

INNOVATION IN ARTIFICIAL INTELLIGENCE

A large, abstract graphic element consisting of numerous thin, curved purple lines that curve and overlap to create a sense of depth and motion, resembling a neural network or a complex data visualization.

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Agenda

History of AI with Alan Turing

What Is AI

Levels of AI with day to day relations

Key concept of AI and day to day examples

Understanding how AI works

Transformative applications of AI

Challenges for a responsible future with AI



Early Days of AI: The Turing Test (1950)

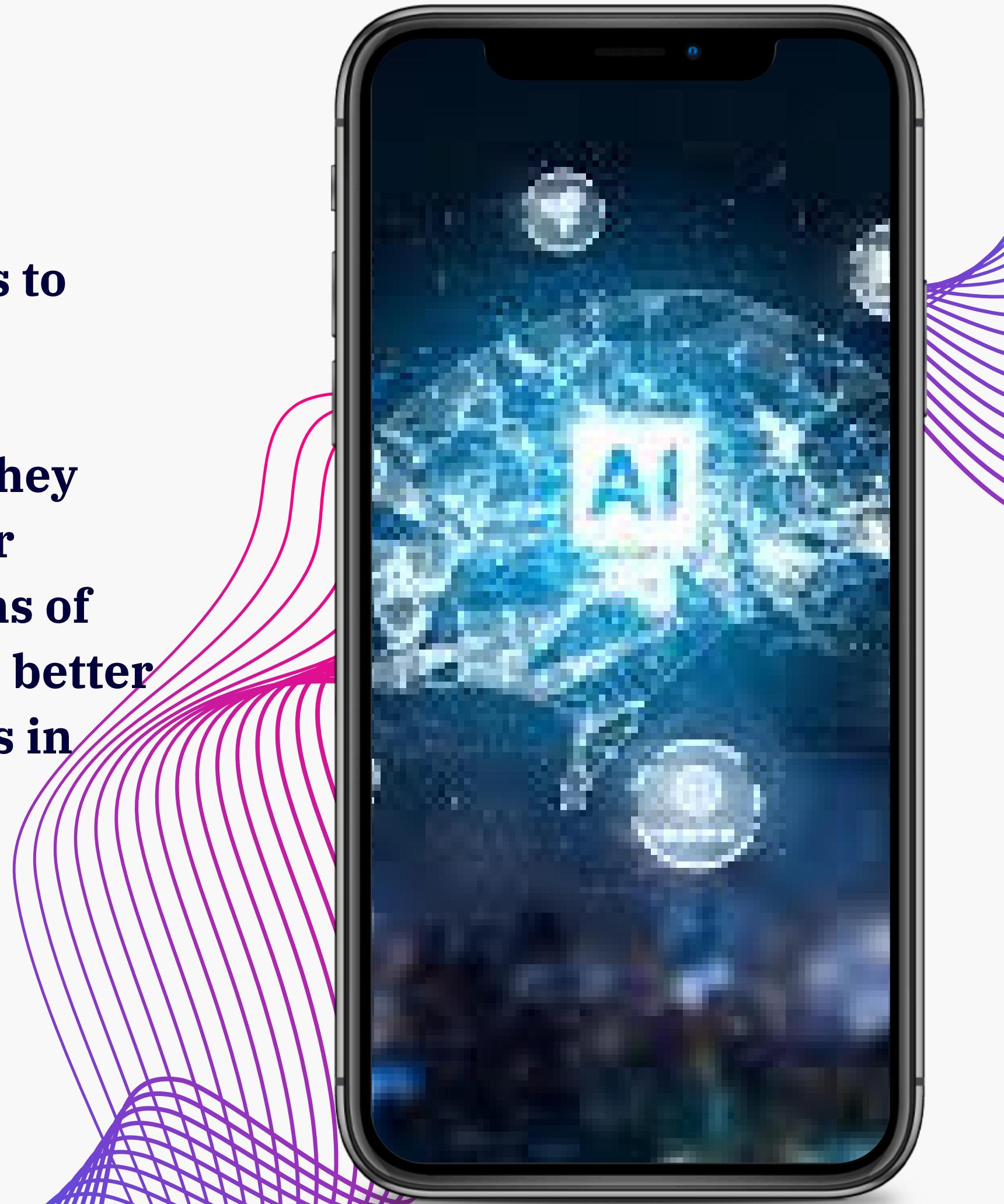
Imagine going back in time to 1950. Back then, a super smart mathematician named Alan Turing came up with a clever idea to test if machines could be as intelligent as humans. His test, called the Turing Test, involved someone having a conversation with a hidden person and a machine, only through text messages. If the person couldn't tell the difference between the machine and the human, then the machine was considered 'intelligent.' The Turing Test is still a big deal in AI research today, because it makes us think about what intelligence really means and how we can measure it in machines.

