Introduction to Artificial Intelligence

1st Webinar

August 28, 2023

UNIVERSITY OF LATVIA

LIKTA
LATVIAN INFORMATION AND COMMUNICATIONS TECHNOLOGY ASSOCIATION

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To register for the course

ej.uz/ai-intro

About the course

Who is this course for?

- Individuals seeking to gain foundational knowledge about AI and Machine Learning concepts.
- No prior experience in AI, Machine Learning, or programming languages, such as Python, is required.
- Suitable for people from various backgrounds who want to explore AI applications in their domain.
- Perfect for those who want to learn how to build and deploy machine learning models using user-friendly tools like Microsoft Azure Machine Learning Designer.

Study process

1st Webinar	2nd Webinar
• Introduction to AI: definition, types of AI, and history • AI applications and real-world examples • Difference between AI, Machine Learning, and Deep Learning • Overview of AI and ML techniques	• Introduction to machine learning • Overview of popular machine learning algorithms • Introduction to regression techniques • Data cleaning and transformation • Model evaluation techniques
3rd Webinar	**4th Webinar**
• Introduction to cloud-based AI services and Microsoft Azure • Introduction to Azure Machine Learning Designer • Building (step by step) AI model using Azure Machine Learning Designer	• Introduction to generative AI • How to use Azure OpenAI • Step by step demonstration building with Azure & OpenAI

1. Webinar - August 28th, 17:30-19:30

Hidden from students

Kurso pristatymas. Kas yra dirbtinis intelektas? Kokie jo tipai? Istorija ir dirbtinio intelekto iškilimas. Mašininis mokymasis kaip dirbtinio intelekto subkategorija. Gilus mokymas kaip mašininio mokymo subkategorija. Dirbtinio itnelekto aplikacijos.

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Introduction to AI technology

MARK AS DONE

How does artificial intelligence (AI) work?

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What is machine learning?

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Artificial intelligence (AI) vs. machine learning (ML)

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What Is Deep Learning?

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Enable business users with key AI use cases

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Identify guiding principles for responsible AI

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Presentation from 1st webinar

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The final test

- **Date:** starting from June 16th
- **Duration:** 1 hour
- **Number of questions:** 30 questions, questions will be similar to self-control questions from the learning materials
- The final test is passed if 18 questions or 60% of the questions are answered correctly
- You can take the test twice

Defining intelligence and AI

What is intelligence?

The ability to learn or understand or to deal with new or trying situations (from Merriam-Webster)

What is intelligence?

Intelligence includes various attributes:

- learning from experience
- generalizing knowledge
- recognizing patterns
- understanding complex ideas
- exhibiting creativity.

What is intelligence?

- **Generalizing knowledge:** Intelligent beings possess the ability to apply knowledge gained in one context to other, similar situations.
- **Learning from experience:** To learn from past experiences and use that knowledge to make informed decisions in the future is a critical component of intelligence.
- **Pattern recognition:** Refers to the essential ability of intelligent beings to identify repeating elements, trends, or structures within data or sensory information. Central to intelligence is the capacity to recognize patterns in data or sensory input. This skill enables intelligent beings to identify relationships and correlations that may not be immediately apparent, leading to a deeper understanding of the world around them.

What is intelligence?

- **Problem-solving:** Ability to approach challenges and create solutions is a fundamental aspect of intelligence. This includes the capacity to reason logically, analyze information, and employ creativity to overcome obstacles.
- **Creativity:** The ability to think creatively and develop innovative ideas or solutions.
- **Adaptability:** Intelligence is closely tied to an individual's ability to adapt to new situations and environments. This involves adjusting behaviors and applying knowledge to new contexts, demonstrating flexibility in the face of change.

What is artificial intelligence?

Artificial Intelligence aims to create machines capable of simulating human intelligence by mimicking the attributes of human cognition, such as problem-solving, pattern recognition, decision-making, and understanding natural language.

Types of AI

Narrow AI (weak AI) - designed to perform specific tasks or solve particular problems. These systems are highly specialized and excel in their designated areas but lack the ability to generalize their knowledge or perform tasks outside their domain.

All AI's developed so far are narrow AI.

Types of AI

General AI (strong AI) - also known as artificial general intelligence (AGI), refers to AI systems with human-level intelligence, capable of understanding and performing any intellectual task that a human can do.

General AI would possess the ability to learn, reason, and adapt across a wide range of tasks and domains same as a human being can do.

Types of AI

Superintelligent AI – is a hypothetical AI systems that would surpass human intelligence in virtually every aspect, including creativity, problem-solving, and decision-making.

