



**ICT academy**

# Uvod v strojno učenje

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Univerza v Ljubljani  
Fakulteta za elektrotehniko

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in komunikacijske  
tehnologije

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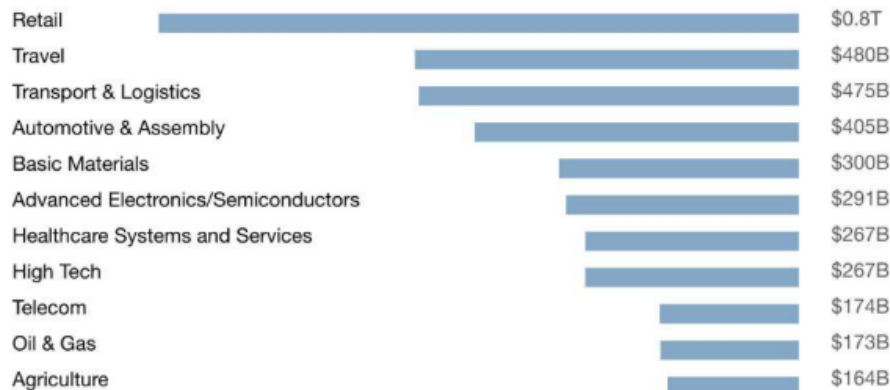
# Kaj je umetna inteligenca (AI)?

# Uvod

- Leta 2030 naj bi AI tehnologija proizvedla dodatnih 13 biljonov \$ letno
- Vedno večja uporaba tudi v ne-tehnoloških sektorjih
  - Težko bo najti industrijo, ki ne uporablja AI tehnologije

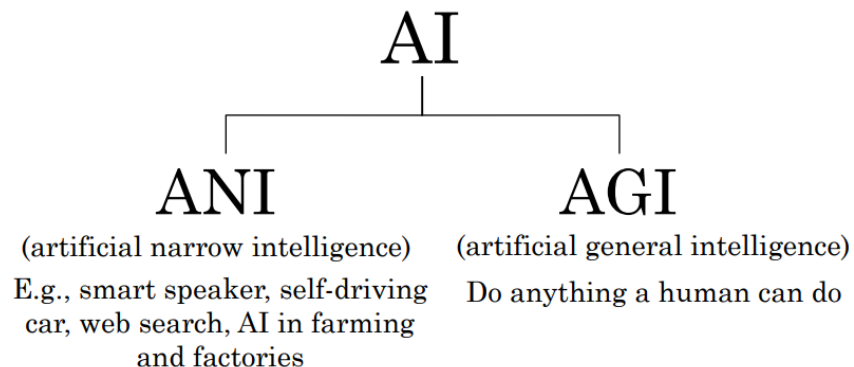
AI value creation  
by 2030

**\$13  
trillion**



# Tipi umetne intelligence

- ANI - Artificial Narrow Intelligence
- AGI - Artificial General Intelligence
- ASI - Artificial Super Intelligence

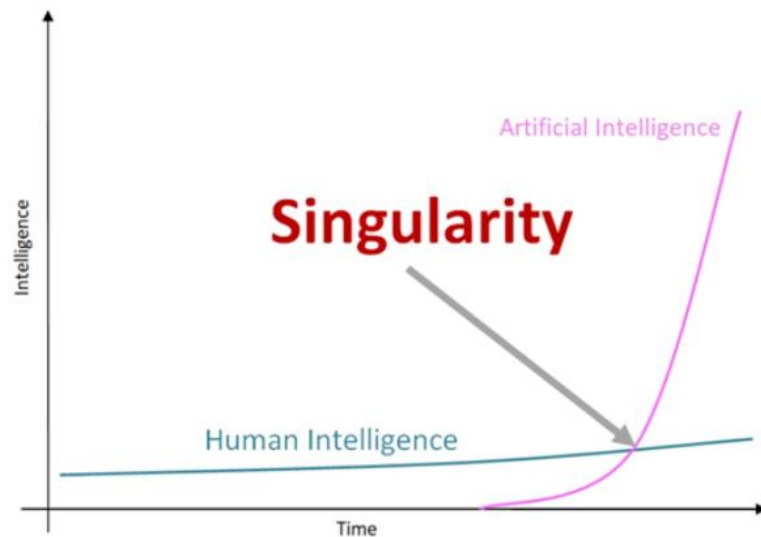
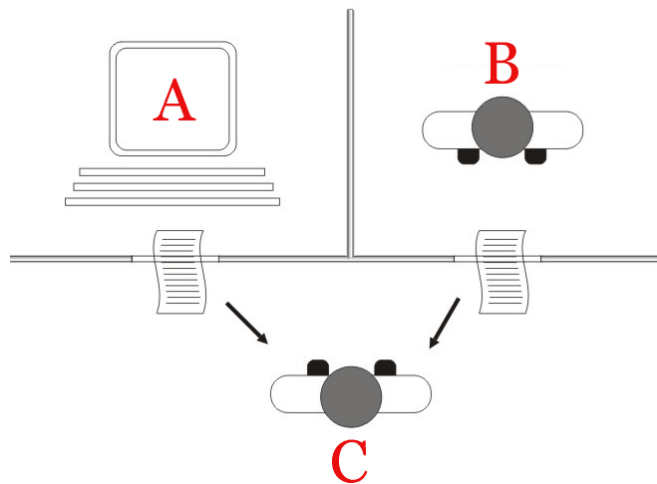


