SAINT Curriculum

UNIT 5: Application of AI in everyday life

Deliverable: WP2/2.2

SAINT

HANDS ON INTRODUCTION TO ARTIFICIAL INTELLIGENCE IN PRIMARY EDUCATION USING MINECRAFT

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REVISION HISTORY

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REFERENCED DOCUMENTS

ID	Reference		Title
1	2022-1-FR01-KA220-SCH-000087794		SAINT Proposal
2			

APPLICABLE DOCUMENTS

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Contents

1 Introduction of the project

1.1 The scope of the project

Working as an ideal digital learning environment to teach children about the practical applications of AI based on theAI4K12 project guidelines, the motivation for this project comprises the following goals:

- Introduce pupils, teachers and educators to AI concepts, its impacts on our society and related practical implementations,
- Address the growing need to develop remote learning solutions facilitating student engagement, creativity, problem-solving and decision-making skills,
- Upskill the teachers and educators with new sets of skills (PBL, AI, gamification etc) developed through innovative ways of teaching,
- Improve engagement rates in children through the use of an innovative way of teaching, helping children develop creativity,
- Reduce the gap between need and availability for AI related skills.

AI Adventures in Minecraft teaches AI related skills to children aged from 9-12 years old, using a Minecraft World. With this, we create a fun, interactive and creative learning environment through specific activities and challenges aligned with the AI4K12 guidelines (ai4ka12.org) and the 5 big ideas of AI: 1) Perception, 2) Representation & Reasoning, 3) Learning, 4) Natural interactions, 5) Societal impact.

To that end, the project develops and promotes the following tangible results:

- This curriculum: a complete learning course for introducing AI in school teaching based on the 5 big ideas of the AI4K12 framework. The course disseminates knowledge about AI4K12's AI education guidelines and the 5 big ideas, explore the impact of AI in our society and enhance understanding of relevant concepts.
- A tailored Minecraft world (AI Adventures World) delivering educational challenges based on the learning course. It makes use of the escape room concept and offer Problem Based Learning activities. One challenge for each unit or lesson.
- The foundry virtual space supporting a growing community of adopters of SAINT and guiding the corrective/perfective and evolutive maintenance of the training package.

1.2 The target groups

The project sees the direct involvement of teachers, mainly teachers of children aged from 9-12 years old or Higher Education staff involved in the teaching of educators. These teachers are either teachers of STEM subjects or have some knowledge and interest in AI and/or Minecraft.

Concerning the Indirect target groups identified, the following can be involved:

- STEM centres looking to develop their catalogue of innovative teaching technologies or their catalogue of product enhancing AI knowledge,
- Higher education institutions collaborating with companies / public authorities engaged in the creation of educational material,
- Organisation, associations or networks looking to provide parents and or educators with educational material on AI: such as coding clubs, adult learning centres, entrepreneurial coaching services, continuing education centres, etc.

1.3 The purpose of this document

The work package n°2 - AI4K12 Educational Programme focuses on producing a complete course on AI with a set of 5 challenges in the related Minecraft World to illustrate the practical implementation of the technology.

This AI Curriculum is composed of a total of 5 units of pedagogical material based on the AI4K12 education guidelines and the learning objectives put into light following national surveys:
1. Application of AI in Machine learning,
2. Application of AI in Work and Entrepreneurship,
3. Application of AI in Speech & vision,
4. Application of AI in Games & puzzles,
5. Application of AI in everyday life.

Additionally, a glossary is created in each Unit in order to ease the adoption of the SAINT package by the teachers and schools.

2 Glossary of the Unit

Words	Definition
Lidar	“Lidar sensors are similar to radar, but they use laser beams instead of radio waves” (Foresight Team, 2022).
Machine learning algorithms	“The method by which the AI system conducts its task, generally predicting output values from given input data” (Wigmore, 2019).
Deep learning	“A machine learning technique that teaches computers to do what comes naturally to humans: learn by example” (Mathworks, 2022).
Perception (in AI)	The ability of machines to sense and interpret the environment around them and “*perform human-like cognitive tasks”* (Benbya et al., 2021).
Representation (in AI)	The way that information is structured and organized within an AI system (Edureka, 2023).
Reasoning (in AI)	The process of using information to draw conclusions or make decisions (Edureka, 2023).
Natural language processing	The area of AI that is concerned with enabling machines to understand and interact with human language (SAS, 2022).