What is AI ?

So, what exactly is AI?

In simple terms, AI refers to the ability of machines to mimic human cognitive functions like learning and problem-solving or in simple terms for example

Imagine you teach a friend a new game. The more they play, the better they get at it, right? AI is like that for machines. Instead of a friend, we give machines tons of data and instructions. The more data they have, the better they become at specific tasks, like recognizing faces in photos or recommending movies you might enjoy.



Levels of Artificial Intelligence

1. Artificial Narrow Intelligence (ANI) which excels at specific tasks, like playing chess or recognizing faces. This is the most common type of AI we encounter today.

For example in:

Streaming Services: When you open your favorite streaming service, ANI powers the recommendations for movies and shows you might enjoy. It analyzes your watch history, ratings, and browsing behavior to suggest similar content.

Social Media Feeds: The content you see on your social media feed is often curated by ANI algorithms. These algorithms consider your likes, shares, and interactions to prioritize content you're likely to engage with.

Chatbots: Many companies use chatbots powered by ANI to provide customer service. These chatbots can answer basic questions, troubleshoot problems, and even schedule appointments.

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2. Artificial General Intelligence (AGI) is a hypothetical future state where machines achieve human-level intelligence across a wide range of tasks. Unfortunately, there are currently no real-world examples of Artificial General Intelligence (AGI) because it's a hypothetical future state of AI. AGI refers to machines achieving human-level intelligence across a wide range of tasks.

Here's why we can't find real-world examples of AGI:

Broad Capabilities: AGI would be able to learn and adapt to new situations just like humans. This requires a level of general intelligence that current AI systems haven't achieved.

Transfer Learning: AGI could apply its knowledge from one task to another. For instance, an AGI system that masters chess might then be able to learn a new game like Go with minimal training. This ability to transfer learning is still under development in AI research.

Common Sense Reasoning: AGI would possess common sense reasoning, allowing it to understand the world in a similar way humans do. This includes understanding social cues, implied meaning, and the physical world around us. Current AI struggles with these aspects.

3 .Artificial Superintelligence (ASI) surpasses human intelligence in all aspects, which remains a subject of debate and scientific exploration.

Artificial Superintelligence (ASI) is a highly theoretical concept that goes beyond even Artificial General Intelligence (AGI). Here's why we can't find real-world examples of ASI:

- **Surpassing Human Intelligence:** ASI implies surpassing human intelligence in all aspects. This includes not just cognitive abilities like logic and problem-solving, but also creativity, emotional intelligence, and even consciousness (which is still not fully understood in humans).
- **Technological Singularity:** Some experts theorize a "technological singularity" where ASI undergoes an intelligence explosion, rapidly surpassing human capabilities beyond our comprehension. This scenario is purely hypothetical.

Concepts of Artificial Intelligence

Machine Learning: This is where AI learns from data without needing explicit programming. Imagine showing a friend thousands of examples of winning moves in your game. Through machine learning, the AI can identify patterns and make its own decisions. There are three levels of machine learning:

- 1. Supervised Learning:** Involves training a model on labeled data, where the desired output is known and the common algorithms include linear regression, logistic regression, and support vector machines.
- 2. Unsupervised Learning:** Involves training a model on unlabeled data to find hidden patterns or intrinsic structures and the common algorithms include k-means clustering, hierarchical clustering, and principal component analysis (PCA).
- 3. Reinforcement Learning:** Involves training an agent to make decisions by rewarding desired behaviors and punishing undesired ones. Algorithms include Q-learning and deep reinforcement learning.

