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**GAP
DATA
INSTITUTE**

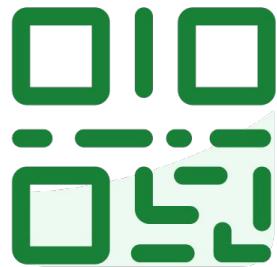
Explainable AI (xAI) & Future of Artificial Intelligence/ML (HLAI & AGI)
1st/old version presented @ CODECON 2023 #CODECON, #CODECON2023
(#AIslovakIA, #AIRadioMeetup, Bratislava, Slovakia)

#AIslovakIA @ sli.do

21. 2. 2024

Radovan Kavický, AIslovakIA & GapData Institute

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#AIslovakIA

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Structure of the talk

- 1. Current development and what's next/what to do now? [15 min.]

Sora, Gemini 1.5, Copilot/ChatGPT & GitHub Copilot

- 2. Future of AI (path towards HLAI/AGI, when? why?) [20 min.]

Strong/Wide AI vs. Weak/Narrow AI, Machine Learning vs. Machine Reasoning

- 3. Ethics & Transparency in AI/Trustworthy AI/Responsible AI/Applied AI/Growth potential [10 min.]

Brain/Neuroscience Research and theory of consciousness

- 4. Explainable AI/xAI, Shapley values, Mathematics of AI [20 min.]

- 5. Conclusion & position of Slovakia/Europe [10 min. + Q&A/15-20 min]
-

- Data Science (definition): collection of scientific results and methods for transformation of data from raw form to meaningful information, knowledge and wisdom, which should support better decisions

- AI (definition) - theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, translation and others



Which programming language do you prefer for AI? (Python, C, Scala, R, Julia, MATLAB, whatever)

- ⓘ Start presenting to display the poll results on this slide.

About me

Economist (Ing./Macro, Finance/NHF); Slovak Economic Association (SEA)

AI Expert, PhD. (xAI & Data Science/TUKE, prof. Sinčák), AI & Data Science Evangelist @ AIsolovakIA (National platform for AI development in Slovakia), President & Principal Data Scientist (GapData), Consulting (public, private)

Member of Slovak.AI (currently AIsolovakIA), CLAIRE, European AI Alliance, TAILOR (TrustworthyAI @ EU) 

Data Science Instructor @ DataCamp, BaseCamp.ai, Learn2Code/Skillmea, robime.it, GapData +others

Founder of PyData Slovakia/Bratislava (#PyDataBA), R <- Slovakia (#RSlovakia),

Julia Users Group Slovakia (#JUGSlovakia) & SK/CZ Tableau User Group (#skczTUG)

[Analýza systému súdnicstva a jeho výkonnosti do r. 2010 - Ministerstvo spravodlivosti SR \(gov.sk\)](#)

<https://www.justice.gov.sk/tlacovespravy/tlacova-sprava-1581/>



DataCamp

Andrea Cirillo

R Data Mining

Implement data mining techniques through practical use cases and real-world datasets



Packt



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Python
Programming
Blueprints

Python Deep
Learning
Cookbook

Build nine projects by leveraging powerful frameworks such as Flask, NumPy, and Django.

By Daniel Furtado and Marcus Pennington



Packt

www.packt.com

Over 75 practical recipes on neural network modelling, reinforcement learning, and transfer learning using Python

By Indra den Bakker



Packt

www.packt.com



Personal
Finance with
Python

Using pandas, Requests, and Recu
Max Humber

Apres



Advanced
Analytics with
R and Tableau

Advanced visual analytical solutions for your business

Packt



R Data
Visualization
Recipes

A cookbook with 65+ data visualization recipes for
smarter decision-making

Packt

Ankit Dixit
Ensemble
Machine Learning

A beginner's guide that combines powerful machine
learning algorithms to build optimized models

Packt



**What IDE you are using for
your AI projects/where you
create/train your models?
(cloud, locally, etc.)**

ⓘ Start presenting to display the poll results on this slide.

AI, AGI, HLAI > Palantir, Flawless, Sora and beyond... Frankie.AI goes to Hollywood



Global GDP ≈ \$100 Trillion USD

\$100,562,000,000,000 (2022, nominal/per year)

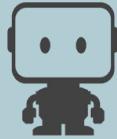
US: 25.5 Trillion USD/year (GDP)

China: 17.9 Trillion USD/year (GDP)

Japan: 4.2 Trillion USD/year (GDP)

Germany: 4 Trillion USD/year (GDP)

India: 3.4 Trillion USD/year (GDP) +UK, France, Russia, Canada, Italy (about 2 Trillion USD/year)



DataRobot

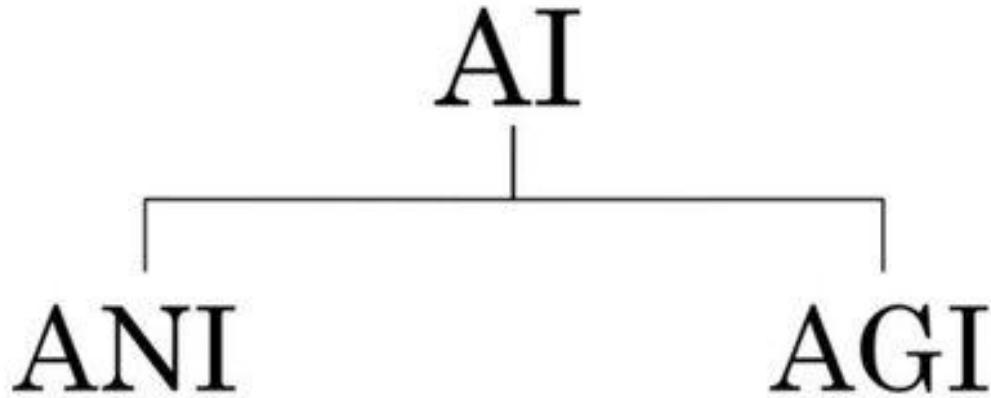


OpenAI CEO Sam Altman Raising \$7 Trillion for AI Chip Company

February 9, 2024 by Brian Wang

OpenAI CEO Sam Altman is talking with leaders of the UAE and elsewhere for \$7 Trillion for a new AI Chip company.

The WSJ report indicates Sam wants to raise money and then ask TSMC to build factories.