Data mining	"To extract relevant data from a larger set of raw data, exploring and analyzing large blocks of information to find out meaningful patterns and trends" (Orecchio, 2022).
Neural networks	"Flexible computing systems applied to complex pattern recognition and prediction problems, clustering and forecasting behaviors" (Orecchio, 2022).
Pattern recognition	"Automated recognition of regularities in datasets through the use of computer algorithms, which are eventually classified into different categories" (Orecchio, 2022).

3 Introduction of the Unit

3.1 Description

This module is about artificial intelligence (AI) and its applications in everyday life. The module will cover five key areas of AI4k12: perception, representation and reasoning, learning, natural interaction, and societal impact.

3.2 Learning objectives & outcomes

In this Unit, learners will become acquainted with the importance of Artificial Intelligence in everyday life and in a wide variety of domains and industries.

On successful completion of this Unit, learners should be able to:

- Outcome 1: Understand the basic principles of AI and how it differs from human intelligence.
- Outcome 2: Identify and describe real-world applications of AI in everyday life.
- Outcome 3: Evaluate the implications as well as the ethical considerations surrounding the use of AI in society.

3.3 Estimated seat time

The completion of the module along with the implementation of the knowledge provided will last 8 hours.

4 Course content of the Unit

4.1 Introduction

This module is about artificial intelligence (AI) and its applications in everyday life. The module will cover five key areas of AI4k12: perception, representation and reasoning, learning, natural interaction, and societal impact.

4.2 Idea 1: Perception

Perception in AI refers to the ability of machines to **sense and interpret the environment around them and "*perform human-like cognitive tasks*"** (Benbya et al., 2021). This involves **acquiring data from various sources**, such as sensors, cameras, microphones, and other input devices, and then **using that data to make decisions or take actions**. Subsequently, AI perception is a critical component of many modern AI systems and is likely to become even more important in the future as AI technology continues to advance. However, there are also concerns about the privacy and security implications of using AI perception in everyday life, and it is important to ensure that these systems are developed and used responsibly (Terzopoulos & Satratzemi, 2020).

Examples of how AI perception is being used in everyday life:

1. **Autonomous vehicles**: One of the most high-profile applications of AI perception is in autonomous vehicles. These vehicles use cameras, lidar, radar, and other sensors to detect objects in their environment and navigate roads safely (Foresight Team, 2022). The data from these sensors is fed into **machine learning algorithms** that can identify and track objects, predict their movements, and make decisions about how to respond.

2. **Facial recognition**: Facial recognition technology is becoming increasingly prevalent in everyday life. It is used to unlock smartphones, to identify individuals in security systems, and to monitor public spaces for security purposes. Facial recognition systems use **deep learning algorithms** to analyze facial features and identify individuals based on unique characteristics Dubey & Jain, 2019).

3. **Smart home devices**: Smart home devices, such as thermostats and lighting systems, **use sensors to detect** motion/when people are present in a room and adjust settings accordingly (Ezlo, 2022). For example, a smart thermostat might use motion sensors to detect when someone enters or leaves a room and adjust the temperature accordingly to conserve energy. Smart home devices can also detect abnormalities in functioning systems. For example, water leak sensors can detect water leaking from a pipe and, hence, prevent major damage.

4. **Health monitoring**: AI perception is also being used in health monitoring systems, such as wearable devices and mobile apps. These devices use **sensors to track a variety of health metrics**, such as heart rate, sleep patterns, and physical activity. Machine learning algorithms can analyze this data to identify patterns and predict health outcomes, such as the likelihood of a heart attack or stroke. Overall, AI in healthcare can ***provide data-driven clinical decision support (CDS)*** and, hence, improve clinical outcomes (Insider Intelligence, 2023).

5. **Security and surveillance**: AI perception is also being used in security and surveillance systems, such as cameras and drones. These **systems use sensors to detect and track** individuals or objects of interest and can **alert** security personnel or take other actions as needed

(Srivastava et al., 2017). For example, a security camera might use **computer vision algorithms to detect suspicious behavior** and send an alert to security personnel.

Image title: Autonomous_Vehicle
Source: Pixabay.com

4.3 Idea 2: Representation & reasoning

Representation in AI refers to **the way that information is structured and organized within an AI system** (Edureka, 2023). This is important because the way that information is represented can have a big impact on the **performance and accuracy of the system.** Reasoning, on the other hand, is **the process of using information to draw conclusions or make decisions.** Although these systems are immensely beneficial for mankind, it is important to ensure that they are developed and used ethically, and that they do not perpetuate biases or discrimination.

