1096–1099) was launched by Pope Urban II in response to a call for help from the Byzantine Empire, which was under threat from the Seljuk Turks. Motivated by religious zeal, the promise of indulgences, and the desire for wealth and land, tens of thousands of European knights, peasants, and nobles took part. The main causes included the growing power of Muslim states in the Holy Land, the Byzantine request for military aid, and the papacy's goal of unifying Western Christendom under its leadership. The crusaders, despite suffering heavy losses, captured Jerusalem in 1099, massacring its Muslim and Jewish inhabitants. This victory established several Crusader states, including the Kingdom of Jerusalem, but also intensified Christian-Muslim conflict, leading to further crusades over the next two centuries.



#### First Crusade

#### Atrodam faktus





## Meklēšanas dzinēji

Source: ARK Invest, SimilarWeb.

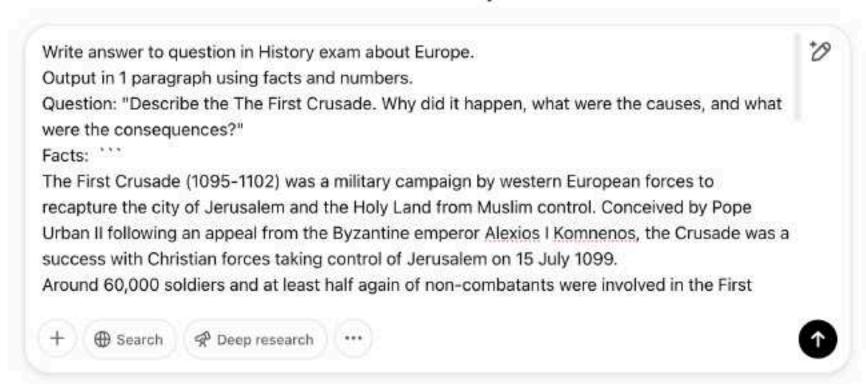
• perplexity.ai

- ChatGPT Search
- gemini.google.com
- chat.bing.com
- chat.you.com



## Pievienojam faktus

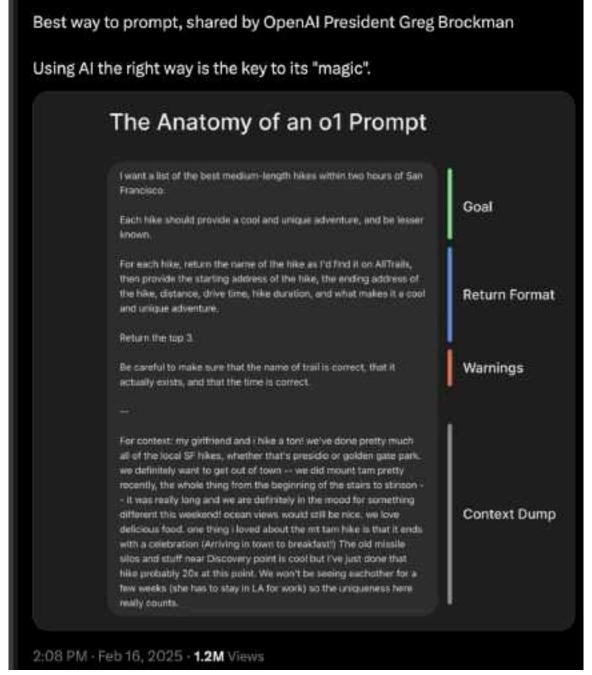
#### What can I help with?



# 10 x Labāks Rezultāts

Write answer to question in History exam about Europe. Output in 1 paragraph using facts and numbers. Question: "Describe the The First Crusade. Why did it happen, what were the causes, and what were the consequences?" Facts: The First Crusade (1095-1102) was a military campa Around 60,000 soldiers and at least half again of Mar 1096 The people's army led by Peter ti 1097 The First Crusaders arrive at Constan 1097 A Crusader army wins a great victory 10 Jul 1099 Siege towers are built by the 15 Jul 1099 Jerusalem is captured during ' 10 Aug 1099 A Muslim army is sent to recap 17 May 1101 Caesarea is captured by the C c. 1130 Albert of Achen's account of the I