(artificial narrow intelligence)

E.g., smart speaker, self-driving
car, web search, AI in farming
and factories

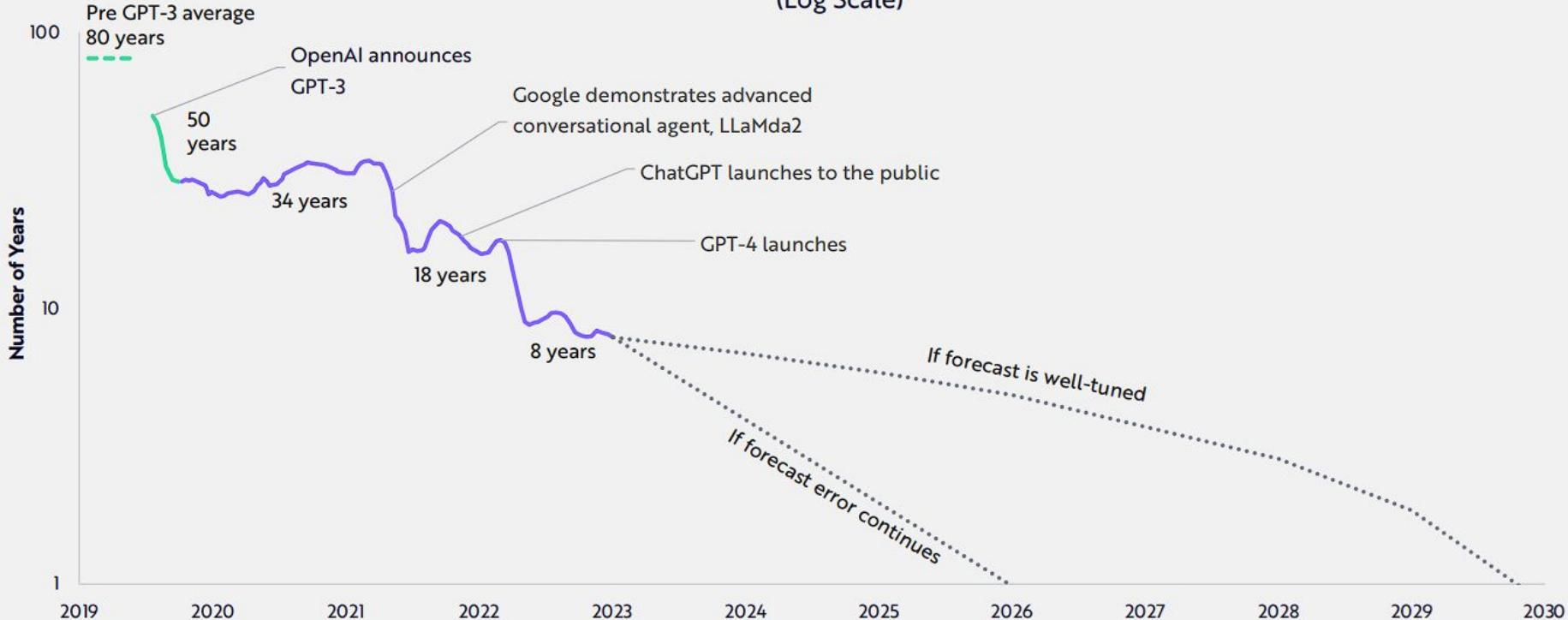
(artificial general intelligence)

Do anything a human can do

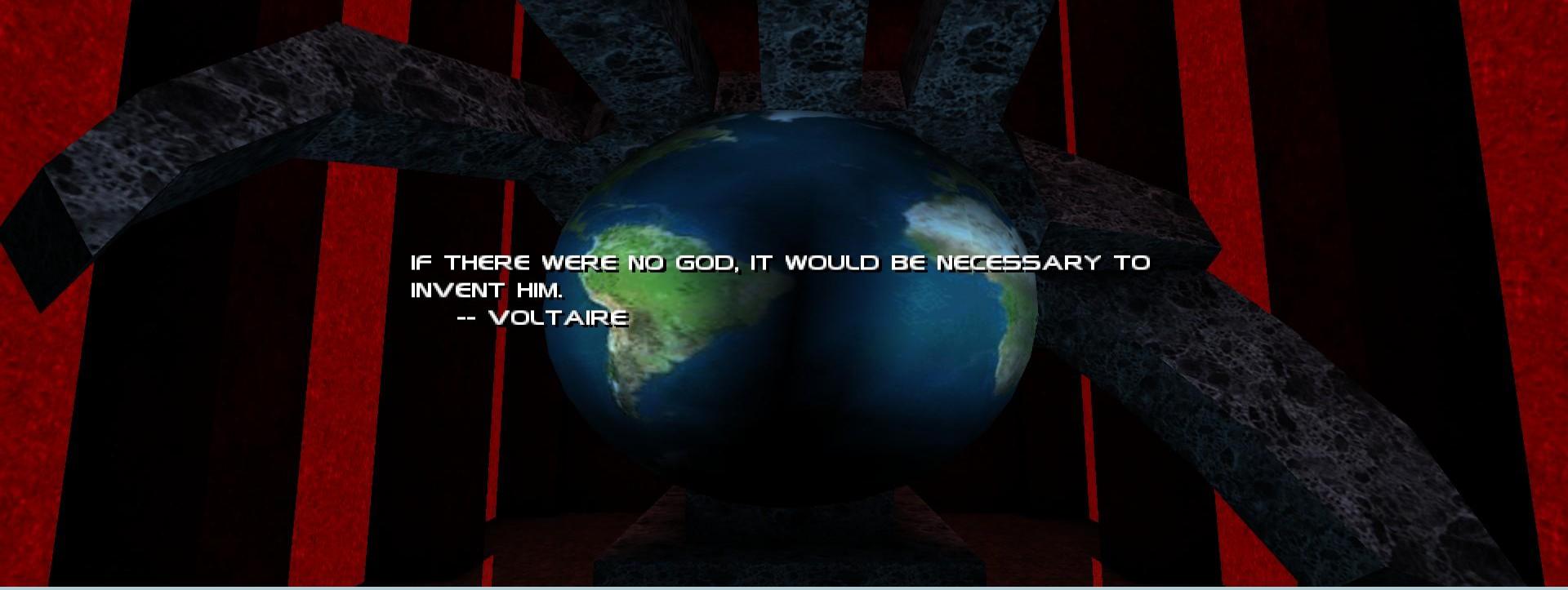


Source: [HLAI Conference | GoodAI](https://www.goodai.com/hlai/) <https://www.goodai.com/hlai/> Ben Goertzel, 2018 (Good.AI & GapData Institute, PyData Slovakia/partnership)

Expected Years Until Launch Of A General Artificial Intelligence System (Log Scale)



Source: <https://ark-invest.com/big-ideas-2024> + <https://www.youtube.com/watch?v=hFg1TMACw4I>



IF THERE WERE NO GOD, IT WOULD BE NECESSARY TO
INVENT HIM.
-- VOLTAIRE

“The year is 2052 and the world is a dangerous and chaotic place. Terrorists operate openly - killing thousands; drugs, disease and pollution kill even more. The world's economies are close to collapse and the gap between the insanely wealthy and the desperately poor grows ever wider.”

