What is AI?

Estimated Reading Time: 5-6 minutes

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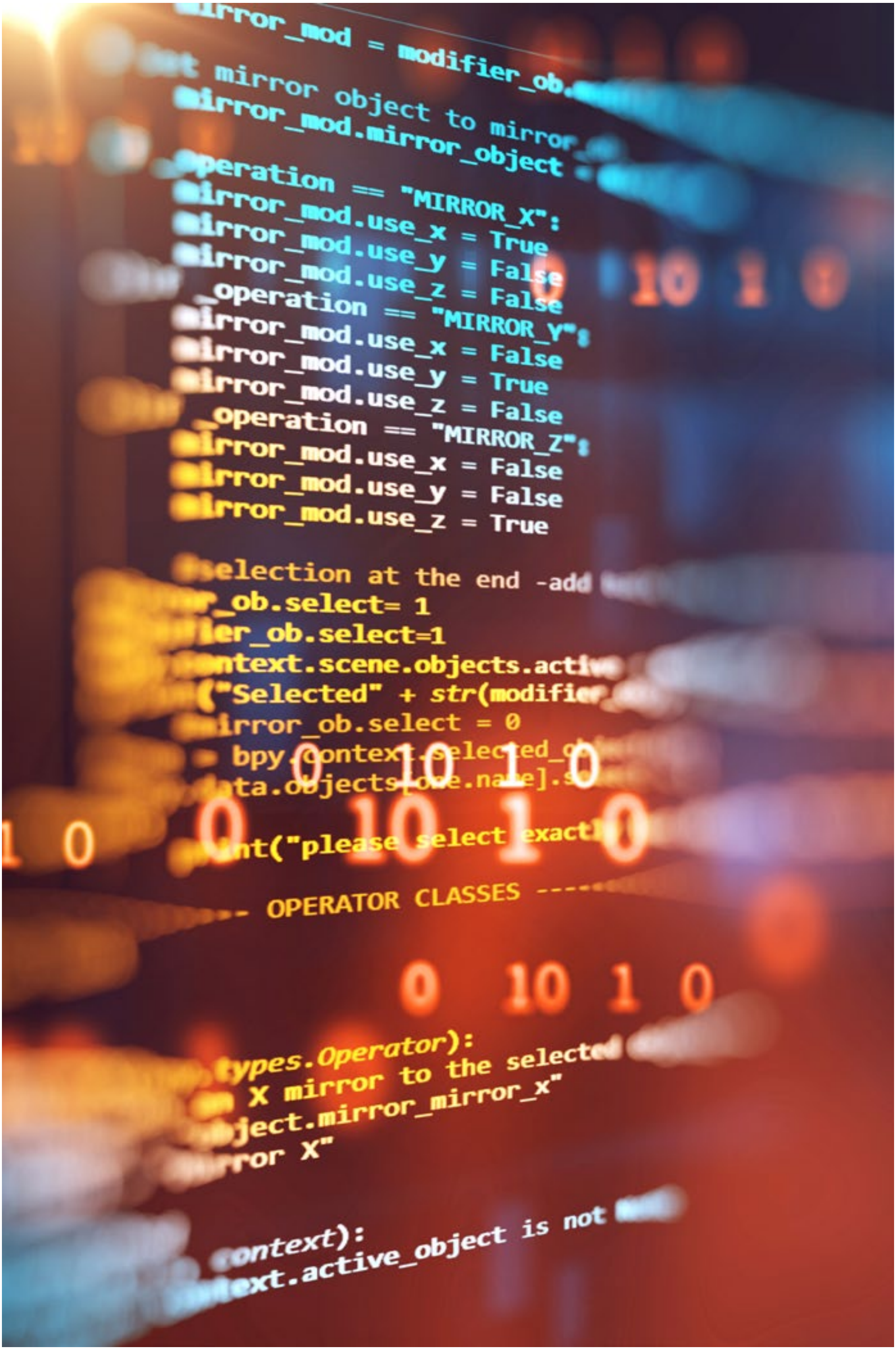

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What is AI?