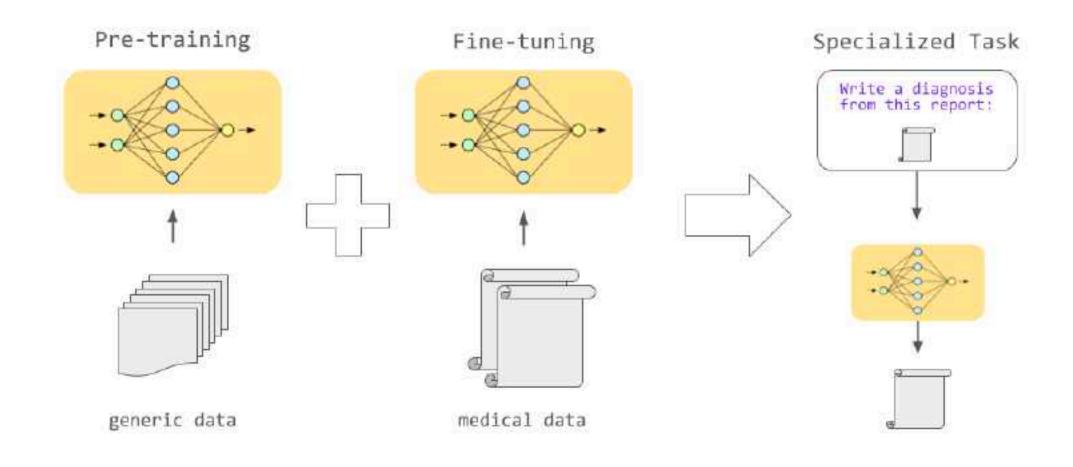
The First Crusade (1095-1102) was launched to reclaim Jerusalem and the Holy Land from Muslim control, initiated by Pope Urban II after a request for military aid from Byzantine Emperor Alexios I Komnenos. Motivated by religious fervor, the promise of indulgences, and political ambitions, around 60,000 soldiers and thousands of non-combatants embarked on the campaign in 1095. Key battles included a victory at Dorylaion (1097) and the capture of major cities such as Nicaea, Antioch, and Jerusalem, which fell on 15 July 1099 after a brutal siege. A Muslim counterattack at Ascalon (10 August 1099) was repelled, securing Crusader control over Jerusalem. The success of the First Crusade led to the establishment of Crusader states but also intensified Christian-Muslim conflicts, setting the stage for further Crusades and even attacks on Christian-held cities like Constantinople in later campaigns.