Source: Warren Spector/Deus Ex (6/2000) + <https://www.youtube.com/watch?v=tffX3VljTtI>



ORIGINAL SCENE - R RATED

AI is here, and it's making movies. Is Hollywood ready? - Los Angeles Times (latimes.com) FLAWLESS, flawlessai.com)

AI & Ethics (food for thought & main challenges for the future)

- we should all be humble & think all the time about ethical implications of our work
- data is not (at least our) reality & need of transparency (explainable AI/HLAI/Superintelligence)
- we have no programming of common sense (fails/CYC)
- we need both left and right brain/lobe thinking
- we don't know how we really think (and if you think you know, well... good luck)
- we don't know what intelligence is (unknown processes)
- we are not walking neural nets (but if some of you are, please, let me know)
- design perceptron (imitate brain without knowing how the brain really works), real research of brain started (Brain Initiative/public and private research, 2013 +DARPA, IARPA)
- we need to rethink the basic design of neural nets (mathematics of deep learning)
- we can count all the neurons in our brains (10's of billions and 1000's of billions synapses)
- we need rules (ethical & law standards/technology is currently before ethics)

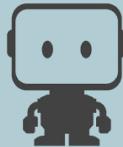
“But the big feature of human-level intelligence is not what it does when it works but what it does when it's stuck.”

-- Marvin Minsky

Explainable Machine Learning/AI (xAI), Era of Chatbots, AI & BI collide



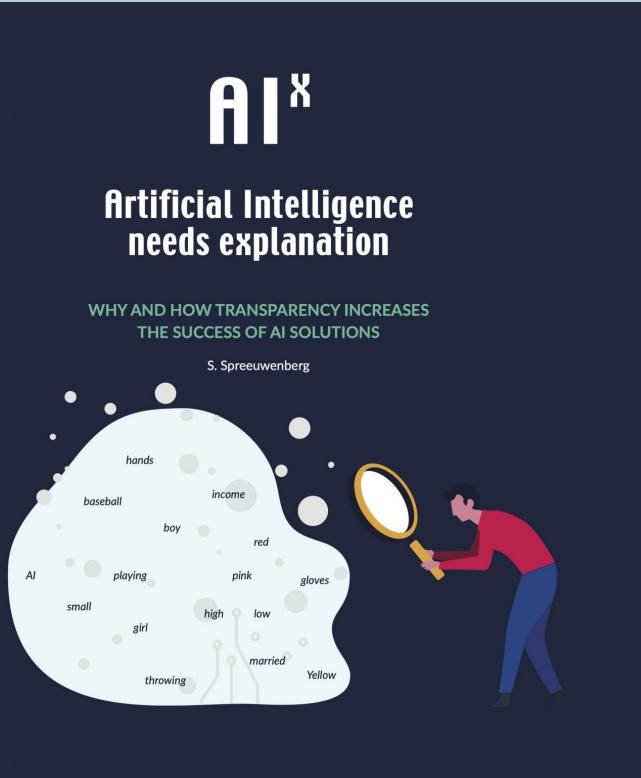
H₂O.ai



DataRobot

- Complex, modern-day ML algorithms, where deep learning & ensemble methods dominate
- really hard to fully understand, but the decision process behind them
- ChatGPT is not transparent/open (at all/bans and restrictions)
- can & need to be transparent and trustworthy for decision makers
- AI & BI coming together
- critical domains as finance, healthcare or public sector & governmental services, where TRUST is a MUST
- Explainability vs. Simplicity
- growing regulatory pressure also outside these areas Explainable AI (xAI) will be necessity for any organization soon
- understand the inner workings of these ML algorithms & how to design systems that imitate intelligence in a transparent way
- overview of current trends in Explainable AI/ML & the challenges that are ahead of us
- Next big thing?

Explainability & Tools (LIME, SHAP & others)



- **LIME** (Local Interpretable Model-agnostic Explanations)
- explainable AI method that helps to illuminate a machine learning model
- make its predictions individually comprehensible
- method explains the classifier for a specific single instance (suitable for local explanations)
- model agnostic tool which can give explanations for any supervised learning model
- one of the most popular XAI tools out there due to its simplicity and intuitiveness

<https://github.com/marcotcr/lime>

- **SHAP** (SHapley Additive exPlanations)

- game theoretic approach to explain the output of any machine learning model.
- connects optimal credit allocation with local explanations using the classic Shapley values from game theory and their related extensions

<https://github.com/slundberg/shap>

+

- Others (100+ tools), f.e.:**

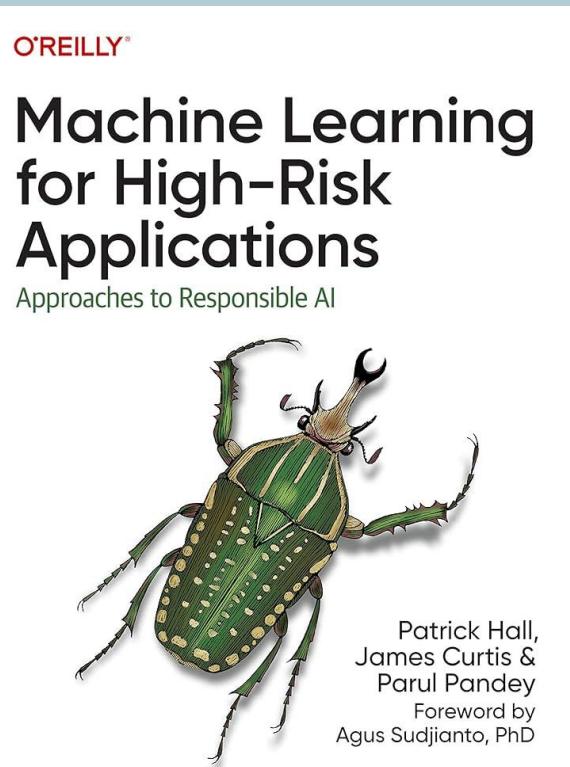
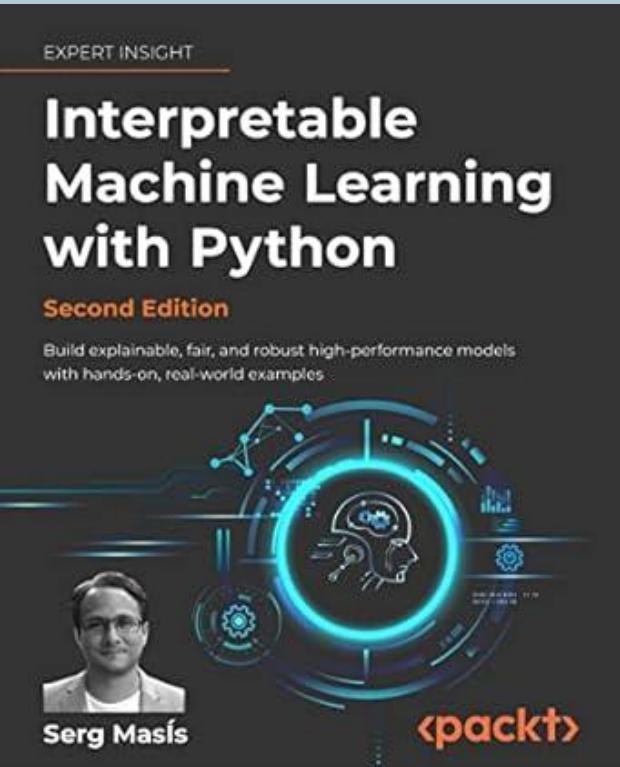
- **Alibi** (Algorithms for explaining machine learning models)