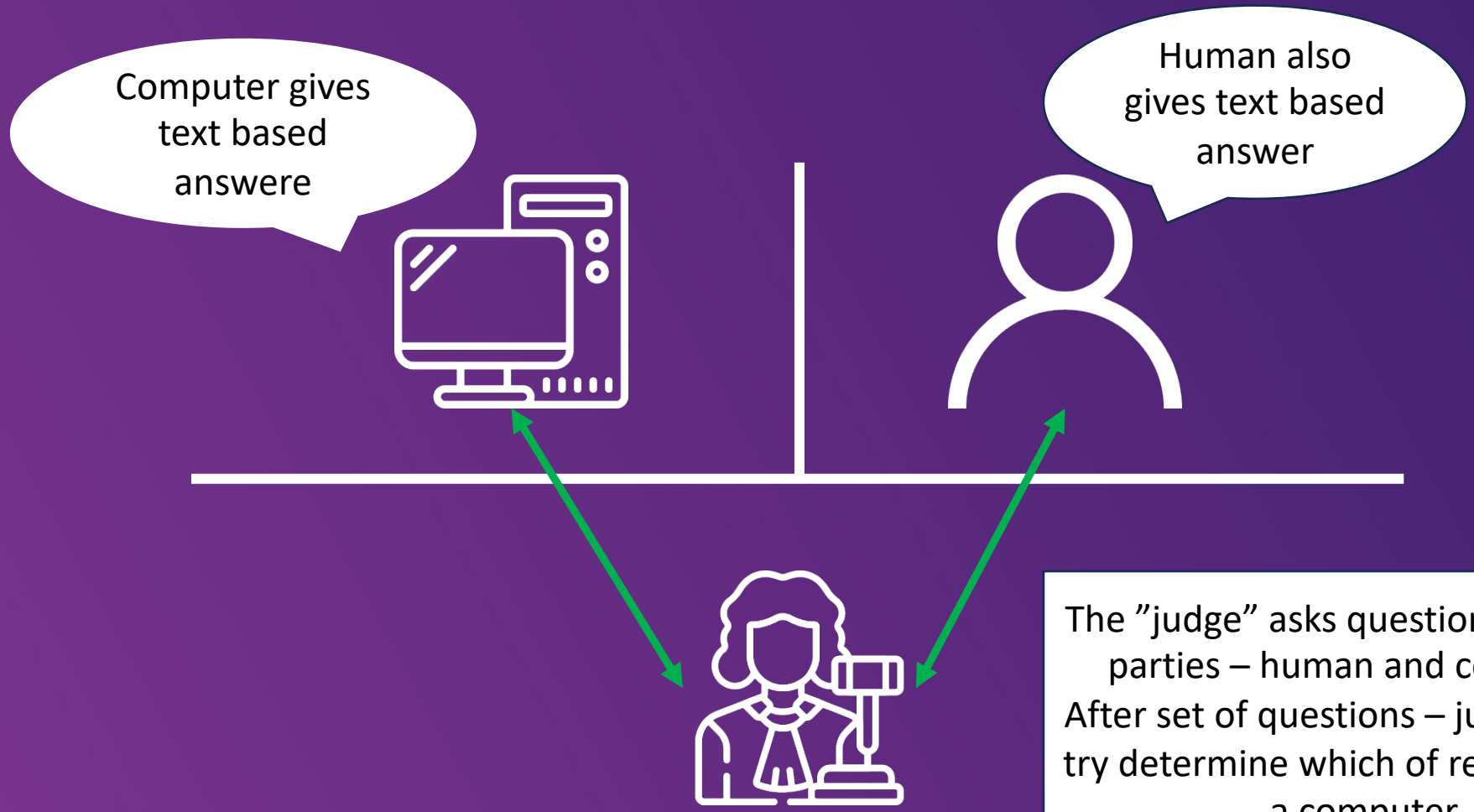
This level of AI could potentially outperform humans in all cognitive tasks, leading to significant advancements in various fields but also raising ethical and safety concerns.

The timeline of AI development

The Turing Test

- Proposed by Alan Turing in 1950, it was an attempt to determine if a machine could exhibit intelligent behavior indistinguishable from a human.
- The test involved 3 parties - a human judge, a human respondent, and a machine disguised as a human respondent
- The test is considered successful, if the judge can't reliably tell the machine and the human apart.
- This test marked the beginning of modern AI research.