Consider a government investing in a smart city initiative to enhance public safety. They want real-time video analytics, advanced forensic investigation capabilities and comprehensive operational intelligence to significantly improve emergency response times and augment human decisions. To manage this and know which challenge is most urgent, they need to bring information from the city's 10,000 cameras into one location. What is AI and how is it crucial to improving their lives?

This brochure provides a clear and accessible explanation of AI, its history and its various forms, including machine learning, deep learning and generative AI. It includes real-world examples to illustrate the concepts, making it easy to understand the vast potential and impact of AI on everyday life.

Introduction to Artificial Intelligence

What is AI?

Artificial Intelligence or AI is a type of technology that allows computers to perform tasks that usually require human intelligence. These tasks include learning from experience, understanding language, recognizing patterns and making decisions.

Why is AI Important?

AI is significant because it can handle complex tasks quickly and accurately, improving efficiency and productivity in many areas of our lives. From smartphones to healthcare, AI's impact is widespread and growing.

Key Components of AI

To further understand AI, it's important to recognize its key components:

- Algorithms: Sets of rules or instructions given to an AI system to help it learn and make decisions.
- Data: Large amounts of information that AI systems use to learn and improve their performance.
- Computing Power: Advanced hardware that enables AI systems to process data and perform tasks quickly.

Applications of AI

AI is utilized in a variety of fields, including:

- **Healthcare:** AI helps in diagnosing diseases, recommending treatments and managing patient care.
- **Finance:** AI systems detect fraudulent transactions, automate trading and provide financial advice.
- **Retail:** AI improves customer experiences through personalized recommendations and efficient supply chain management.
- **Transportation:** AI powers autonomous vehicles, optimizes logistics and enhances traffic management systems.

The Evolution of AI

Early Beginnings

AI has been around as an idea since the 1950s when scientists first began to explore how machines could mimic human thinking.

Major Milestones

- 1956: The term “Artificial Intelligence” is coined at a conference.
- 1997: IBM’s Deep Blue defeats world chess champion Garry Kasparov.
- 2011: IBM’s Watson wins the game show Jeopardy! against top human players.
- 2016: Google’s AlphaGo beats a world champion ‘Go’ player. (Go is a game much more complex than chess.)

Today’s AI

Technology continues to advance, integrating into everyday applications and becoming more sophisticated in solving complex problems.

AI is not a new concept, but its potential has historically been limited by the computational power available. As computers become faster, more powerful and more efficient, their capacity to utilize AI analytics with speed, accuracy and reliability grows significantly. This ongoing evolution enables AI to tackle increasingly complex problems and integrate seamlessly into a wide array of applications, enhancing both functionality and user experience.

Ethical Considerations

As AI technology advances, it is crucial to address ethical considerations such as privacy, bias and accountability. Ensuring that AI systems are transparent and fair is essential for gaining public trust and maximizing their benefits.

Understanding Machine Learning (ML)

What is Machine Learning?

Machine Learning (ML) is a subset of AI where computers learn from data. Instead of being explicitly programmed, these systems improve their performance by identifying patterns and making decisions based on data.

How Does ML Work?

ML uses algorithms to analyze data, learn from it and make predictions or decisions without human intervention. The more data it processes, the better it becomes at its tasks.

What Makes Up a Machine Learning System?

A machine learning system typically consists of:

- Server: A powerful computer equipped with high-performance hardware to handle processing tasks.

- GPUs (Graphics Processing Units): Specialized hardware that accelerates complex computations, particularly effective for tasks like deep learning.

Companies like Intel and Nvidia develop dedicated AI hardware for computers, enhancing the performance and efficiency of machine learning and deep learning tasks.

- Software Tools and Libraries: Frameworks and libraries that provide functions and algorithms to develop, train and deploy ML models. AI software designers leverage a combination of these tools to build robust machine learning and deep learning models, enhancing their capabilities to provide accurate and efficient analytics.

Key Concepts:

Annotated Data: Annotated data is data that has been labeled with the correct output or category. This labeling process is essential for supervised learning, where models learn to make predictions based on these examples. For instance, in image recognition, images may be annotated with labels identifying the objects they contain (i.e. 'dog.')