<https://github.com/SeldonIO/alibi>

- **Captum** (Model Interpretability for PyTorch)

<https://captum.ai/>

Explainable AI/xAI + key literature

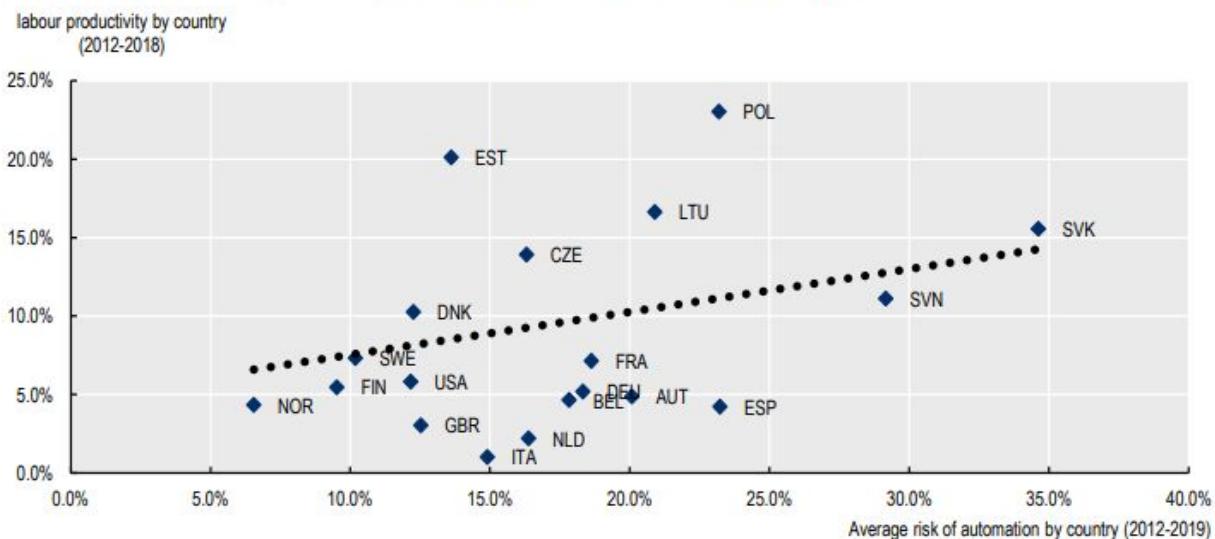


- Source:
<https://christophm.github.io/interpretable-ml-book/>
- [https://www.amazon.com/Machine-Learning-High-Risk-Applications-Responsibl e/dp/1098102436](https://www.amazon.com/Machine-Learning-High-Risk-Applications-Responsibl-e/dp/1098102436)
- <https://www.amazon.com/Interpretable-Machine-Learning-Python-hands/dp/180323542X/>

AI & Slovakia or why should you even care?

Figure 4. Labour productivity growth was greater in countries that were at higher risk of automation

Percentage change in labour productivity (2012-2019) and risk of automation (2012)



Note: The averages presented are unweighted. Labour productivity is measured by GDP (in USD, constant prices) per hour workers.

Source: OECD Productivity Database and (Nedelkoska and Quintini, 2018^[1])

- Source:
<https://www.oecd.org/future-of-work/reports-and-data/what-happened-to-jobs-at-high-risk-of-automation-2021.pdf>
+
- [AI Strategies and Policies in Slovak Republic - OECD.AI](https://oecd.ai/en/dashboards/countries/Slovakia),
<https://oecd.ai/en/dashboards/countries/Slovakia>
+
- [AI, automation, and the future of work: Ten things to solve | McKinsey Global Institute](https://www.mckinsey.com/featured-insights/future-of-work/ai-automation-and-the-future-of-work-ten-things-to-solve)

AI & Slovakia, what exactly are you talking about? What future?



- **OECD.AI** that provides an overview of AI strategies and policies in Slovakia. It includes an action plan for the transformation of Slovakia into a successful digital country and development of the digital single market. The action plan offers a set of concrete steps on how to start building a sustainable and human centric, and trustworthy AI.
- **AIslovakIA**, which is a neutral, independent and non-profit platform with an ambition to develop excellence and bring together experts and those interested in artificial intelligence in Slovakia.
- The national platform of artificial intelligence (AIslovakIA) is part of the Center for Artificial Intelligence (hereinafter referred to as “CAI”), a non-profit organization
- AI/ML augmented analytics (scenarios for data-driven decision making)
- build and deploy highly accurate machine learning models without writing a single line of code, experiment, simulate and compare different scenarios using various models/scenarios to identify the best strategy or test ideas before committing resources
- focus on the right data to analyze, get predictive insights with explanations in your dashboards + run simulations to get actionable prescriptive guidance on what to do next and get instant visual response
- Alphaai.ai (world's 1st AI voice analyst/not just regular “chat bot”)

GAP DATA INSTITUTE

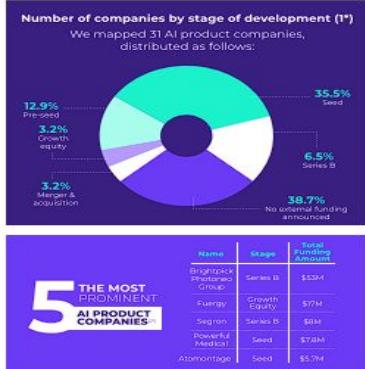
KiNIT

AlslovakIA



SLOVAKIA

Key Players in the AI Innovation Ecosystem



Supporting Infrastructure

Communities, associations, event organizers

- National platform for AI development in Slovakia
- AlslovakIA - AmCham

Research institutions

- Kempelen Institute of Intelligent Technologies (KIIT)
- Project TERAIS
- Centre of Excellence for SMART Technologies, Systems and Services (Slovak University of Technology)

Startup programs - incubators and accelerators

- Industry Innovation Cluster, an accelerator and platform for innovation in Slovak industry

Funding Landscape

Total funding raised by AI product companies in Slovakia (4*)

\$100,000,000

Split of funding activity and sources for analyzed AI companies in CEE (5*)



Key local AI-focused investors

Zero Gravity Capital

Zero Gravity Capital
a €23M venture capital fund fuelling pre-seed, seed, series A innovations.



Venture to Future Fund

a joint initiative of EIB, the Ministry of Finance of the Slovak Republic, and the Slovak Investment Holding looking for SMEs in high-tech industries in their growth phase (Series A and later rounds).