The Turing Test



The ”judge” asks questions two both parties – human and computer. After set of questions – judge should try determine which of responders is a computer

The Dartmouth Conference

- Held in 1956 to explore the potential of artificial intelligence
- The conference was organized by John McCarthy, Marvin Minsky, Nathaniel Rochester, and Claude Shannon
- This conference marks the formal establishment of AI as a research field

The Golden Age of AI

- The period from 1960s and 1970s are often called: Golden Age of AI
- Focus on encoding human knowledge and problem-solving strategies using formal symbols and rules
- Notable early systems: General Problem Solver (GPS) and ELIZA

ELIZA – Natural Language Understanding

- Developed by Joseph Weizenbaum in the mid-1960s
- Simulated conversation with users through pre-determined scripts
- Most famous iteration: "DOCTOR", imitating a psychotherapist
- Paved the way for further research in natural language processing

Expert Systems

- Emerged in the 1970s and 1980s, and was among the first truly successful forms of artificial intelligence (AI) software
- Used knowledge from human experts to solve complex problems
- Examples: MYCIN for diagnosing infectious diseases, XCON for configuring computer systems
- Showcased the practical potential of AI in various industries

AI Winter and Challenges

- Period of reduced funding and interest in AI during the 1980s and early 1990s
- Caused by the failure of early AI systems to meet high expectations
- Limitations of symbolic AI, lack of computational power, and scarcity of large-scale data

Revival of AI

- The revival of AI research began in the late 1990s and early 2000s
- Fueled by the rise of machine learning and deep learning techniques

Factors Contributing to AI Revival

- Increased computational power: advances in hardware and parallel processing
- Large, diverse datasets: crucial for data-intensive approaches like machine learning
- Algorithmic advances: deep learning breakthroughs, such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs)

Recent breakthroughs and AI Milestones

- IBM's Watson won in “Jeopardy” back 2011
- Google DeepMind's AlphaGo defeated Go champion Lee Sedol in 2016
- Deep learning techniques have accelerated progress in computer vision, leading to advancements in autonomous vehicles
- Advancements in natural language processing models, such as OpenAI's GPT-3 and ChatGPT

Expert systems

Expert systems are a type of AI that aims to replicate the decision-making abilities of a human expert within a specific domain. They are built to solve complex problems by reasoning through the knowledge stored in their knowledge base, much like a human expert would. Expert systems were one of the earliest applications of AI and gained significant attention in the 1970s and 1980s.

Components of expert systems

1. **Knowledge Base:** The knowledge base is a collection of facts, rules, and heuristics about the specific domain. This information is gathered from domain experts and stored in a structured format.
2. **Inference Engine:** The inference engine is responsible for applying the rules and facts in the knowledge base to deduce new information or make decisions. It uses various reasoning techniques, such as forward chaining (data-driven) or backward chaining (goal-driven), to infer conclusions from the given data.
3. **User Interface:** The user interface allows users to interact with the expert system, inputting data or queries and receiving the system's conclusions or recommendations.

Advantages of expert systems

- **Consistency and reliability:** Expert systems can provide consistent and reliable analysis, as they are not subject to human biases or fatigue.
- **Knowledge preservation:** By encoding the expertise of domain experts, expert systems can preserve valuable knowledge even if the experts become unavailable.
- **Availability and accessibility:** Expert systems can be easily accessed by multiple users simultaneously and can provide expertise in situations where human experts may not be readily available.

Limitations of expert systems

- **Limited scope:** Expert systems are designed for specific domains and are not capable of handling problems outside their area of expertise.
- **Knowledge acquisition:** The process of gathering and encoding domain knowledge can be time-consuming and resource-intensive.
- **Adaptability:** Expert systems lack the ability to learn and adapt to new situations or changing environments, as they rely on predefined knowledge and rules.

Machine Learning as a subset of AI

"Field of study that gives computers the ability to learn without being explicitly programmed". *(Arthur Samuel, in 1959)*

Defining Machine Learning

Machine Learning (ML) is a subset of AI that focuses on developing algorithms that enable computers to learn from data and improve their performance over time. The main idea behind ML is to enable machines to automatically adapt and make decisions without explicit programming.

In short:

- *Subset of AI*
- *Learning from data & experience*
- *No explicit programming*

ML versus Traditional programming

Traditional programming - a programmer writes an algorithms to solve a specific problem. The computer takes the input data, processes it based on the given rules, and produces the desired output. Works well for problems with clear and well-defined rules.

In machine learning, algorithms are fed with input data and the desired output, and the system learns the patterns or relationships within the data to generate a model that can make predictions or decisions for new, unseen data.

Types of Machine Learning

- **Supervised Learning**: Learning from labeled data
- **Unsupervised Learning**: Identifying patterns in unlabeled data
- **Reinforcement Learning**: Learning through trial and error