NARROW AI	ARTIFICIAL GENERAL INTELLIGENCE (AGI)
<ul style="list-style-type: none"><li>■ AI focused on a specific, singular or limited task</li><li>■ Examples include image recognition, hyper-personalization, chatbots, predictive text</li><li>■ Trained on specific tasks by data scientists</li><li>■ Correlates questions or assignments to a specific data set to accomplish a task</li><li>■ No self-awareness, consciousness, ability to think</li></ul>	<ul style="list-style-type: none"><li>■ Not fully realized, with some developers questioning if it will be possible</li><li>■ Seeks machines that can handle a range of cognitive tasks with little oversight</li><li>■ The ability to learn, generalize, apply knowledge and plan for the future</li><li>■ Must consistently pass the Turing Test</li><li>■ Single, general intelligence that possesses common sense and creativity and expresses emotions</li></ul>

- Razlika med ANI in AGI je torej v njihovi sposobnosti razmišljanja in učenja. ANI je omejena na določeno področje, medtem ko je AGI sposobna delovati na splošno, kot človek.
- Izumitelj in futurist Ray Kurzweil je napovedal, da bodo računalniki dosegli človeško raven inteligence do leta 2029
- Primeri ANI:
  - self-driving cars
  - customer service chatbots
  - voice assistants like Siri and Alexa
  - recommendation engines such as those Google, Netflix and Spotify use
  - facial recognition applications
- Primeri AGI (trenutno še ne obstaja, približki):
  - IBM Watson supercomputer
  - Language model Generative Pre-trained Transformer 3. [GPT-3](#)

# Singularnost (Singularity)

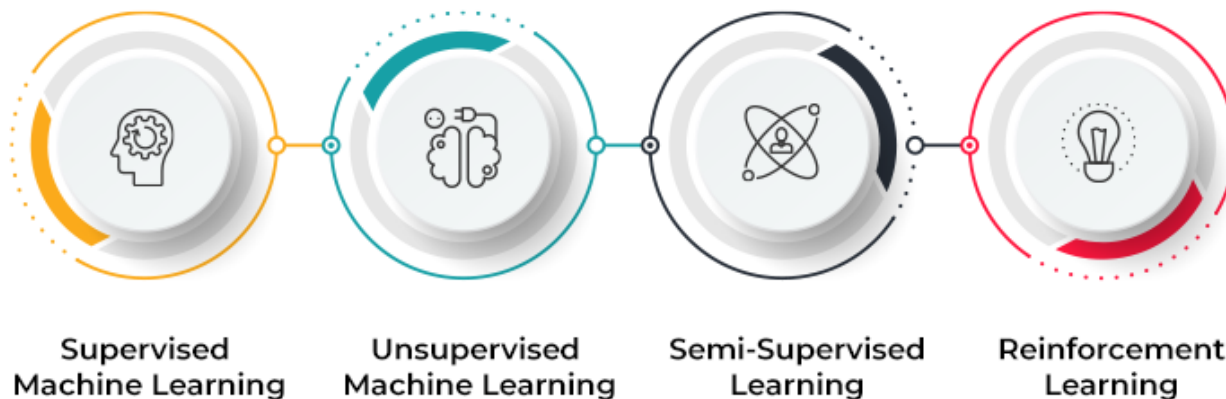
- **Singularnost** je hipotetični trenutek v prihodnosti, ko bi lahko **umetna inteligenca dosegla ali presegla človeško inteligenco** in postala najmočnejša sila na svetu.
  - samostojno razvijala svoje sposobnosti
  - napredovala na način, ki bi presegel zmožnosti človeškega razumevanja
- Turingov test (Alan Turing, 1950)



# Strojno učenje

# Kaj je strojno učenje?

- Strojno učenje je **področje umetne inteligence**, ki se ukvarja s tem, kako lahko računalniki samostojno pridobivajo nove sposobnosti in znanje iz podatkov, ne da bi jim bilo treba vnaprej določiti, kaj naj počnejo.
- **Pridobivanje znanja iz podatkov.**
- Uspeh AI-ja je močno odvisen od strojnega učenja.