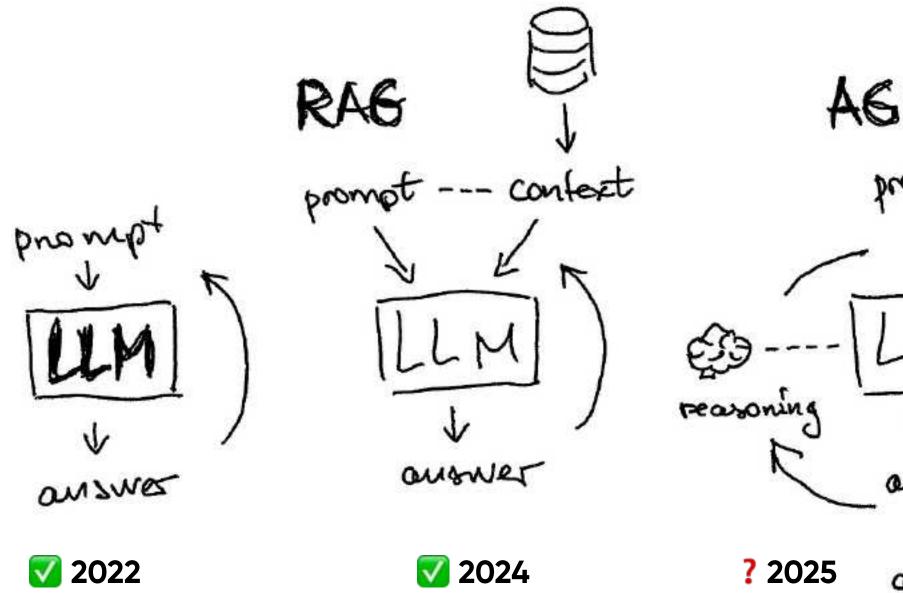


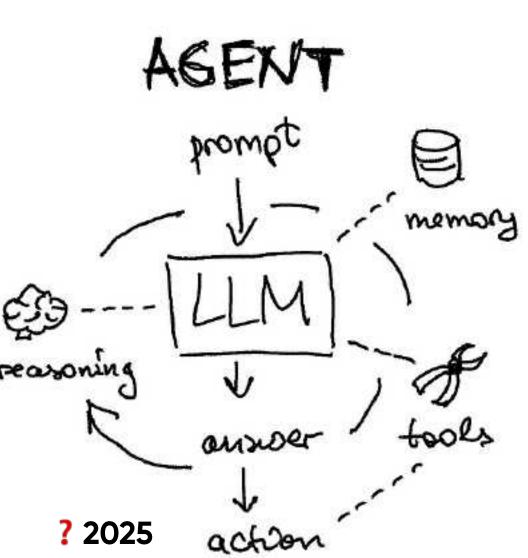
# Not an oracle, but ImproTheater



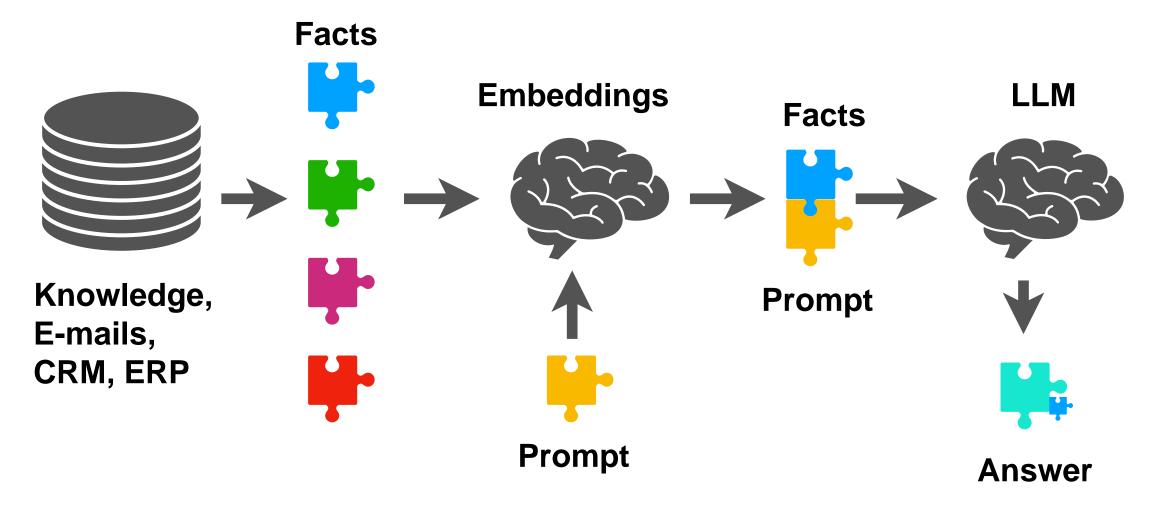
# Training of models (LLM Studio, HuggingFace PyTorch)