Data: This is the fuel for AI! The more data a machine has, the better it becomes at its task. Think of a friend practicing the game over and over – that is data that helps them in learning.

Let's delve deeper into the concept of data and its importance in AI:

The Role of Data in AI

1. **Training Models:** AI models, especially those based on machine learning, learn patterns, relationships, and insights from data. This process is known as training. The more data an AI model has access to, the more accurately it can learn and make predictions.
2. **Quality and Quantity:** Both the quality and quantity of data are crucial. High-quality data ensures that the model learns correctly, while a larger quantity of data helps the model generalize better to new, unseen data.
3. **Learning from Data:** Similar to how a person improves at a task with practice, an AI model improves its performance as it is exposed to more data. Each data point provides new information that the model can use to refine its predictions and decision-making processes.

Algorithms: These are like recipes for the machine. They tell the AI how to process data and make decisions. Think of the game's rules as an algorithm – they guide how the game is played. Examples of algorithms include:

Linear Regression: Predicts a continuous target variable based on one or more input features
Logistic Regression: Used for binary classification tasks, predicting the probability of a categorical outcome.

K-Means Clustering: Partitions data into k clusters, where each data point belongs to the cluster with the nearest mean.

Hierarchical Clustering: Builds a hierarchy of clusters by progressively merging or splitting existing clusters.

Tokenization: Splits text into individual words or tokens.

Sentiment Analysis: Determines the sentiment expressed in text (positive, negative, neutral)

Just like choosing the right recipe for a specific dish, selecting the appropriate algorithm depends on the task at hand and the type of data available. The best algorithm will help the AI make the most accurate and efficient decisions based on the data it has.

Deep Learning: Deep learning is a subfield of Machine Learning inspired by the structure and function of the human brain. It utilizes artificial neural networks with multiple layers to process complex data like images, text, and speech.

Real-world examples of deep learning include:

Image recognition: Deep learning powers facial recognition software used for unlocking phones, security purposes, or tagging friends in photos.

Speech recognition: Virtual assistants like Siri and Alexa use deep learning to understand your voice commands and respond to your requests.



Computer vision: Computer vision is a field of AI that enables machines to extract meaningful information from digital images and videos. It allows computers to “see” and understand the visual world around them.

Real-world examples include:

- Self-driving cars: Computer vision helps self-driving cars identify objects like pedestrians, traffic signs, and lanes, enabling them to navigate roads safely.
- Medical image analysis: In healthcare, computer vision assists doctors in analyzing medical images like X-rays and MRIs to detect abnormalities and support diagnoses.

Security and surveillance: Computer vision is used in security systems for object detection and facial recognition in security cameras.



Expert Systems: Expert systems are computer programs designed to capture and simulate the knowledge and reasoning capabilities of human experts in a specific domain. They act as decision-making aids by offering advice and recommendations based on the knowledge stored within the system.

Real-world examples:

Medical diagnosis support: Some expert systems can analyze patient symptoms and medical history to suggest potential diagnoses, assisting doctors in the decision-making process.