Talent Pool

Number of people working in ICT (6*)

115,500
employees in 2022

Number of people working in AI (7*)

The number of people working in AI in Slovakia across different AI specializations:



Universities and degrees that teach AI-related courses (8*)

a) Number of students in IT&C or specifically AI related degrees



b) Degrees in AI in Slovakia

Cybernetics & Artificial Intelligence, Department of Cybernetics and Artificial Intelligence, Technical University of Kosice

Data Analysis & Information Processing, Artificial Intelligence, Faculty of Informatics and Information Technologies, Slovak University of Technology in Bratislava

Integrated Teaching for Artificial Intelligence Methods, The Laboratory of Artificial Intelligence at the University of Zilina

Easiness with which companies manage to find and attract AI talent (9*)

3.0
low to medium difficulty

Source: <https://therecursive.com/ai-trends-central-and-eastern-europe-report/>,

Interview: <https://therecursive.com/collaboration-is-the-key-to-success-radovan-kavicky-on-fostering-ai-innovation-in-slovakia/>

#AlslovakIA @ sli.do

Explainable Machine Learning/AI (xAI) & Future of Artificial Intelligence



Who's on the picture?

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Future of AI/ML and Data Science

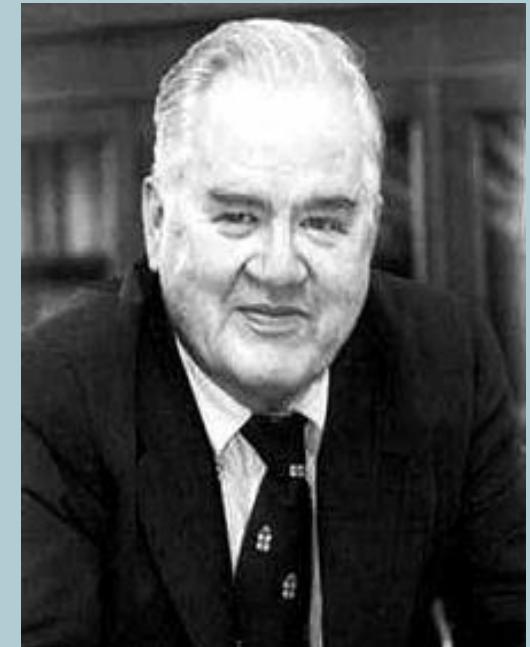
- Back to Basics

What Machine Learning/Artificial Intelligence is? What Data Science is?

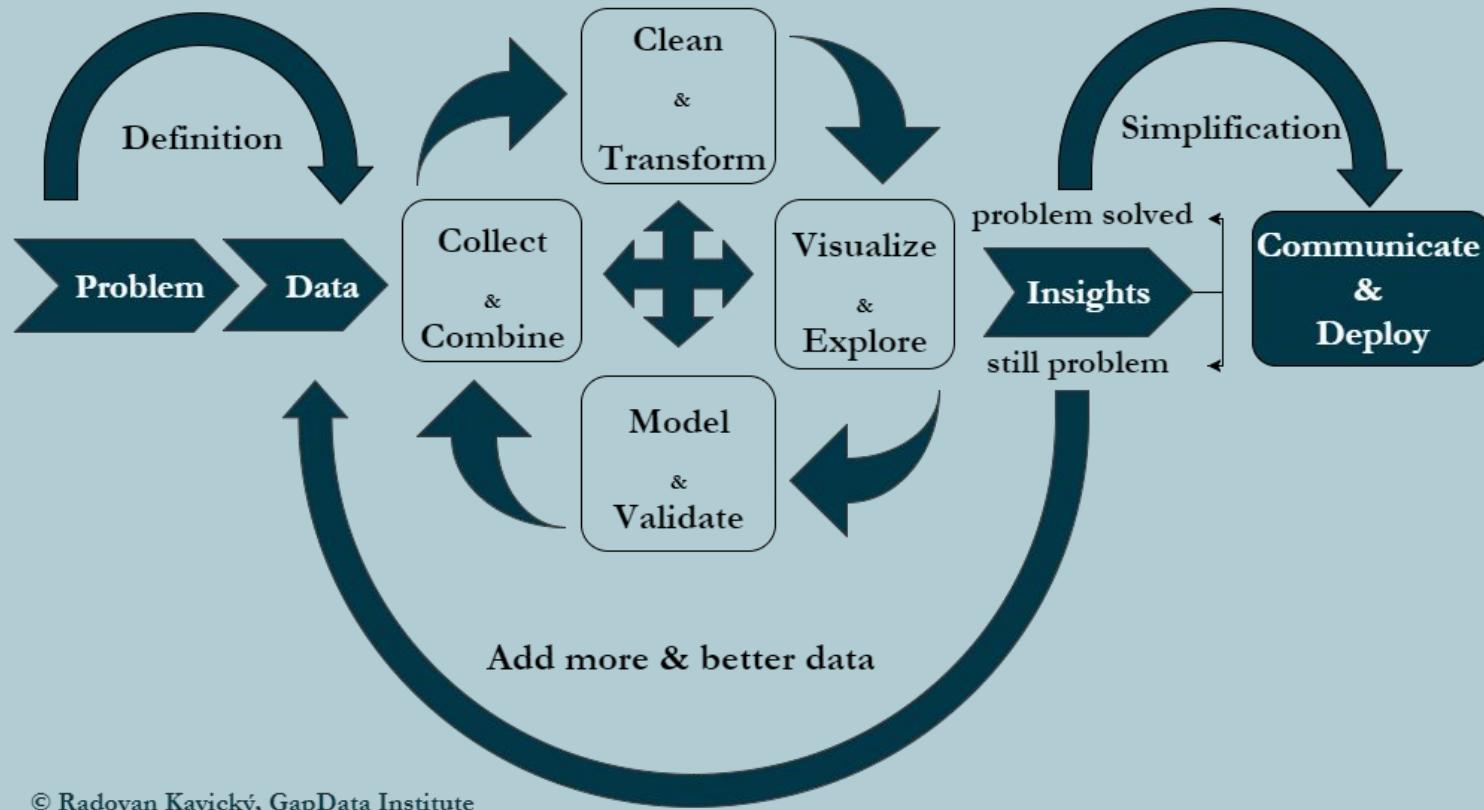
“Artificial intelligence is the science of making machines do things that would require intelligence if done by men.”