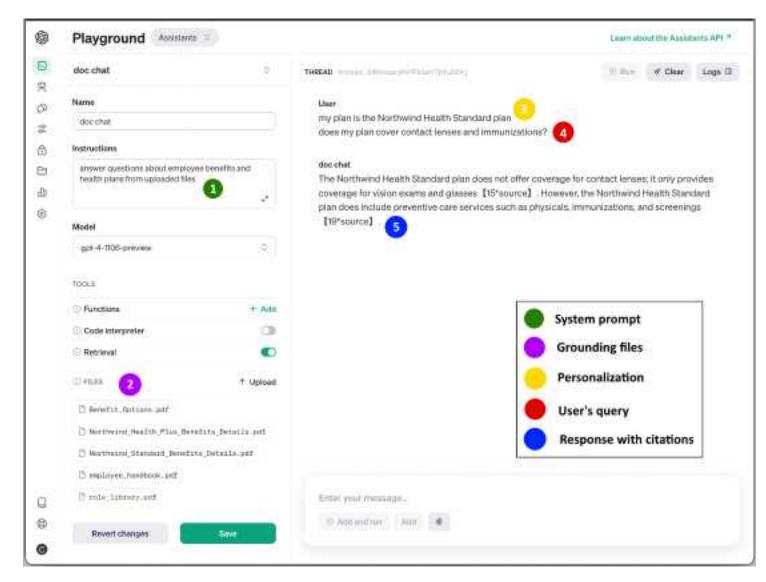




# RAG (Retrieval Augmented Generation)



# Open Al - Projects / Perplexity - Spaces

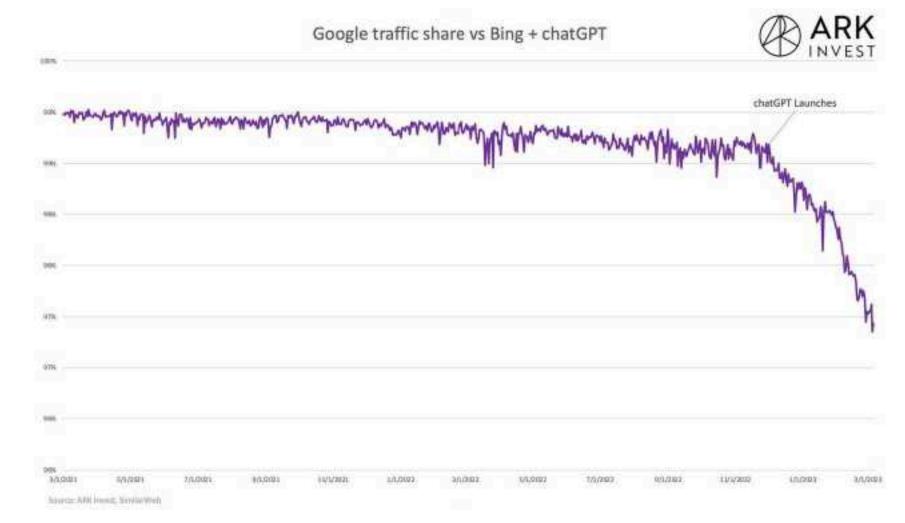


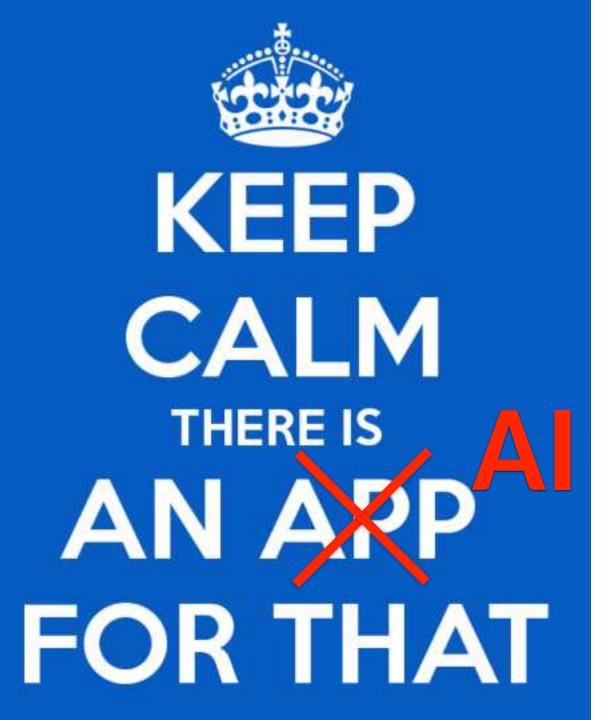


## Al search engines

#### Al search engines:

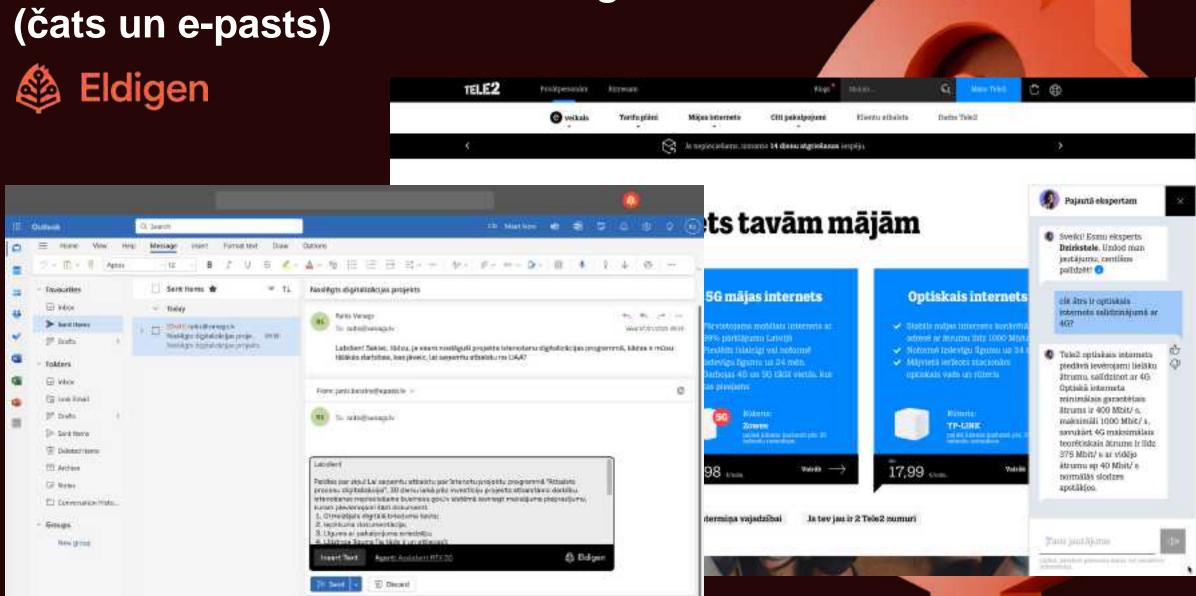
- perplexity.ai
- ChatGPT Search
- gemini.google.com
- chat.bing.com
- chat.you.com