● machine learning  
Iskalni izraz

+ Primerjava

Ves svet ▼

Od 2004 do zdaj ▼

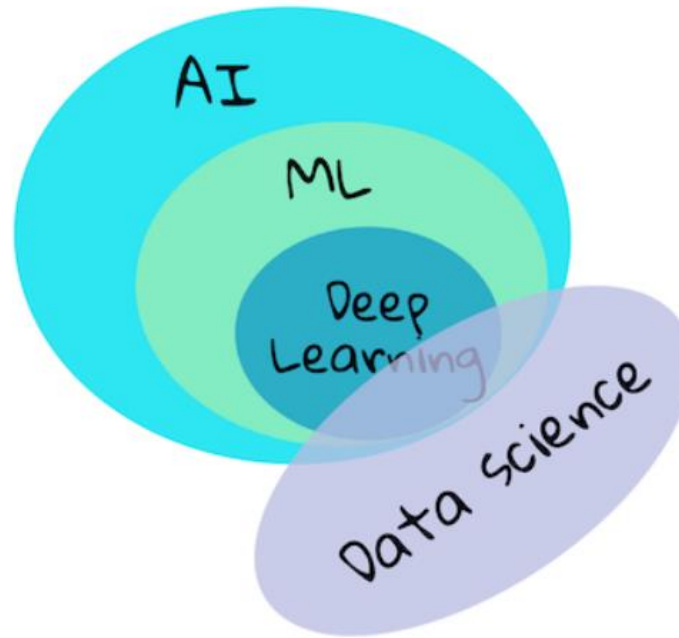
Vse kategorije ▼

Spletno iskanje ▼

Zanimanje skozi čas ⓘ



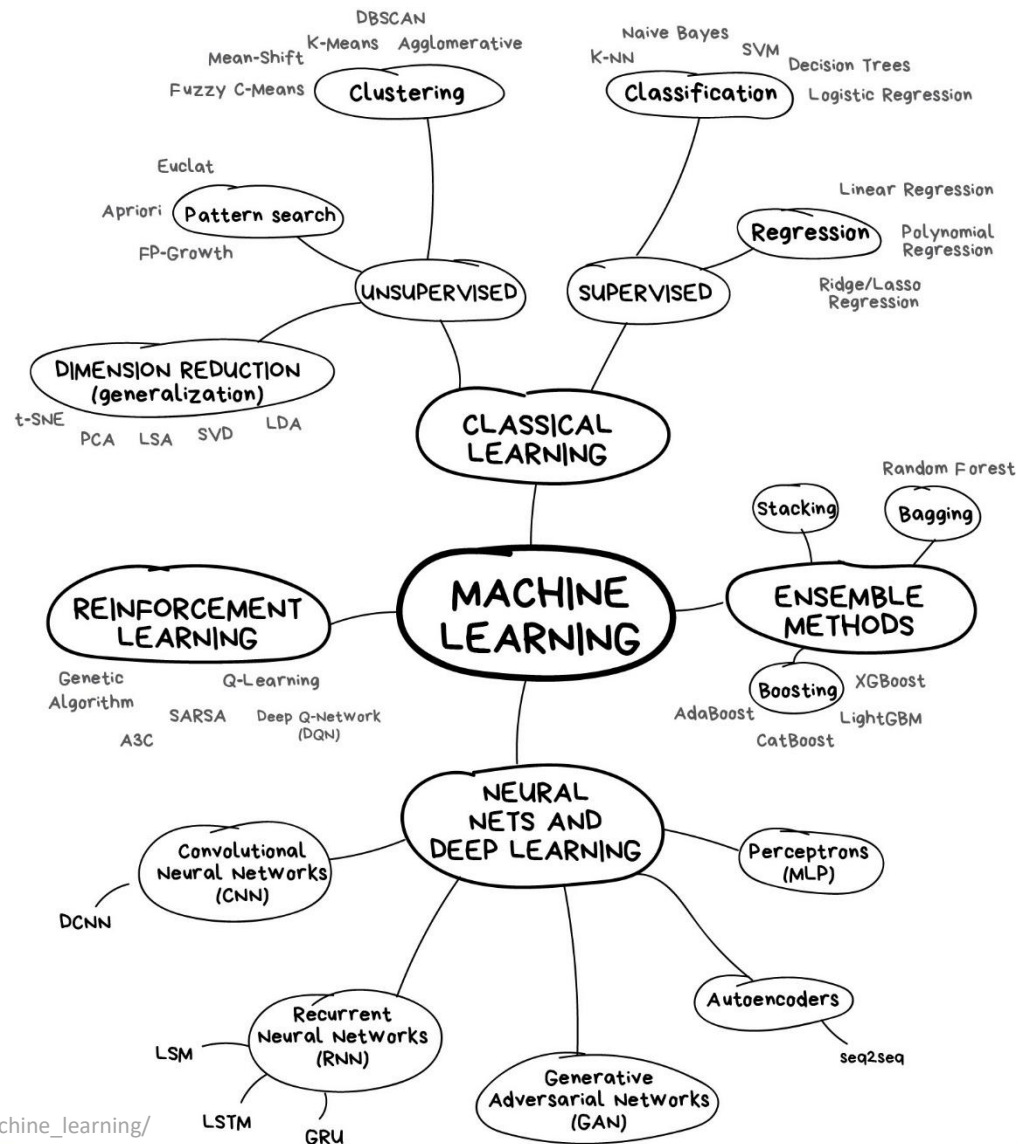
- **ML is concerned with using specialized algorithms to uncover meaningful information and find hidden patterns from perceived data to corroborate the rational decision-making process.**