Inference: In machine learning, inference is the process by which a trained model applies its learned knowledge to new, unseen data in a real-life situation to make predictions or decisions. This is how an ML model identifies a previously unseen animal as a member of the dog species, based on its training.

Generalization: Generalization is the ability of an ML model to perform well on new, unseen data, not just on the data it was trained on. A well-generalized model accurately predicts outcomes for new data samples, ensuring its usefulness in real-world scenarios.

Deployment: Deployment refers to the process of integrating a trained machine learning model into a production environment where it can be used for its intended purpose. This involves setting up the necessary infrastructure, ensuring scalability, security and accessibility for end-users or systems. Deployment enables the model to perform inference in real-world applications, making predictions or decisions based on new data.

Common Real-World Examples

- Email Filtering: ML helps in detecting spam emails by analyzing patterns in the content and sender information.
- Recommendations: Streaming services like Netflix use ML to suggest shows and movies based on your viewing history.
- Financial Services: Banks use ML to detect fraudulent transactions by identifying unusual patterns and behaviors in financial data.

Deep Learning (DL) Simplified

What is Deep Learning?

Deep Learning (DL) is a more advanced type of machine learning inspired by the human brain. It uses neural networks with many layers (= "deep") to analyze data in complex ways. Basically, the more layers, the bigger the 'brain.'

Key Differences

- **Machine Learning:** Uses simpler models and less data.
- **Deep Learning:** Uses complex models and large amounts of data, enabling it to handle more intricate tasks like image and speech recognition.

Deep Learning Concepts:

Deep learning builds on the key concepts of machine learning such as inference and generalization. In deep learning:

- **Inference** involves applying the neural network's learned knowledge to new data, such as understanding and responding to new spoken instructions.
- **Generalization** refers to the model's ability to accurately process and analyze new, unseen data, like recognizing new images or understanding new voice commands (beyond the specific examples it was trained on).

Challenges and Considerations:

- **Data Requirements:** Deep learning models require large datasets for training.
- **Computational Resources:** High-performance GPUs and TPUs are often necessary. (A TPU, or Tensor Processing Unit, is a type of specialized hardware accelerator.)
- **Overfitting:** Ensuring the model generalizes well to new data and does not just memorize the training data.
- **Interpretability:** Deep learning models are often seen as black boxes, making it difficult to understand how decisions are made.

Real-World Examples

- **Voice Assistants:** Siri and Alexa use deep learning in the form of Natural Language processing to understand and respond to voice commands with accuracy.
- **Image Recognition:** Facebook uses DL to tag people in photos automatically, by recognizing their faces.
- **Healthcare:** DL helps in diagnosing diseases from medical images by identifying patterns and anomalies, particularly valuable for doctors.

Generative AI

What is Generative AI?

Generative AI refers to systems that can create new content, such as text, images or music, based on the data they have been trained on.

How Does it Work?

Generative AI uses models like Generative Adversarial Networks (GANs) to generate new data. These models learn the patterns and structures of the input data and then create new, similar data.

Key Concepts in Generative AI:

Training: Generative models are trained on large datasets to learn the underlying patterns and structures.

Inference: In generative AI, inference involves the generation of new data based on the learned patterns from the training data.

Generalization: The ability of a generative model to create new, plausible content that is not directly derived from the training data.

Real-World Applications

- Art and Music: AI can compose music and create visual art.
- Content Creation: AI tools can write articles, stories, and even poetry.
- Problem-Solving: AI can design new products or suggest improvements to existing ones.

Examples of Generative AI:

Generative AI is not new.

- **Google Translate:** Utilizes generative models to improve translation accuracy and fluency, starting in 2006.
- **Siri:** Apple's voice assistant, launched in 2011, uses generative AI for natural language processing.
- **ChatGPT:** Used by over 180 million people, ChatGPT can generate human-like text and has announced that Version 4 can outperform 90% of humans on the SAT.
- **AI in Surveillance & Monitoring:** AI analytics can now use written requests and natural language processing to drive real-time searches of camera-derived data.

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Irisity is a global provider of AI-powered video analytics software, with 20 years of experience in a variety of vertical markets. Irisity offers real-time detection, search, and operational insights to their customers through both on premise or cloud deployments.

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