Examples of how representation and reasoning are used in AI:

1. **Natural language processing**: Natural language processing (NLP) is an area of AI that is concerned with enabling machines to understand and interact with human language (SAS, 2022). In order to do this, NLP systems must be able to represent language in a way that machines can understand, such as through the use of ontologies or semantic networks. They also use reasoning algorithms to interpret the meaning of language and respond appropriately.

2. **Recommendation systems**: Recommendation systems are used to suggest products, services, or other items to users based on their past behavior and preferences. These systems use machine learning algorithms to **analyze data** about user behavior and **make predictions**

about what items they are likely to be interested in (NVIDIA, 2023). They represent this data in a way that is easy for the algorithms to work with and use reasoning algorithms to make predictions about future behavior.

3. **Fraud detection**: AI is increasingly being used to detect fraudulent behavior, such as credit card fraud or insurance fraud. These **systems use machine learning algorithms to analyze data about transactions and other user behavior and look for patterns** that indicate fraudulent activity (Orecchio, 2022). They represent this data in a way that is easy for the algorithms to work with and use **reasoning algorithms** to make predictions about whether a particular activity is likely to be fraudulent. This is feasible with techniques like:

    - Data mining (see: Glossary)
    - Neural networks (see: Glossary)
    - Pattern recognition (see: Glossary)

4. **Financial modeling**: AI is also used in financial modeling to make predictions about stock prices, market trends, and other economic factors. These systems use **machine learning algorithms to analyze data about economic indicators and make predictions** about future performance (Aslam & Sarkar, 2021). They represent this data in a way that is easy for the algorithms to work with and use reasoning algorithms to make predictions about future trends.

5. **Medical diagnosis**: AI is increasingly being used in medical diagnosis to analyze medical images, such as X-rays or MRI scans, and identify potential health problems. AI systems use machine learning algorithms to **analyze the data in the images** and make predictions about potential health issues by *distinguishing disease from health and signal from noise* (Park, 2022). In this context, data is represented in a way that is easy for the algorithms to work with and use reasoning algorithms to make predictions about the likelihood of each diagnosis.

Image title: Smart_Home
Source: Pixabay.com

4.4 Idea 3: Learning

Learning in AI refers to **the process of machines being able to improve their performance on a task over time through experience**, as well as adapt to new tasks and environments **(Jordan & Mitchell, 2015)**. Learning is a critical component of many AI systems. However, it is important to ensure that these systems are trained on unbiased data and that they are used ethically, in order to avoid perpetuating biases or discrimination.

There are several different types of machine learning that are commonly used in AI:

1. **Supervised learning**: Supervised learning is a type of machine learning where the machine is trained on a labeled dataset, meaning that the correct output for each input is provided (ibid.). The machine learns by comparing its output to the correct output and adjusting its parameters to minimize the difference between them.

2. **Unsupervised learning**: Unsupervised learning is a type of machine learning where the machine is given an unlabeled dataset and must find patterns or structure in the data on its own (ibid.). This can be useful for tasks such as clustering or anomaly detection.

3. **Reinforcement learning**: Reinforcement learning is a type of machine learning where the machine learns through trial and error by receiving feedback in the form of rewards or punishments for its actions (ibid.). This type of learning is often used in robotics or game playing.

Examples of how learning is used in AI:

1. **Image recognition**: Machine learning is often used in image recognition tasks, such as identifying objects in a photograph. The machine is trained on a dataset of labeled images, and learns to identify patterns in the data that correspond to different objects.

2. **Speech recognition**: Machine learning is also used in speech recognition, where the machine is trained on a dataset of audio recordings and corresponding transcriptions. It learns to identify patterns in the audio data that correspond to different words or phrases.

3. **Natural language processing**: As mentioned in section 2, natural language processing involves enabling machines to understand and interact with human language. Machine learning is often used in this task, where the machine is trained on a dataset of labeled text data and learns to identify patterns in the data that correspond to different parts of speech, sentence structures, and other linguistic features.