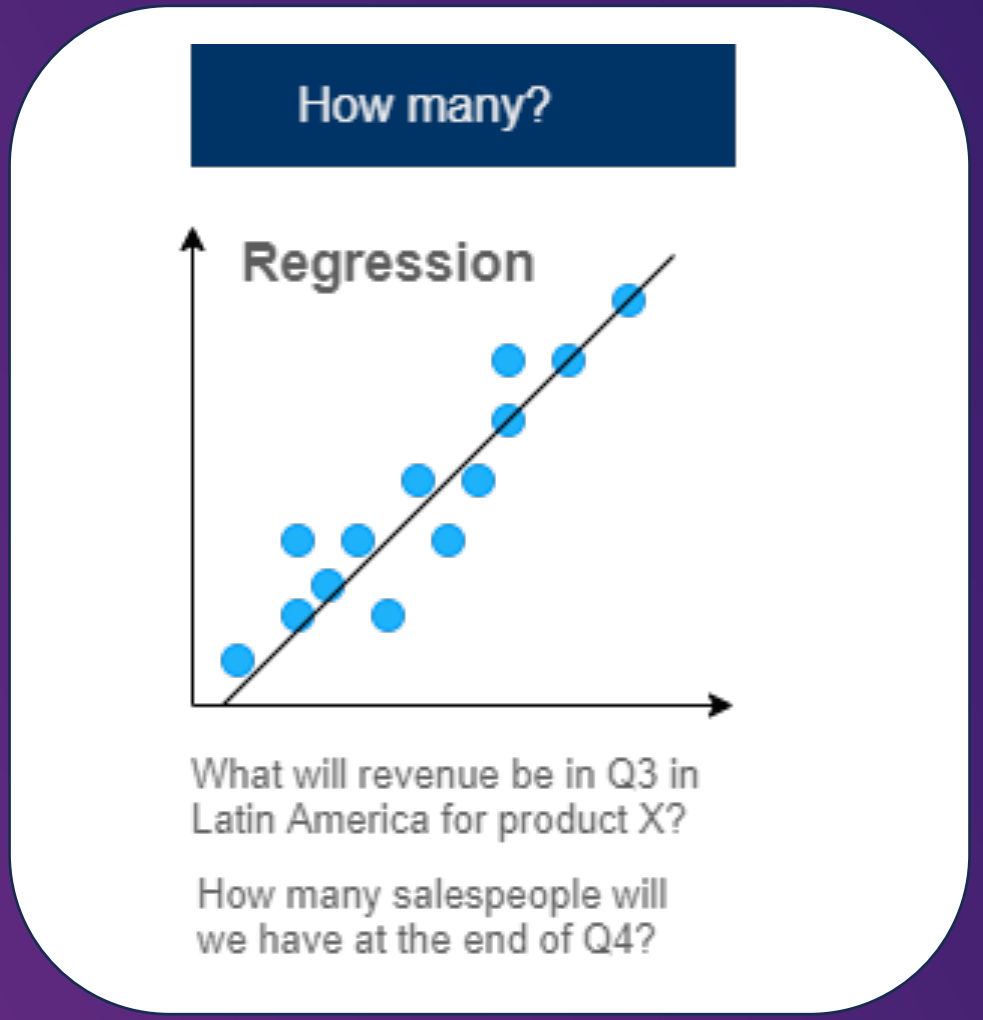
Supervised Learning: Learning from Labeled Data

In this type of ML, the algorithm is trained on a labeled dataset, with both input features and corresponding output labels. The goal is to learn a mapping from inputs to outputs, which can then be used to make predictions on new, unseen data.

Supervised Learning: Learning from Labeled Data

Regression is used to estimate or predict continuous numerical values based on given input data (features).