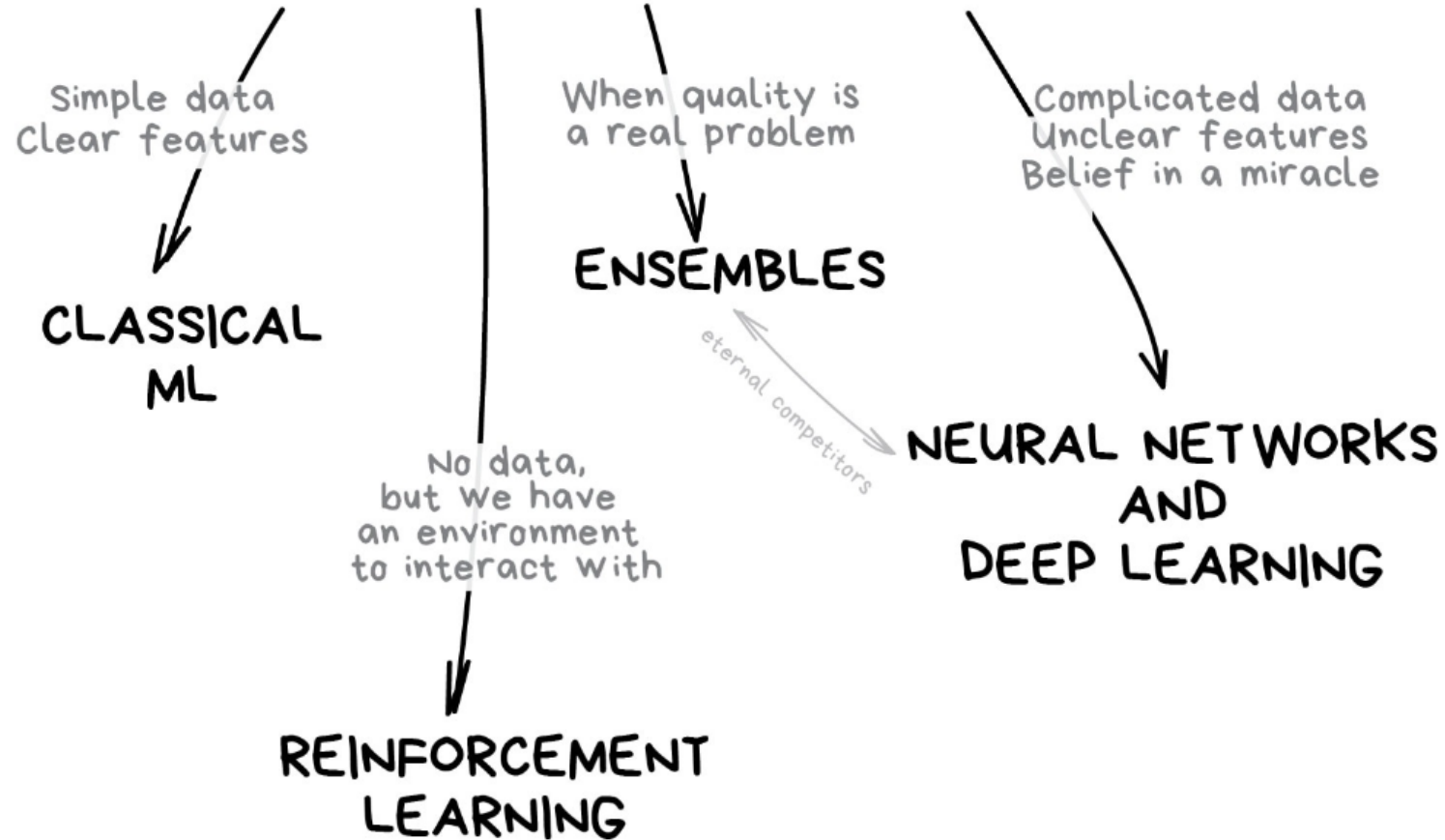
<https://microsoft.github.io/ML-For-Beginners/1-Introduction/1-intro-to-ML/images/ai-ml-ds.png>