4. **Autonomous vehicles**: Machine learning is used extensively in the development of autonomous vehicles, where the machine learns to recognize and respond to different road conditions, obstacles, and other factors. The machine is trained on a dataset of labeled images, sensor data, and other information, and learns to make decisions based on the patterns it identifies in the data.

5. **Fraud detection**: Machine learning is also used in fraud detection, where the machine learns to identify patterns in data that correspond to fraudulent activity. It is trained on a dataset of labeled data, such as credit card transactions, and learns to identify patterns that indicate potential fraud.

Image title: Algorithm
Source: Pixabay.com

4.5 Idea 4: Natural interaction

Natural interaction in AI refers to **how machines can interact with humans in a more intuitive and natural way** (Feldman et al., 2017). This is an important area of AI research and implementation, as it can help machines to better understand and respond to human needs and preferences. However, it is also important to ensure that these systems are designed with privacy and security in mind, so that they are used ethically and responsibly.

Examples of how natural interaction is used in AI:

1. **Chatbots**: Chatbots are computer programs designed to simulate conversation with human users. They use natural language processing and machine learning to understand the user's input and provide an appropriate response. Chatbots are often used in customer service, where they can help users find information or resolve issues.

2. **Virtual assistants**: Virtual assistants, such as Apple's Siri, Amazon's Alexa, or Google Assistant, are examples of natural interaction in AI. They use speech recognition and natural language processing to understand user requests and respond in a natural and intuitive way. They can perform a wide range of tasks, such as setting reminders, answering questions, or controlling smart home devices.

3. **Gesture recognition**: Gesture recognition technology allows users to interact with machines using hand gestures or body movements. This technology is often used in gaming, where players can use gestures to control characters on the screen, or in healthcare, where doctors can use gestures to manipulate medical images or other data.

4. **Brain-computer interfaces**: Brain-computer interfaces (BCIs) allow users to control machines using their thoughts. This technology can be used to help people with disabilities, such as those with paralysis, to communicate or control devices. BCIs use a combination of sensors, machine learning, and natural language processing to interpret brain signals and translate them into actions.

5. **Augmented and virtual reality**: Augmented reality (AR) and virtual reality (VR) are technologies that allow users to interact with digital content in a more natural and intuitive way. AR overlays digital content onto the real world, while VR creates a completely immersive digital environment. Both technologies can be used in gaming, education, or training, among other applications.

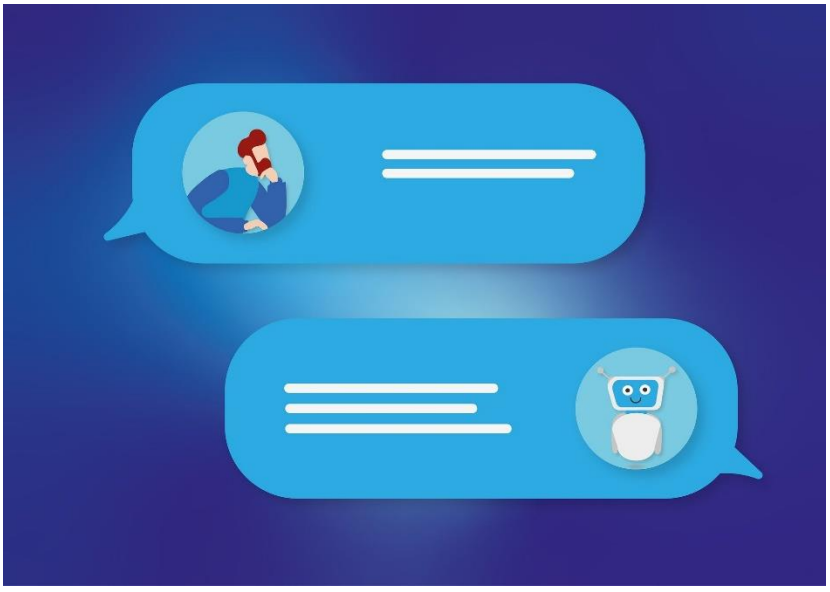

Image title: Chat_AI_Chatbot
Source: Pixabay.com

4.6 Idea 5: Societal impact

AI has the potential to benefit society in many ways, but it also involves significant risks and challenges (Hagerty & Rubinov, 2019). The use of AI systems has multiple ethical implications and can significantly affect society. Accordingly, when developing and deploying AI systems it is important to prioritize transparency, accountability, fairness, privacy, and safety.