-- Marvin Minsky

- Data Science (definition): collection of scientific results and methods for transformation of data from raw form to meaningful information, knowledge and wisdom, which should support better decisions
- Data Science: Statistics + programming; data analysis + Computer Science, modelling + Econometrics, Big Data, ML/DL
- Expectation/Prediction: Data Scientists, one of the first “victims” of automation
- Is Data Reality? Do we model reality? (noise/signal)



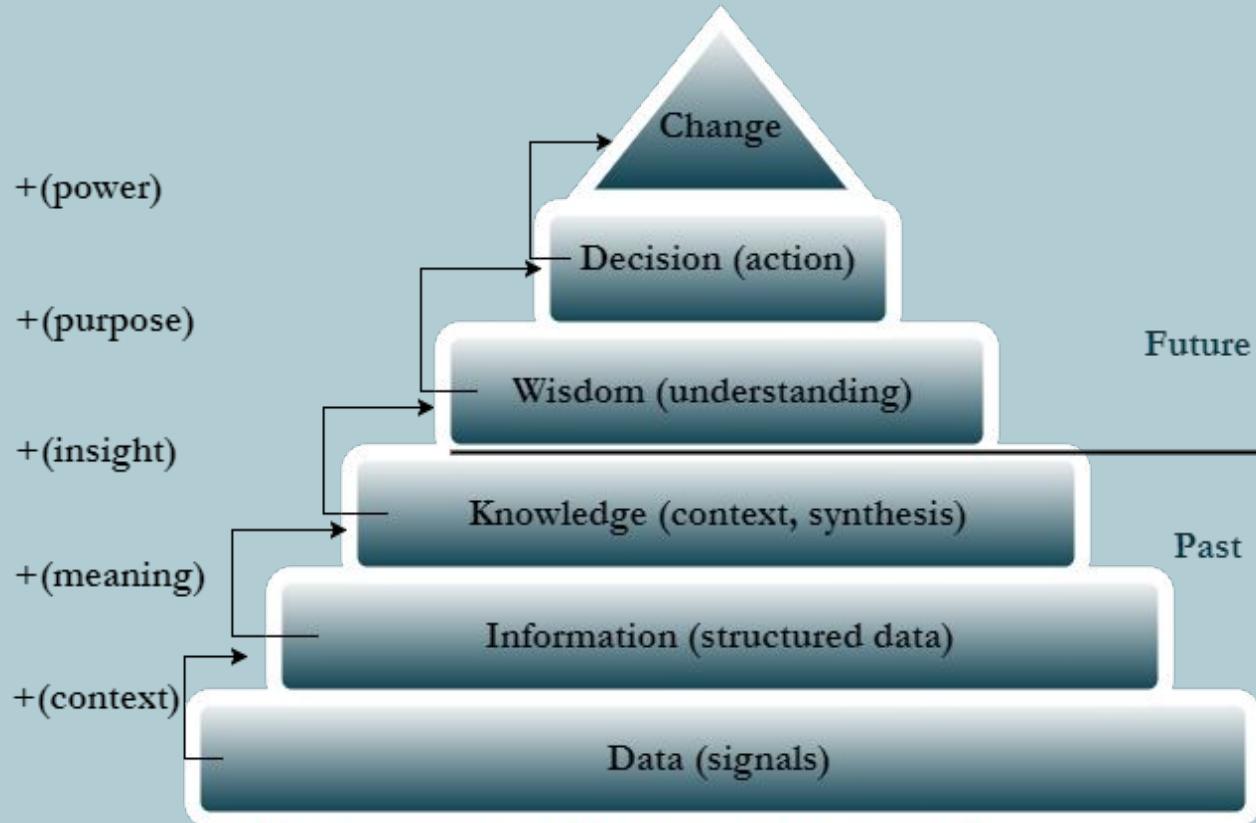
Data Science Process & Workflow



© Radovan Kavický, GapData Institute

Test

Data Science Pyramid



© Radovan Kavický, GapData Institute (inspired by DIKWD model by Curt Swindoll)



Is data reality?

Data is not reality.
And if you think so, you
should quit doing so...
right now.

Source: Me :), H2O.ai Meetup, Prague 2019,
<https://www.meetup.com/Prague-Artificial-Intelligence-Deep-Learning/events/264335458/>

AI & Ethics of AGI (Transhumanism & Empathy/future challenges)

≡ CNN BUSINESS Markets Tech Media Calculators Videos

Neuralink, Elon Musk's brain implant startup, set to begin human trials

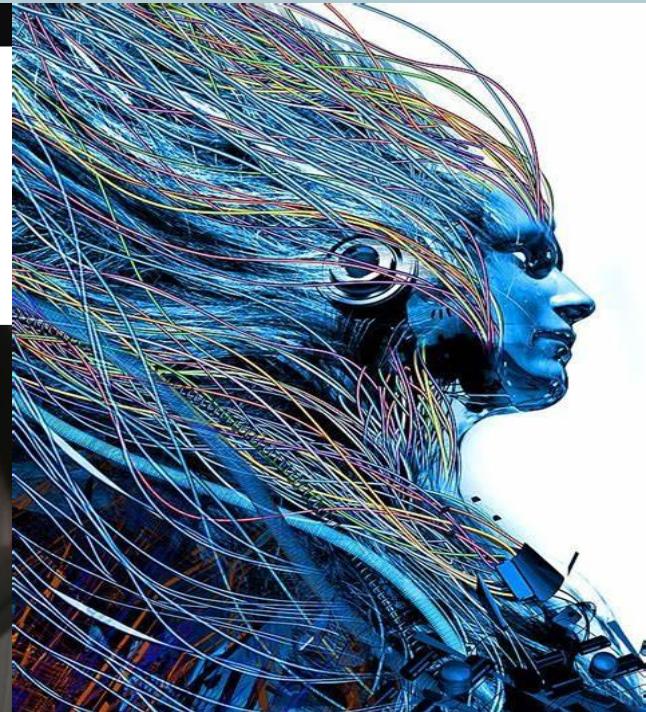
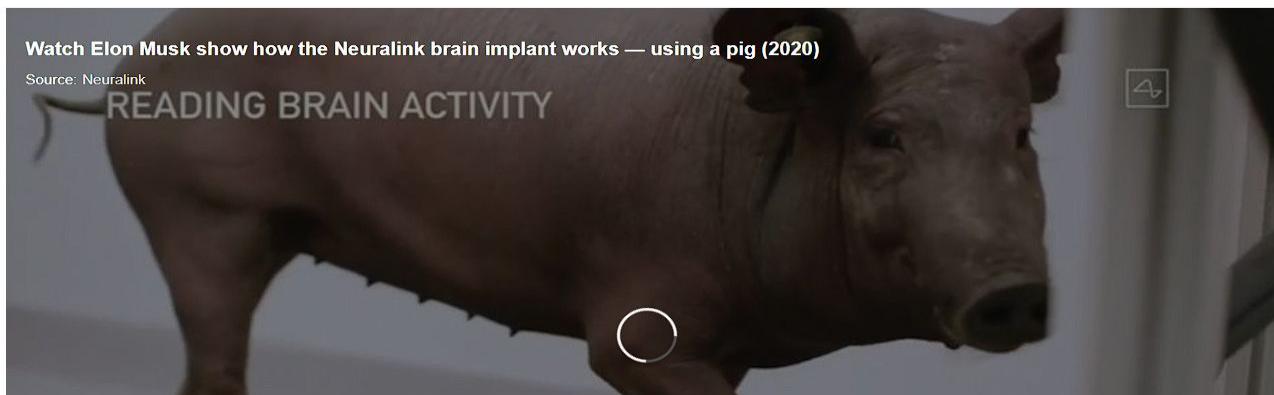
By Jennifer Korn, CNN
🕒 3 minute read · Updated 1:05 PM EDT, Wed September 20, 2023



Watch Elon Musk show how the Neuralink brain implant works — using a pig (2020)

Source: Neuralink

READING BRAIN ACTIVITY



Source: <https://edition.cnn.com/2023/09/20/tech/musk-neuralink-human-trials/index.html>

AI, Consciousness & Ethics of AGI (Transhumanism & Empathy/future challenges)

25.9.2023 15:20 | Správy

živě Vedkyňa skúma, ako sa dá vidieť do mozgu. Pýtali sme sa, čo s tým robiť'



Na rozhovore sa podielal Radovan Kavický z Národnej platformy pre rozvoj umelej inteligencie AlislovakIA.