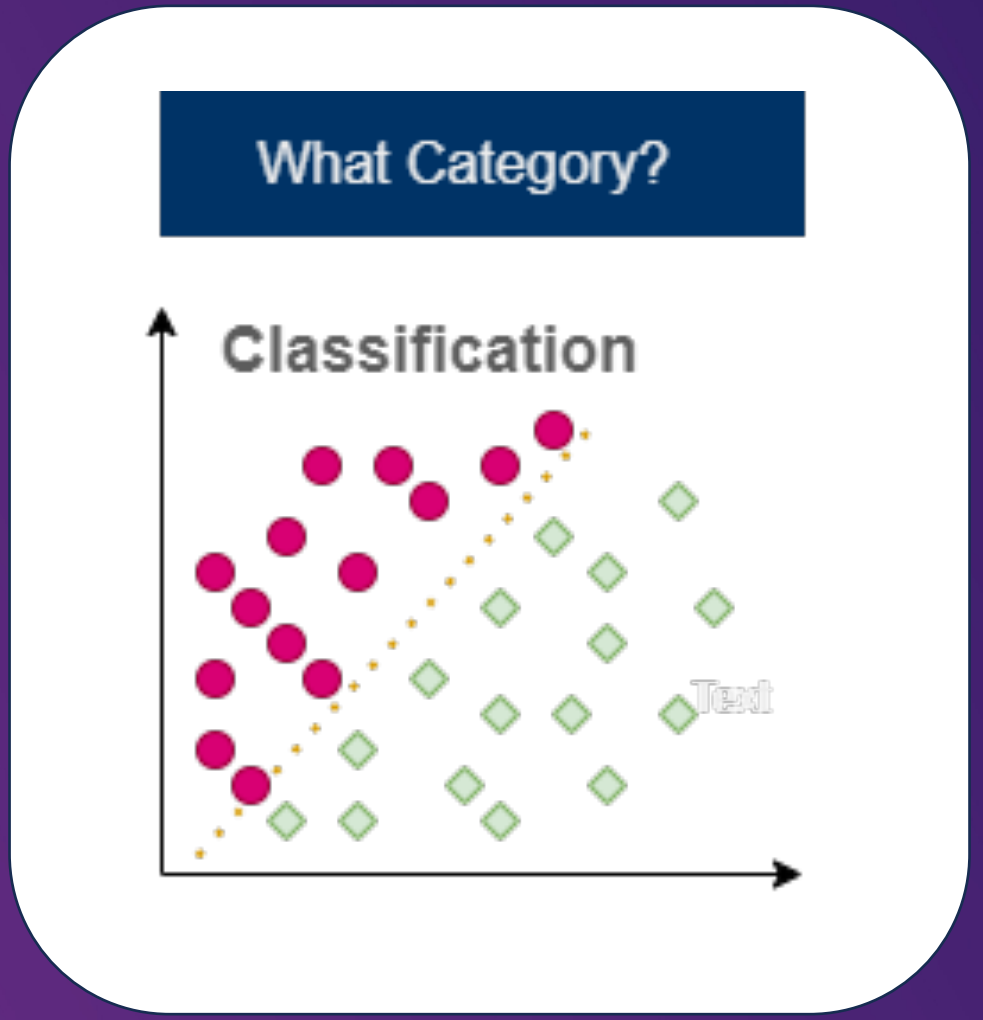
It helps us understand the relationship between these input features and the desired output, which is typically a number on a continuous scale.



Supervised Learning: Learning from Labeled Data

Classification is used for predicting discrete categories or classes, based on the relationships between input variables (features) and output variables (target).

The goal of classification is to create a model that can accurately predict the class or category (y) given a set of input values (x).



Unsupervised Learning: Self learning by identifying patterns

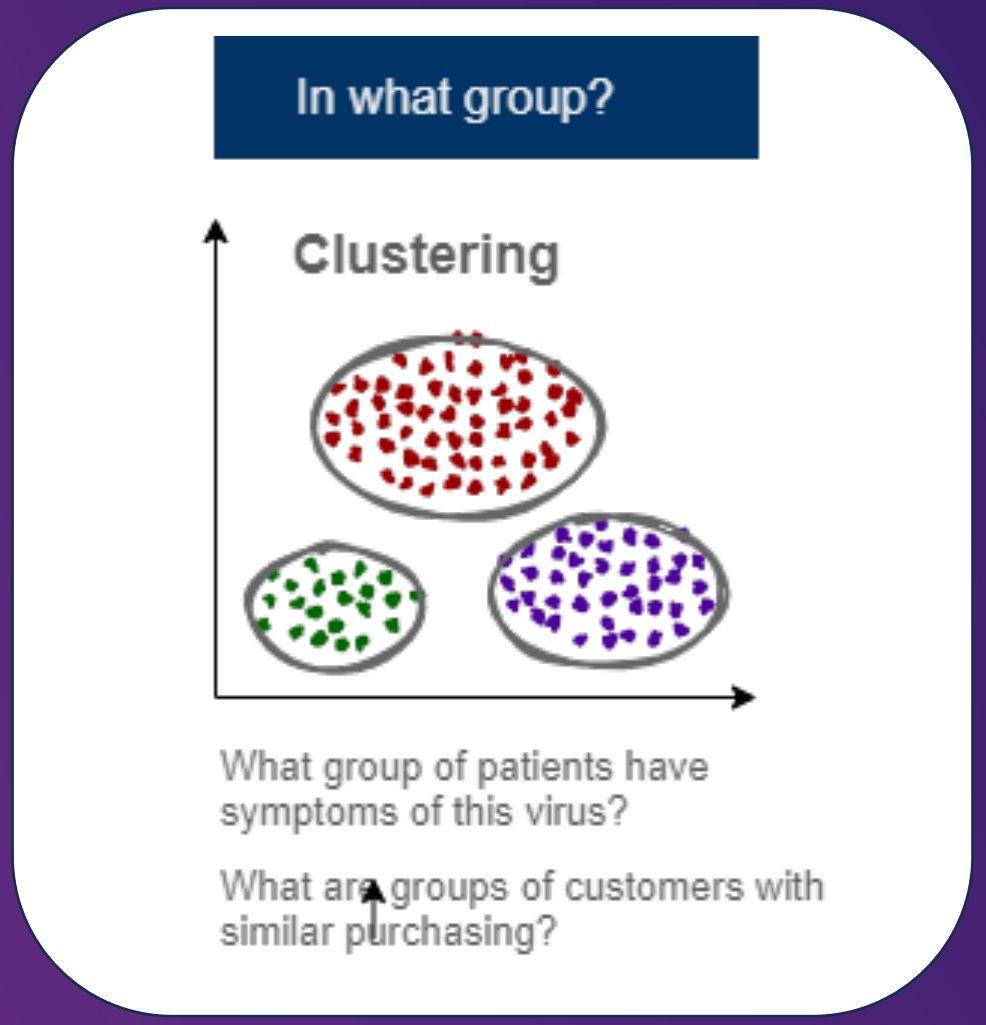
Unsupervised learning is a type of ML technique where the algorithm learns from data without any specific guidance or labels.