When weighing on the **societal impact** of AI, it is crucial to consider the following **key points**:

Benefits:

- **Improved efficiency**: AI can automate repetitive tasks and streamline complex processes; this results in greater efficiency and productivity.
- **Enhanced accuracy**: AI can analyze large amounts of data quickly and accurately, and, hence, help in identifying patterns and trends that might not be visible to humans.
- **Personalization**: AI can help to personalize products and services, such as personalized recommendations based on past behavior or preferences.
- **Improved healthcare**: AI can be used to analyze medical images, diagnose diseases, and develop new treatments, thus improving patient outcomes etc.
- **Environmental sustainability**: AI can be used to optimize energy consumption, reduce waste, and improve resource management, thus contributing to a greener future.

Challenges:

- **Job displacement**: AI has the potential to automate many jobs, which could lead to job loss and a shift in the labor market.
- **Bias**: AI systems can perpetuate existing biases in data and algorithms, leading to unfair outcomes and discrimination.
- **Privacy**: AI systems can collect and analyze large amounts of personal data, raising concerns about privacy and surveillance.
- **Security**: AI systems can be vulnerable to hacking and cyberattacks, posing a threat to individuals and organizations.
- **Ethical considerations**: AI raises several ethical questions, such as who is responsible for decisions made by AI systems, and how to ensure that AI is used in a fair and just manner.

Ethical considerations:

- **Transparency**: AI systems should be transparent about how they make decisions and what data they use to make those decisions.
- **Accountability**: There should be clear lines of accountability for AI systems, and those responsible for their development and use should be held accountable for any negative outcomes.
- **Fairness**: AI systems should be designed to promote fairness and eliminate biases and should be regularly audited to ensure that they are not discriminating against any particular social group.
- **Privacy**: AI systems should respect individuals' privacy rights and be designed with privacy and data protection in mind.
- **Safety**: AI systems should be designed and tested to ensure that they are safe and do not pose a threat to individuals or society as a whole.

Image title: AI_Generated
Source: Pixabay.com

4.7 Case Studies & Success Stories

4.7.1 Example 1: Thymia

https://thymia.ai

Thymia is a healthcare company that uses AI and machine learning to improve mental health diagnosis and treatment. Thymia.ai develops AI-powered tools for mental health professionals to help them better diagnose and treat mental health conditions such as depression, anxiety, and bipolar disorder. Their technology uses natural language processing (NLP) algorithms to analyze patients' speech and identify patterns and markers of mental health conditions. They also use machine learning algorithms to continuously improve their models, make their diagnoses more accurate, and improve patient outcomes.

4.7.2 Example 2: Nvidia

https://www.nvidia.com/en-eu/geforce/

Nvidia is a technology company that specializes in *Graphics Processing Units* (GPUs), which are used in a wide range of applications, including video games, scientific simulations, and deep learning and other AI applications.

Nvidia's GPUs are highly parallelizable, which means that they can perform many computations simultaneously. This makes them ideal for use in training and running machine learning models, which require large amounts of data and many iterations to improve accuracy. By using GPUs, companies

can train and run these models much faster than they would be able to with traditional CPUs (Central Processing Units).

Nvidia has also developed a number of AI-specific hardware and software products. Its *Tensor Cores*, for example, are designed specifically for use in deep learning applications, and can perform matrix multiplication: a common operation in deep learning, much faster than traditional CPUs or GPUs. The company also offers a range of software tools for AI development, including its *CUDA* parallel computing platform and its *cuDNN* deep neural network library.

Nvidia's GPUs and AI-specific products are used in a wide range of industries, including healthcare, finance, and autonomous driving. For example, they are used in medical imaging applications to help doctors diagnose diseases, and in financial applications to detect fraud and perform risk analysis.

4.7.3 Example 3: Google

https://www.google.com

Google is one of the largest technology companies in the world and uses AI and machine learning to develop and deliver innovative products and services.