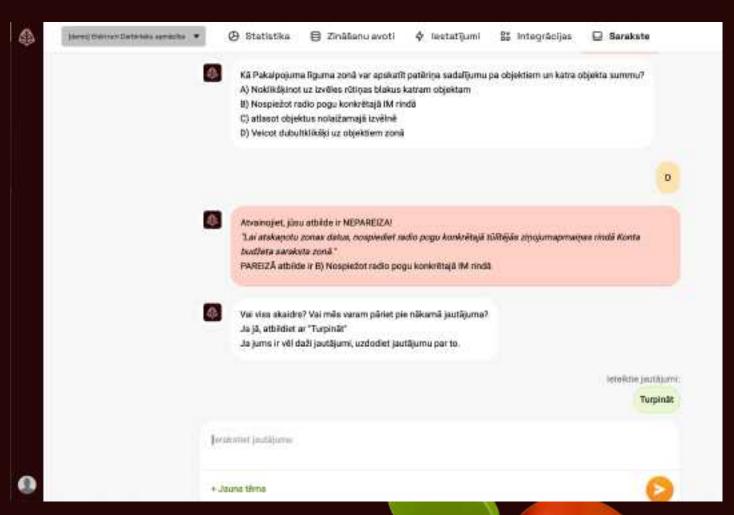


theresanaiforthat.com

## Daudzkanālu klientu atbalsta aģents (čats un e-pasts)



#### Automātiska darbinieku apmācība

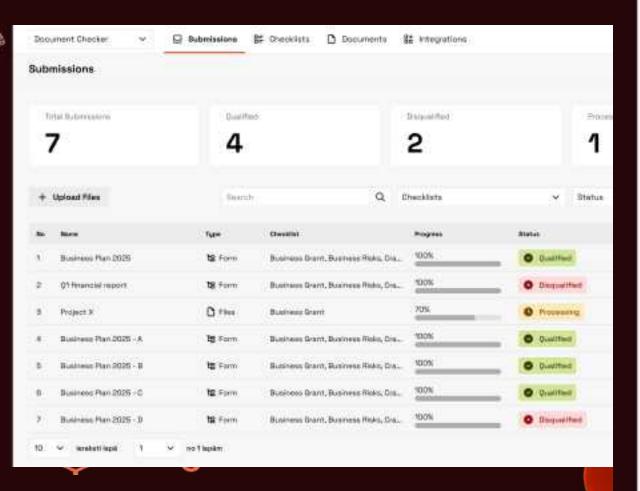


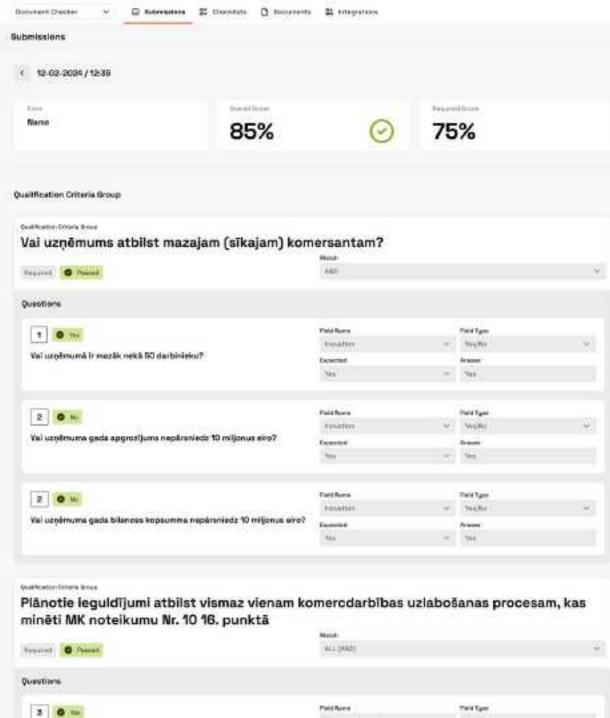




#### Dokumentu validācija



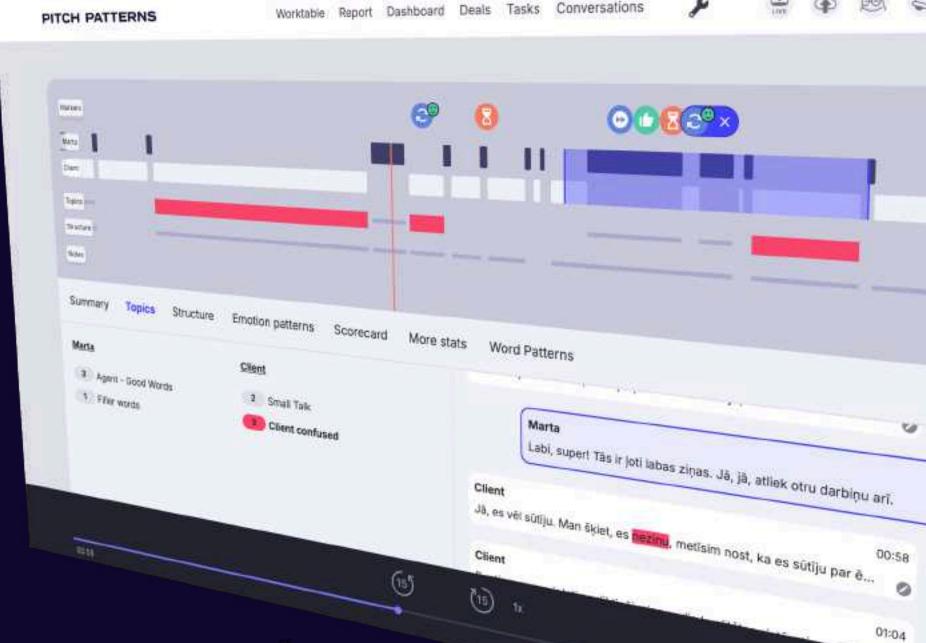






#### Tēmu atsekošana

Mākslīgā intelekta kopsavilkums, atslēgvārdu/frāžu tēmas un nodoma loģika, lai identificētu sliktu uzvedību un ieviestu kvalitātes kontroli.



PITCH PATTERNS

## LEADERBOARD

Points for today

1 🛕 1 Jānis Ezeriņš

1019

2 V-3 Una Pārdaugaviete

900

3 A + Helmuts Jānis Laipotājs

875 900