In simple terms, it's like giving the AI system a bunch of information and asking it to find interesting patterns or groupings on its own, without providing any specific instructions about what those patterns or groupings should be.

Unsupervised Learning: Self learning by identifying patterns

Clustering

Clustering aims to find and organize data points into groups (or clusters) in such a way that data points within the same cluster are more similar to each other than to those in other clusters.



Reinforcement Learning: Learning through trial and error

Reinforcement Learning (RL) is a type of Machine Learning in which an agent learns to make decisions by interacting with an environment. The agent takes actions, receives feedback in the form of rewards or penalties, and adjusts its behavior to maximize the cumulative rewards over time. This learning process is inspired by the way humans and animals learn from trial and error, making it suitable for tasks that involve sequential decision-making and adaptive control.

Deep Learning as a subset of Machine Learning

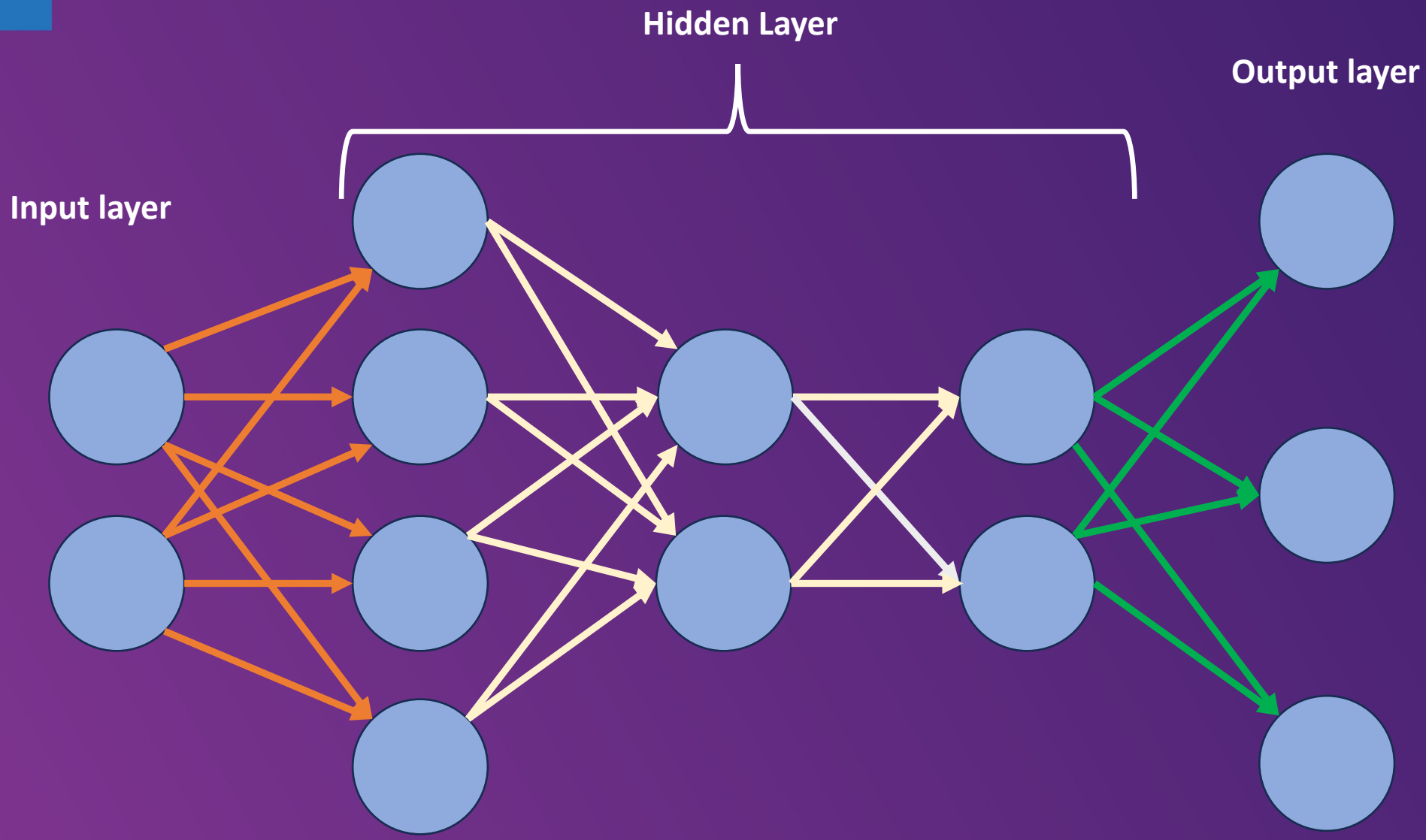
Deep learning is a subfield of machine learning that focuses on algorithms inspired by the structure and function of the human brain, called artificial neural networks.