Svetové sympózium Digitálna inteligencia pre systémy a stroje sa konalo 21. – 22. septembra v Košiciach. Organizátormi boli Národná platforma pre rozvoj umelej inteligencie AlislovakIA, profesijná organizácia inžinierskej a technologickej komunity Institute of Electrical and Electronics Engineers (IEEE), Technická univerzita v Košiciach a Elfa, s. r. o. Organizátori za podporu d'akujú Ministerstvu investícií, regionálneho rozvoja a informatizácie SR a UNESCO SK.

[Maryam Alimardani — Tilburg University Research Portal, https://research.tilburguniversity.edu/en/persons/maryam-alimardani](https://research.tilburguniversity.edu/en/persons/maryam-alimardani)
Vedkyňa skúma, ako sa dá vidieť do mozgu. Pýtali sme sa, čo s tým robiť' (aktuality.sk)



Future is awesome.
All we have to do
now is to build it.

#PyData

Data Science & Data Visualization in Python.
How to harness power of Python for social good?



Source: PyData Berlin 2017 (w/Marek Rosa), Talk on YouTube: <https://www.youtube.com/watch?v=I5578BhU4sE>

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Explainable Machine Learning/AI (xAI) & Future of Artificial Intelligence

PyData Slovakia & activities within CEE + V4



- 300+ members
- 3000+ on mailing list
- 800+ followers



AI Startup Showcase Machine Learning Prague



- Partners: O'Reilly, robime.it, codecon.sk, TouchIT.sk
- Sponsors: H2O.ai, Microsoft, kiwi.com
- WeAreDevelopers World Congress ("GAPDATA-25" & "PYDATA-25"), Berlin, 17.-19. July 2024
- Machine Learning Prague ("pydatask15" for 15% discount), Prague/O2 , 22.-24. April 2024
- WebExpo, Prague/Lucerna, 29.-31. May 2024 ("pydatask15" for 15% discount)
- Our meetups (26.2., 15:00 PyData Slovakia & Bratislava 16:00

GapData Institute (GDI) and how to support us.



- Economic Research & Public Policy & Data Science + AI think-tank (data-tank)
- Data. Think. Change.
- GapData Institute (GDI) is a non-profit nonpartisan research institution harnessing power of data & wisdom of economics for public good.
- Transparent account (from day #1;
SK7383300000002200933920
<https://www.fio.sk/ib2/transparent?a=2200933920>)
- Partnership (openness, transparency)
- Slides (this talk): tinyurl.com/slides-xAI
- <https://github.com/radovankavicky/aislovakia2024>



PAY by square



Thank you for your attention

Contact:

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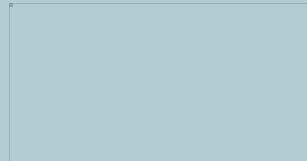
<https://gapdata.slack.com/>

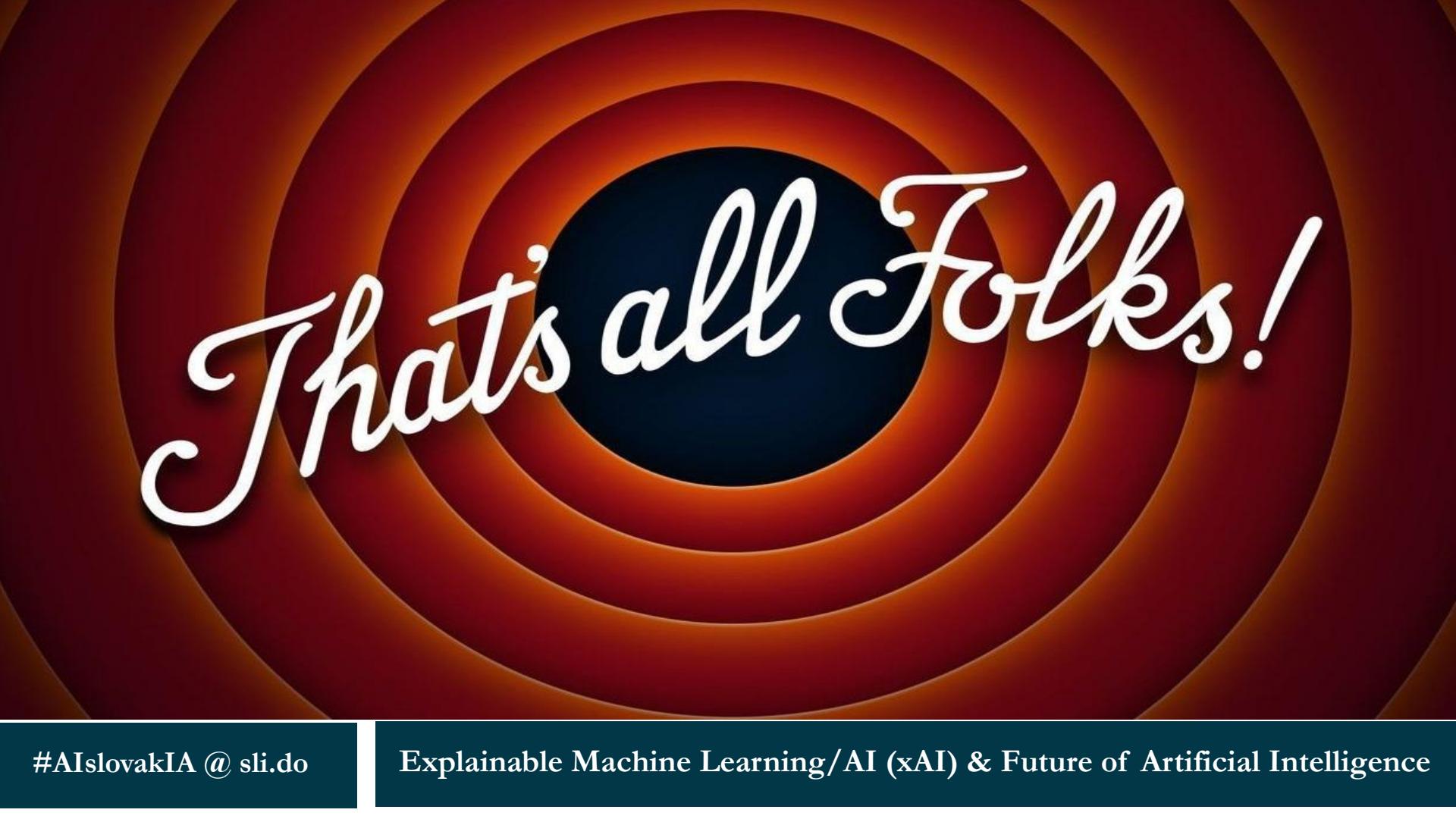


<https://github.com/radovankavicky>

<https://www.facebook.com/groups/356635138031671>

@radovankavicky, @PyDataBA, @GapDataInst





That's all Folks!