4 🛕 Rēzija Bedrīte

820

5 V a Laima Oga

740

6 ▼ ≈ Ritvars Liepnieks

710

7 – Kristine Karkliņa

695

8 🛕 🖈 Raivis Dzintariņš

600 580

Darbinieku aktivizācijas sistēma, izmantojot tiešraides līderu sarakstus

Renāte Kalniņa

520 710

### ACTIVITIES

In the last 5 minutes



Dāvis Deal atjaunots ar piezimi





James
Stoped up from position 2 to 1



Kelly Call to Intergitz (didn't record



Older



Reminder
There are 4 working days left this week



Reitis The Great Received a 5 star rating \$100,2003





Dāvis Steped up from position 2 to 1 1103.7013



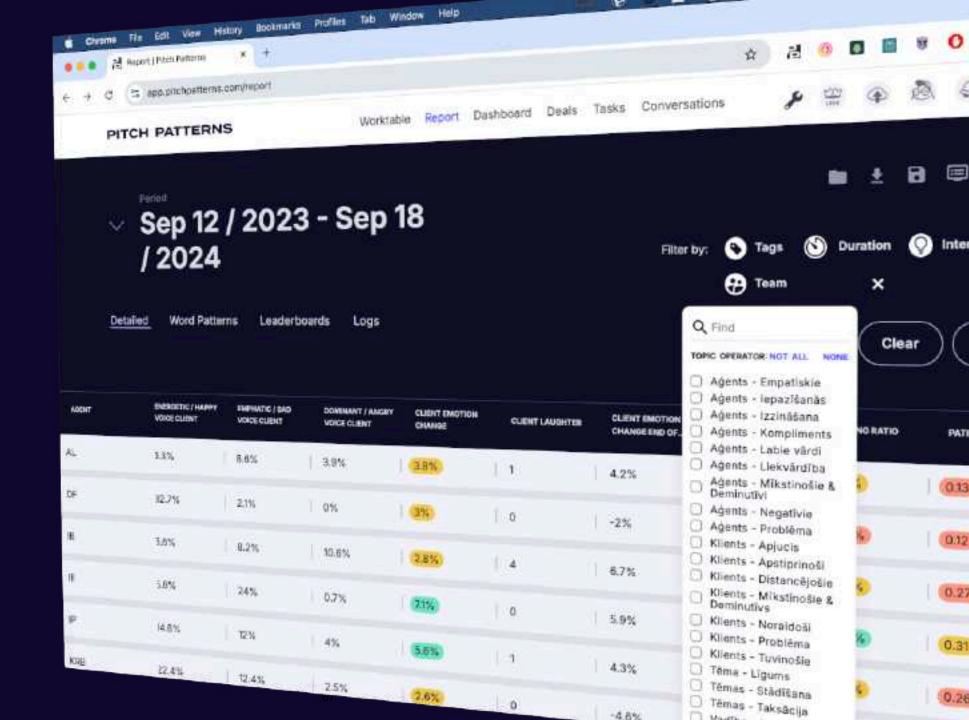
avis all to Lego (didn't record) oxiosis