Defining Deep Learning

Deep learning is a subfield of machine learning that focuses on algorithms called artificial neural networks.

Deep learning focuses on building and training multi-layered artificial neural networks to automatically learn and extract hierarchical representations and features from complex, large-scale data sets, without relying on explicit programming.

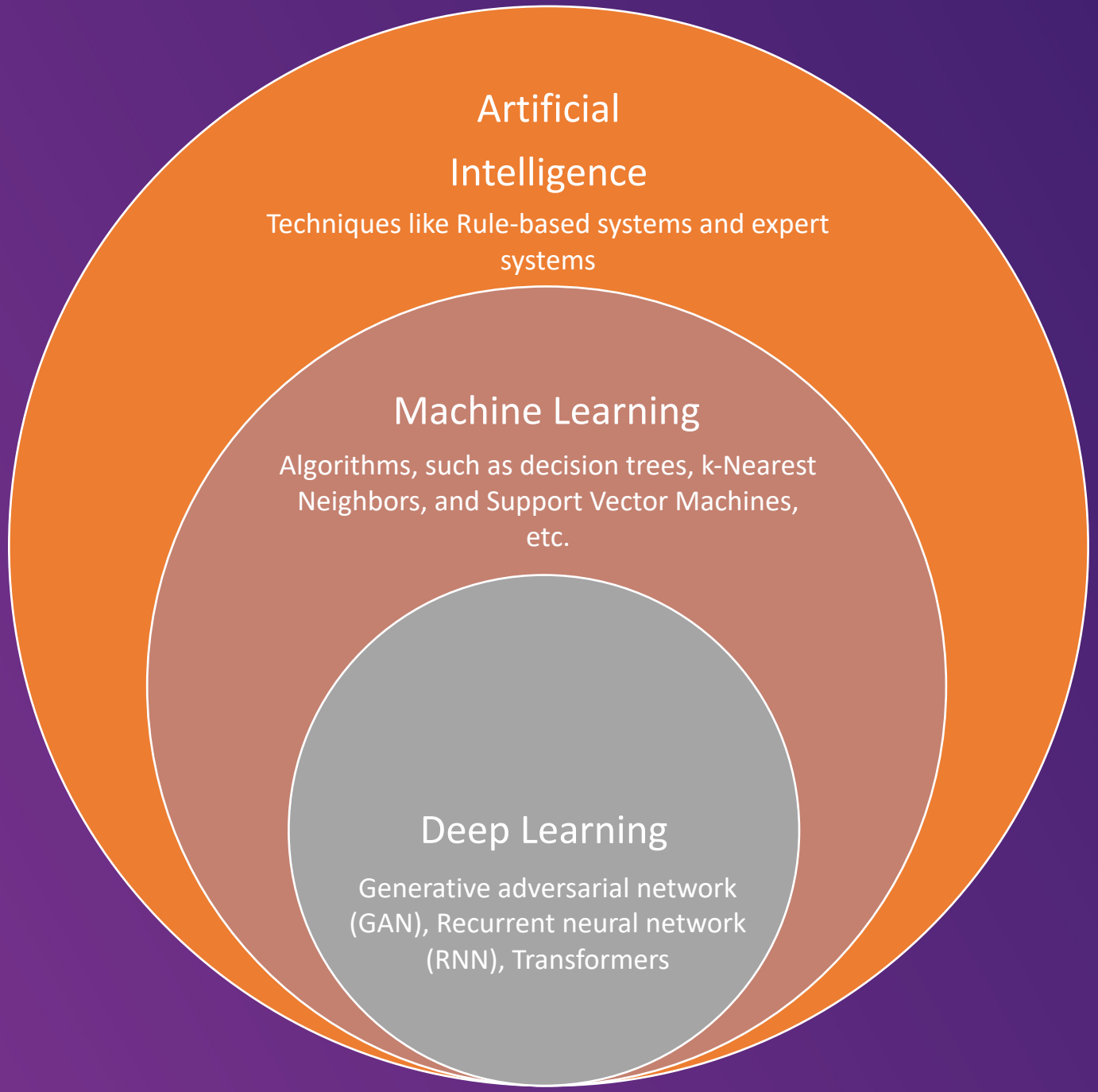
Neural network



Defining Deep Learning

Deep learning has been particularly successful in various applications, such as image and speech recognition, natural language processing, and game playing.