slido



**How would you rate this talk? (scale 1-10,
10/awesome, 5/meh, 1/worst talk ever, but
"try again, fail again, fail better")**

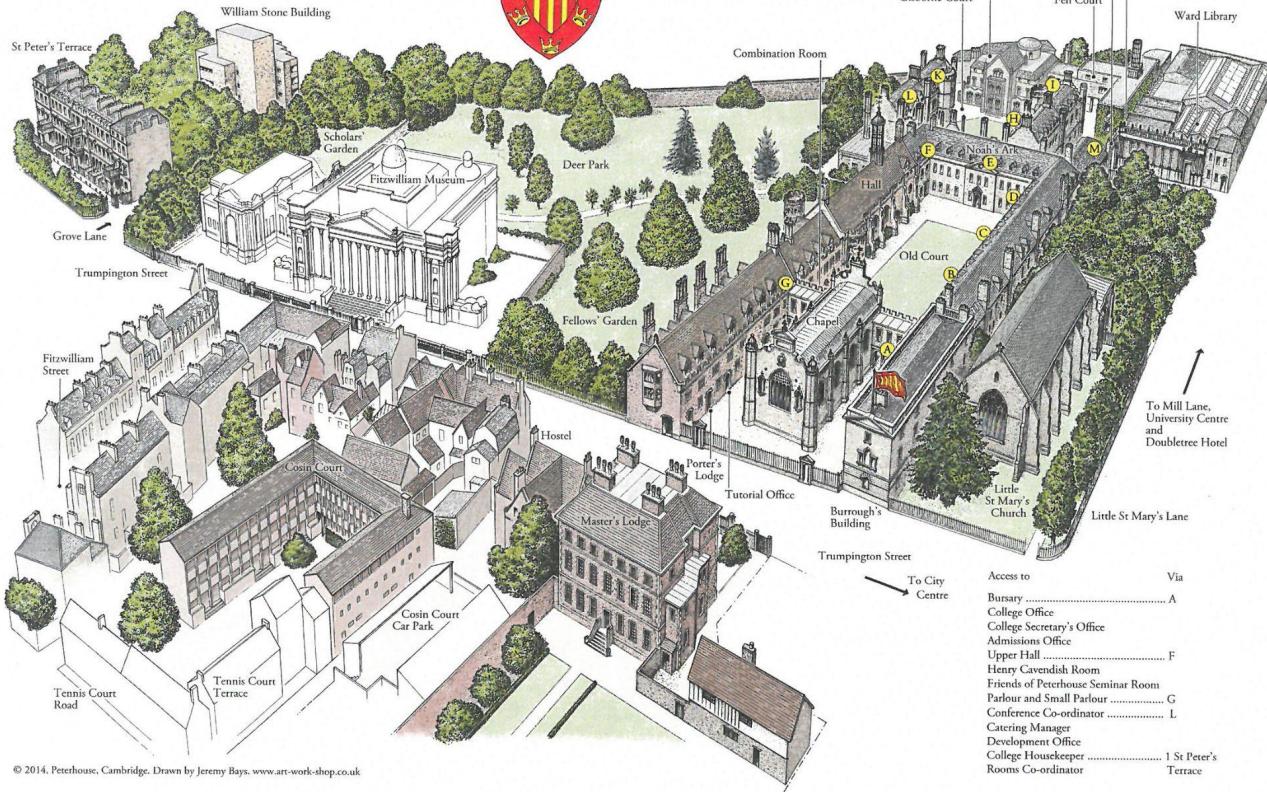
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Explainable Machine Learning/AI (xAI) & Future of Artificial Intelligence



PETERHOUSE
CAMBRIDGE



© 2014, Peterhouse, Cambridge. Drawn by Jeremy Bays. www.art-work-shop.co.uk

Thank you MIRRI/MIRDI &
AIlovakIA
(Viera Borðoy
& Nikola Dobrovská)!

Source:

<http://www.bcs-sgai.org/ai2023/>

AI-2023 Forty-third SGAI
International Conference on
Artificial Intelligence
CAMBRIDGE, ENGLAND 12-14
DECEMBER 2023

AI-2023 is the 43-rd Annual
International Conference of the
British Computer Society's
Specialist Group on Artificial
Intelligence (SGAI)
Alan Turing studied (math, 1931,
Cambridge)



Source: Jana Novohradská,
MIRRI/MIRDI

AI-2023 Forty-third SGAI
International Conference on
Artificial Intelligence
CAMBRIDGE, ENGLAND
12-14 DECEMBER 2023

AI-2023 is the 43-rd Annual
International Conference of
the British Computer
Society's Specialist Group on
Artificial Intelligence (SGAI)

Alan Turing studied (math, 1931,
Cambridge), Stephen Hawking
lived few meters from
Peterhouse College

Dear Mr. Radovan Kavicky,

I trust this letter finds you in good health. It is with great honour and enthusiasm that I extend this formal invitation to you on behalf of the **Global AI Show**.

Your expertise and insights are highly regarded in the field of digital transformation. Recognizing your significant contributions to the advancement of technology and innovation, we believe that your participation as a speaker would greatly enrich the discourse at our upcoming event.

Event Name: Global AI Show

Date: 16 – 17 April 2024

Venue: Grand Hyatt Dubai Conference and Exhibition Centre

The Global AI Show Dubai serves as a prominent platform that brings together thought leaders, experts, and innovators from around the world to share knowledge and discuss the latest trends and advancements in artificial intelligence. Your perspective on the current landscape of AI and its prospects would undoubtedly captivate our audience and contribute to the overall success of the event.

We sincerely hope that you can honour us with your presence and insights. Your participation will not only benefit the attendees but also further promote the exchange of ideas and collaboration within the global AI community.

We would be more than happy to accommodate any preferences for topics you may have.

We kindly request you to confirm your availability.

Thank you for considering our invitation. We eagerly anticipate the opportunity to welcome you as a distinguished speaker at the Global AI Show Dubai 2024.

One more thing... Global AI Show:
The World's Premier AI & ML Event
<https://www.globalaishow.com/>
10000+ attendees, 3000+ companies



OFFICIAL AI AMBASSADOR

SOPHIA

Humanoid Robot

Hanson Robotics



Audience Q&A Session

- ① Start presenting to display the audience questions on this slide.