Google’s AI application examples:

1. *Google Search*: Google's search engine is one of the most widely used in the world, and it uses machine learning algorithms to provide users with relevant search results. The algorithms analyze the content of web pages, as well as user behavior, to determine which results are most likely to be useful to each individual user.
2. *Google Assistant*: Google Assistant is a virtual personal assistant that uses natural language processing (NLP) to understand and respond to user queries. It can perform a variety of tasks, such as setting reminders, playing music, and answering questions, and it uses machine learning to adapt to each user's preferences over time.
3. *Google Translate*: Google Translate is a tool that uses AI to translate text between languages. It uses machine learning algorithms to analyze patterns in language and to improve the accuracy of its translations over time.
4. *Google Photos*: Google Photos is a photo storage and sharing service that uses AI to organize and tag users' photos. It can automatically identify people, places, and objects in photos, and it uses machine learning to suggest edits and enhancements to photos, such as brightness and contrast adjustments.
5. *Google Maps*: Google Maps is a navigation and mapping service that uses AI to provide users with real-time traffic updates and suggestions for alternate routes. It uses machine learning algorithms to analyze traffic patterns and to predict congestion on different routes.

5 Additional materials and resources

Type of resource	Title	Topic	Link
Blog	Cameras, Radar and Lidar: Which is the Right Choice for Autonomous Vehicles?	This post explains the levels of autonomous driving and the equipment that is appropriate for each case.	https://www.foresightauto.com/cameras-radar-and-lidar-which-is-the-right-choice-for-autonomous-vehicles/
Online article	What Is Deep Learning? 3 things you need to know	This article explains what deep learning is, how it works, and how it is applied.	https://www.mathworks.com/discovery/deep-learning.html
Online article	Use of AI in healthcare & medicine is booming – here's how the medical field is benefiting from AI in 2023 and beyond	This article explains the benefits of AI in healthcare and medicine.	https://www.insiderintelligence.com/insights/artificial-intelligence-healthcare/
Blog	Security & Surveillance – Role of Artificial Intelligence	This post explains how AI and deep learning are embedded in security & surveillance devices.	https://www.mistralsolutions.com/blog/security-surveillance-role-artificial-intelligence/
Online article	What is a Recommendation System?	This article explains what a recommendation system is and how it works.	https://www.nvidia.com/en-us/glossary/data-science/recommendation-system/

Online article	AI Fraud Prevention: how Artificial Intelligence could help companies.	This article explains how AI can help with fraud prevention.	https://finscience.com/en/blog/alternative-data/ai-fraud-prevention/

6 Wrap-up

This module covers the application of AI in everyday life through five basic ideas: perception, representation and reasoning, learning, natural interaction, and societal impact. It discusses the types of AI sensors used, how data is processed and represented, and how machine learning works. It also explores how AI interacts with humans and the pros and cons of AI implementation in society, including ethical considerations. Overall, this module provides a comprehensive overview of AI's role in our daily lives.

7 Quiz

Question 1: Which of the following is NOT an example of AI perception technology?
a) Facial recognition
b) Speech recognition
c) Autonomous vehicles
d) Robotics

Question 2: What is representation and reasoning in AI?
a) The process of acquiring new knowledge
b) The process of converting data into a useful form
c) The process of using logic to make decisions
d) The process of identifying patterns in data.

Question 3: What is machine learning in AI?
a) The process of training machines to make decisions
b) The process of teaching machines to think like humans
c) The process of programming machines to complete specific tasks
d) The process of machines learning from data to improve their performance.

Question 4: Which of the following is an example of natural interaction with AI?
a) Text messaging with a chatbot
b) Using a voice assistant to control home appliances
c) Playing video games with AI opponents
d) Watching a movie with AI-generated special effects.

Question 5: What is the societal impact of AI?
a) Positive impacts on employment and economic growth
b) Negative impacts on privacy and security
c) Both positive and negative impacts on society
d) No impact on society

Question 6: Which of the following is a potential negative impact of AI on society?
a) Improved healthcare outcomes through AI-assisted diagnosis
b) Job displacement due to automation
c) Improved traffic flow through AI-controlled traffic lights
d) Improved personalization of online shopping recommendations.

Question 7: Which of the following is a potential positive impact of AI on society?
a) Increased economic inequality due to job displacement
b) Improved accessibility for people with disabilities
c) Decreased availability of information due to biased algorithms
d) Decreased trust in government institutions due to AI decision-making.

Question 8: What is the process of converting sensory data into meaningful information?
a) Data Transformation
b) Data Representation
c) Data Processing

Question 9: What is the process of using logical rules to draw inferences from data?
a) Perception
b) Representation
c) Reasoning

Question 10: How does machine learning work?
a) It uses pre-programmed rules to make decisions
b) It learns from data and improves its performance over time
c) It relies on human input to make decisions.

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