Its ability to process and learn from vast amounts of unstructured data has made deep learning a driving force behind the rapid advancements in artificial intelligence.


Artificial
Intelligence
Techniques like Rule-based systems and expert systems
Machine Learning
Algorithms, such as decision trees, k-Nearest Neighbors, and Support Vector Machines, etc.
Deep Learning
Generative adversarial network (GAN), Recurrent neural network (RNN), Transformers

Applications of Artificial Intelligence

Natural language processing and translation

- Natural language processing (NLP) focuses on enabling computers to understand, interpret, and generate human language.
- NLP combines computational linguistics, machine learning, and deep learning techniques to analyze and process text or speech data.
- Popular tasks in NLP include language translation, sentiment analysis, text summarization, and others.

Use cases of NLP

Customer support: NLP-powered chatbots can be used to provide customer support by answering frequently asked questions, guiding users through processes, or even troubleshooting issues. This can help improve efficiency, reduce response times, and provide personalized support 24/7.

Use cases of NLP

Content analysis: NLP can be used to analyze large volumes of text data, such as news articles, social media posts, or research papers, to identify trends, patterns, or insights. This can help businesses and researchers make data-driven decisions and understand public sentiment around specific topics.

Use cases of NLP

Real-time translation: NLP applications like Google Translate enable real-time translation of text or speech, allowing users to communicate with others who speak different languages. This can be especially useful for international travel, business communication, or language learning.

Healthcare applications

AI has the potential to transform the healthcare industry by improving diagnosis, treatment, and patient care. Thanks to machine learning, deep learning and NLP, AI can analyze vast amounts of medical data, identify patterns, and make data-driven decisions. This can lead to more accurate diagnoses, personalized treatment plans, and better patient outcomes.

Use cases in healthcare

AI-driven diagnostics: AI algorithms can analyze medical images, such as X-rays, MRIs, or CT scans, to detect abnormalities or diagnose diseases more accurately and efficiently than traditional methods. For example, AI has shown promise in detecting early-stage cancers and other conditions.

Use cases in healthcare

Drug discovery: AI can accelerate the drug discovery process by analyzing vast amounts of data to identify potential drug candidates, predict their effectiveness, and optimize their chemical structures. This can help reduce the time and cost associated with bringing new drugs to market.

Use cases in healthcare

Personalized medicine: AI can analyze an individual's genetic, clinical, and lifestyle data to develop personalized treatment plans tailored to their specific needs. This can lead to more effective treatments with fewer side effects and an improved quality of life for patients.

Finance applications

Financial institutions are leveraging artificial intelligence to analyze vast amounts of financial data, identify patterns, and make predictions. AI applications in finance include fraud detection, algorithmic trading, and robo-advisors, among others. These advancements lead to increased efficiency, cost savings, and improved customer experiences.

Use cases in finance sector

Risk assessment: AI can analyze various data sources, such as credit scores, financial history, and market trends, to predict and assess potential risks associated with loans, investments, or other financial products. This helps financial institutions make more informed decisions and minimize potential losses.

Use cases in finance sector

Fraud detection: AI algorithms can analyze transaction data in real-time to identify unusual patterns or behaviors that may indicate fraudulent activity. This enables financial institutions to quickly detect and prevent fraud, reducing losses and enhancing security for customers.

Use cases in finance sector

Robo-advisors: Robo-advisors are AI-driven financial advisors that provide personalized investment advice and portfolio management services based on a user's financial goals, risk tolerance, and investment preferences. These platforms offer a cost-effective alternative to traditional financial advisors and enable users to easily manage their investments.

Summary of the webinar

- AI has been around for almost 70 years
- Artificial Intelligence aims to create machines capable of simulating human intelligence
- Machine Learning and Deep Learning are both subfields of AI
- The main idea behind ML is to enable machines to automatically adapt and make decisions without explicit programming
- There are different types of machine learning, depending what result we want to achieve
- There is very few (or none) industries that won’t be affected by AI

Lithuanian GitHub repository

- In Lithuanian.
- The presentations of Lithuanian and English comments under them.
- PowerPoint presentations and PDF of the presentation.
- Additional material in either Lithuanian or English.
- Graphics.

Repo: https://github.com/aurimas13/Pazink-Dirbtini-Intelekta/tree/main

See you next time!

Don’t forget to check learning materials on COURSES.BALTICINTERNSHIPS.EU and if you have questions, contact me at auraimas.nausedas@gmail.com or follow and write me on twitter/X as AurimasNausedas or through LinkedIn as https://www.linkedin.com/in/aurimasnausedas/ or through the course’s repository