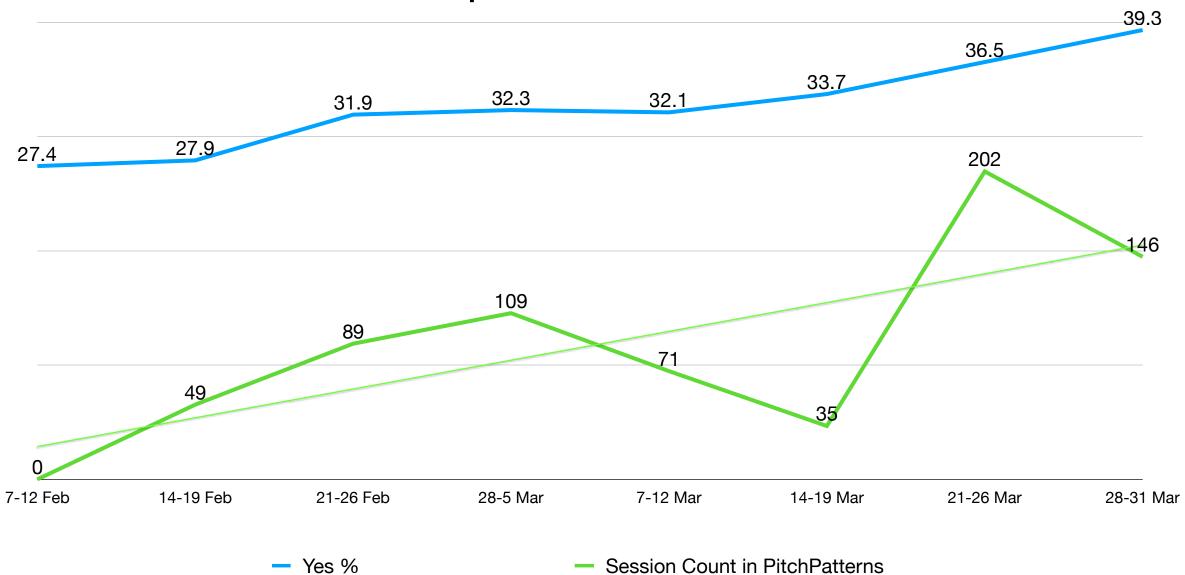


#### Dziļa analītika

Vairāk nekā 50 rādītāju, kas aptver gan mīkstās, gan cietās prasmes, lai izsekotu lielas tendences komandā un uzlabotu veiktspēju un kvalitāti.



#### 43% improvement in closed sales



#### 20+ Lielie klienti

# TELE2

























Ministry of Economics Republic of Latvia





















## Aģentos balstīta automatizācija





Wabshop Descriptions

124







#### stastiem.com



#### Unikāli stāsti, kas rakstīti Jums

Katrs stāsts un ilustrācija ir unikāli veidota

















# 'I Made Over \$1M Selling AI-Generated eBooks': How This 20-Year-Old Built A Million-Dollar Brand

Popelas' journey highlights the potential of Al and the importance of continuous lea