# Applications of machine learning

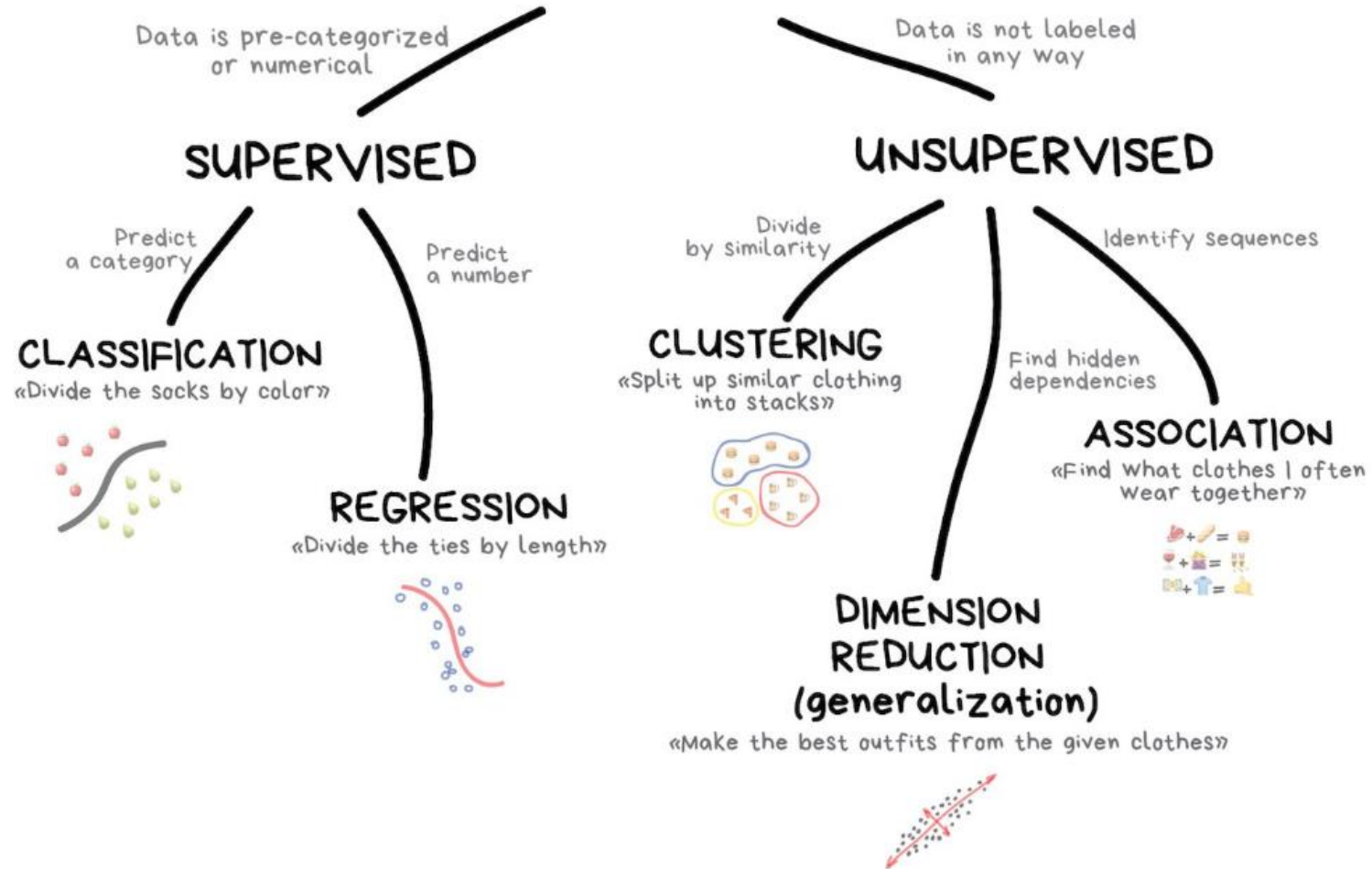
- Examples of applied ML:
  - To predict the likelihood of disease from a patient's medical history or reports.
  - To leverage weather data to predict weather events.
  - To understand the sentiment of a text.
  - To detect fake news to stop the spread of propaganda.
- Finance, economics, earth science, space exploration, biomedical engineering, cognitive science ...