By Vinay Patel X @VinayPBPatel

Published 12 November 2024, 4:56 PM GMT











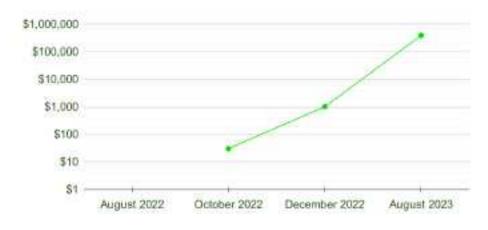
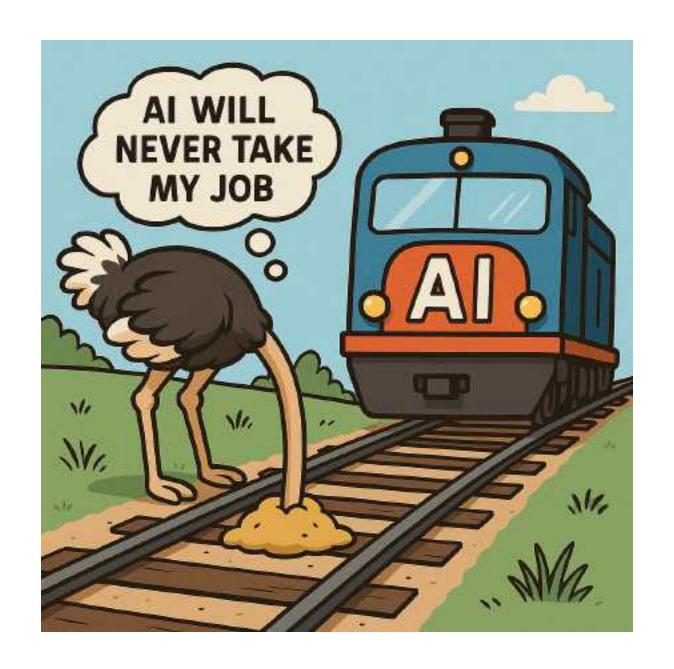


Chart: Joe's Profits Over a Value

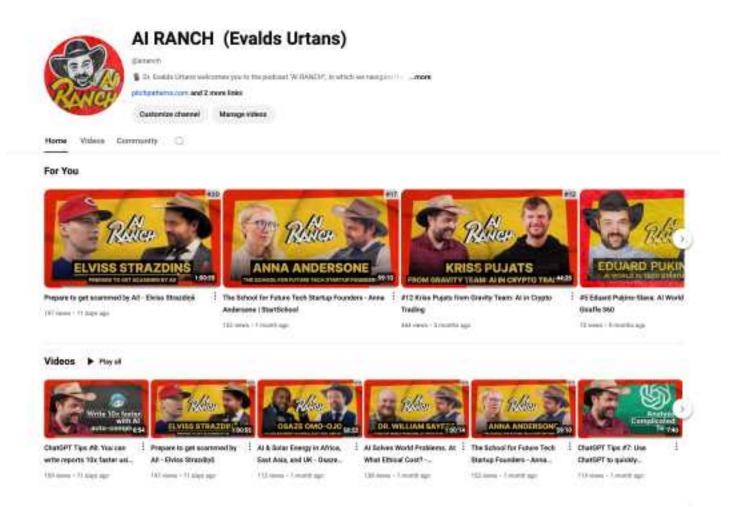








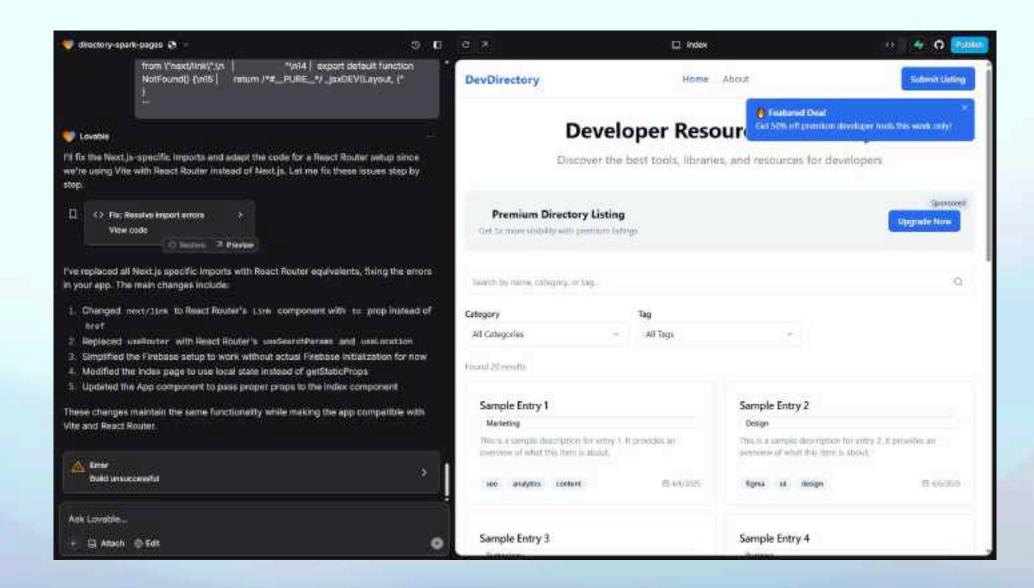
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# Lovable.dev

2025



# Images, Video

Gemini

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