# THE MAIN TYPES OF MACHINE LEARNING



# CLASSICAL MACHINE LEARNING



# Podatki

- Kako jih pridobimo?
  - Ročno označevanje (Manual labeling)



cat



not  
cat



cat



not  
cat

- Obnašanje uporabnikov

user ID	time	price (\$)	purchased
4783	Jan 21 08:15.20	7.95	yes
3893	March 3 11:30.15	10.00	yes
8384	June 11 14:15.05	9.50	no
0931	Aug 2 20:30.55	12.90	yes

machine	temperature (°C)	pressure (psi)	machine fault
17987	60	7.65	N
34672	100	25.50	N
08542	140	75.50	Y
98536	165	125.00	Y

- Prenos obstoječih podatkov iz interneta

# Advantages and Disadvantages of Machine Learning



- Easily identifies trends and patterns
- No human intervention needed (automation)
- Continuous Improvement
- Handling multi-dimensional and multi-variety data
- Wide Applications

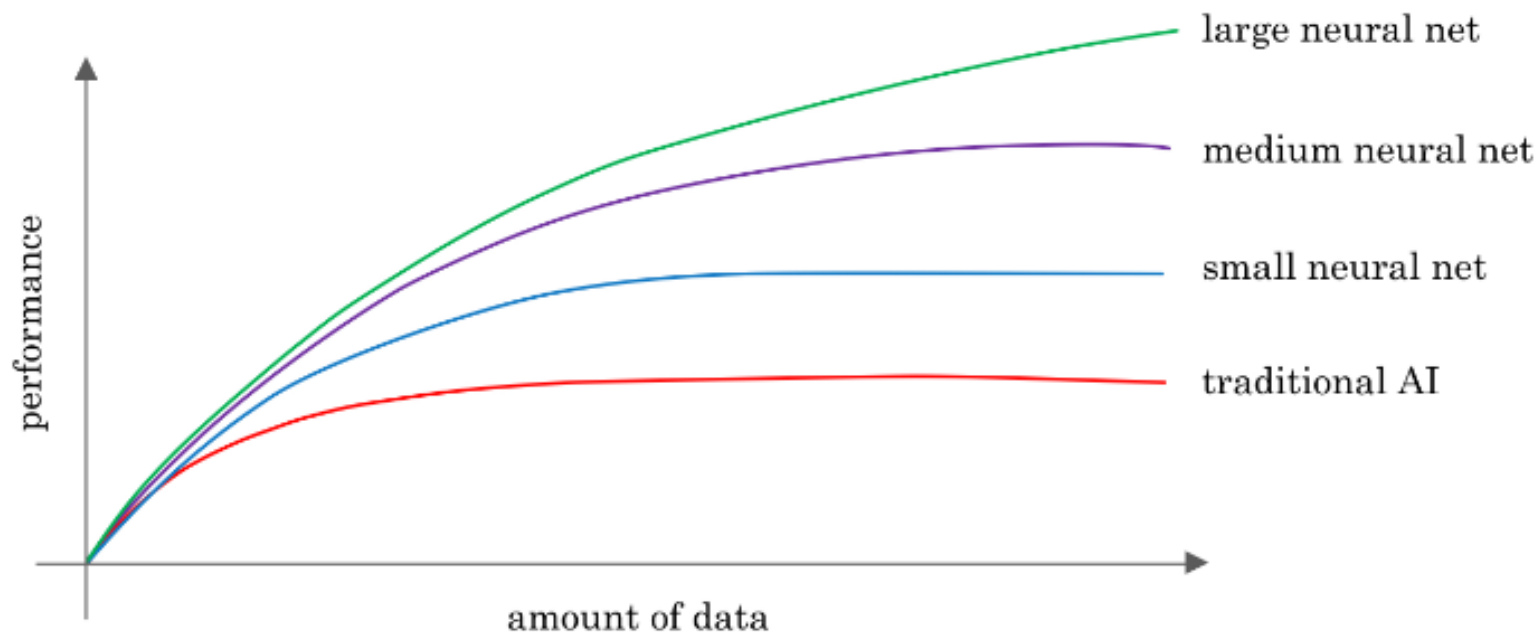


- Data Acquisition
- Time and Resources
- Interpretation of Results
- High error-susceptibility

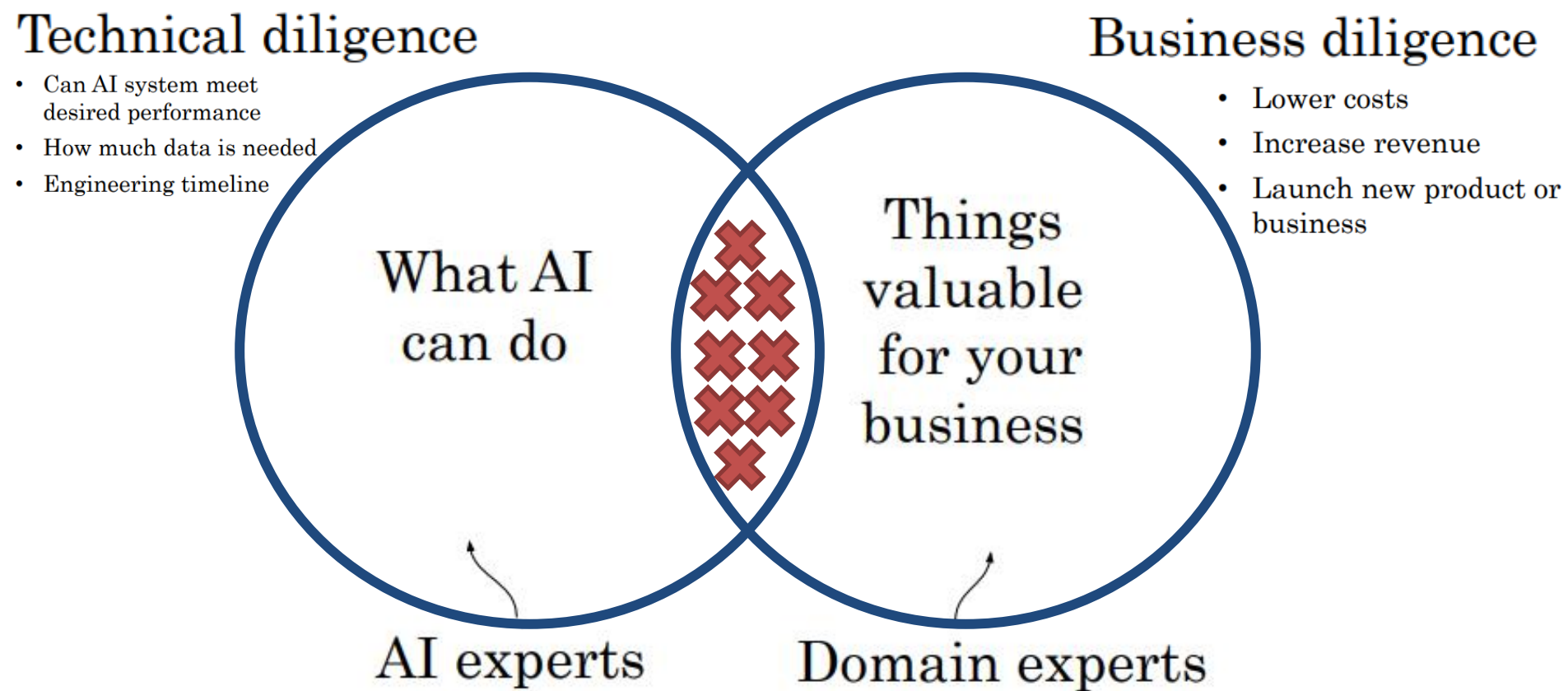


# Workflow of a machine learning project

1. Decide on the question
2. Collect and prepare data
3. Choose a training method
4. Train model (iterate many times until good enough)
5. Evaluate the model
6. Parameter tuning
7. Predict
8. Deploy model
  1. Get data back
  2. Maintain / update model



# How to choose an AI project?



# Technical tools

- Machine learning frameworks:
  - TensorFlow
  - PyTorch
  - Keras
  - MXNet
  - CNTK
  - Caffe
  - PaddlePaddle
  - Scikit-learn
  - R
  - Weka

# CPU vs. GPU

CPU: Computer processor (Central Processing Unit)



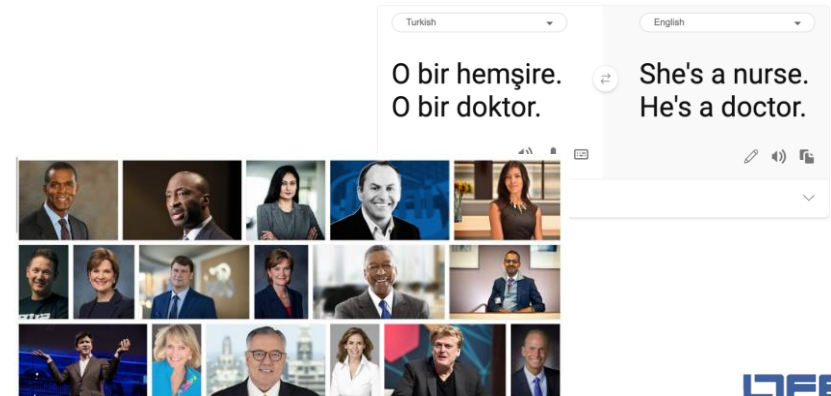
GPU: Graphics Processing Unit



Cloud vs. On-premises

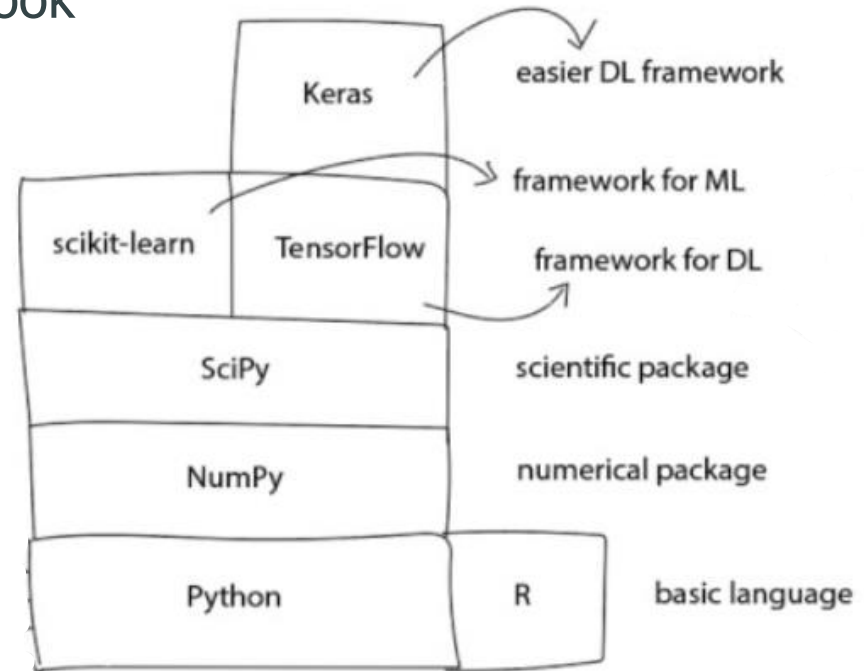
# Fairness in Machine Learning

- *"If you torture the data long enough, it will confess to anything" - Ronald Coase*
- Data can be **manipulated** to support any conclusion
- Guaranteeing **fairness in AI** and machine learning remains a complex sociotechnical challenge
- [Fairlearn](#) is an open-source Python package that allows you to assess your systems' fairness and mitigate unfairness.
- The main fairness-related harms can be classified as:
  - Allocation
  - Quality of service
  - Stereotyping
  - Denigration
  - Over- or under- representation



# Priprava okolja

- Python, VSCode, Jupyter Notebook



# Hvala!

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