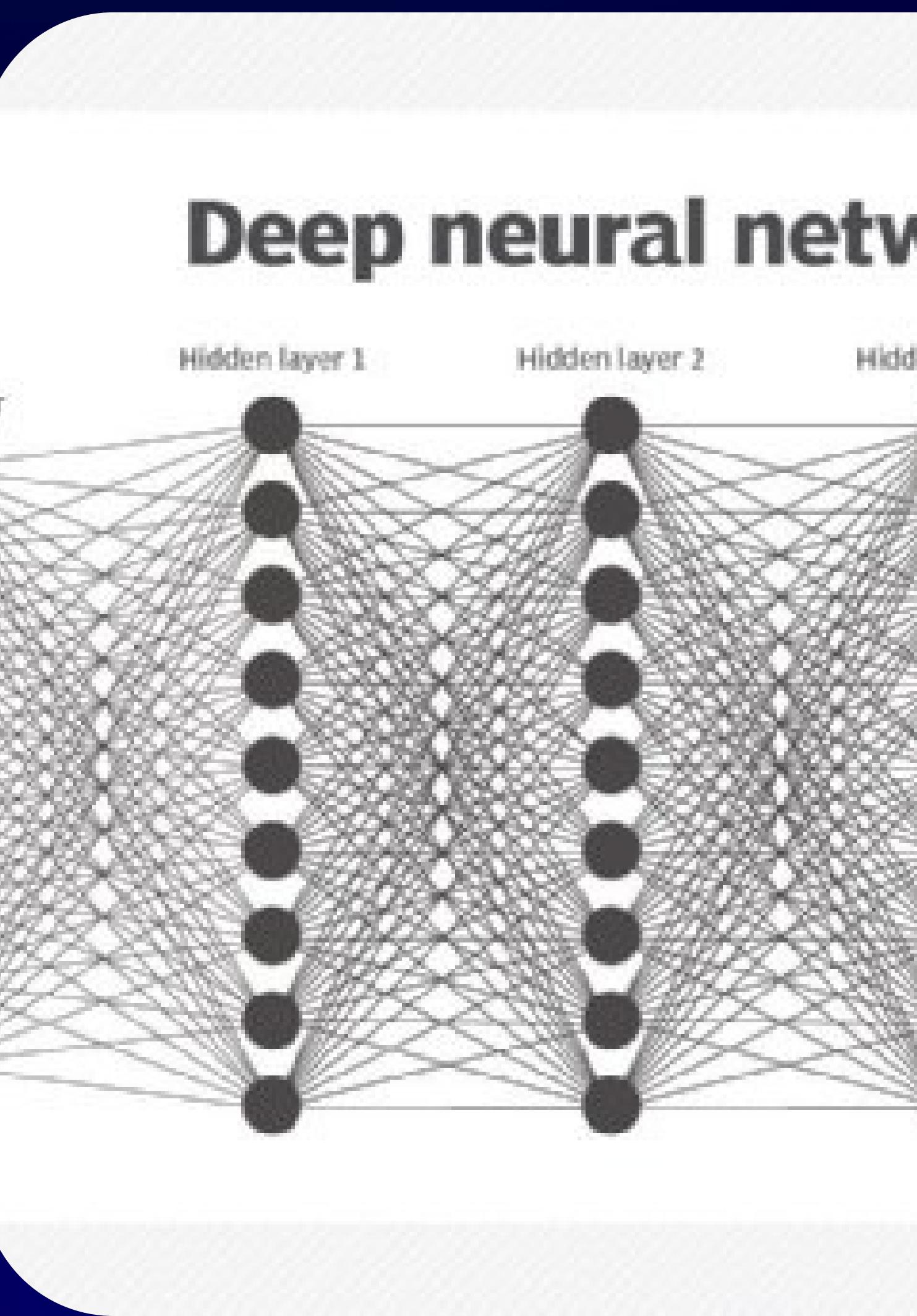
Technical support systems: Customer service chatbots or troubleshooting tools can use expert systems to guide users through solving technical problems based on predefined rules and knowledge bases.



1. Neural Networks:

Neural Networks: Neural networks are a type of algorithm inspired by the structure and function of the human brain. They consist of interconnected nodes (artificial neurons) that process information by transmitting signals between each other. Through learning algorithms, these networks adjust their connections to improve their performance on a specific task. Neural networks are a core building block of deep learning. They are used in various AI applications, including:

- Image recognition: Neural networks can learn to identify objects in images by analyzing patterns and features within the data.
- Speech recognition: Neural networks can learn to convert spoken language into text by analyzing the sound waves and identifying patterns.
- Natural language processing: Neural networks help machines understand the nuances of human language and perform tasks like machine translation or sentiment analysis.



Understanding How Artificial Intelligence (AI) Works

Artificial Intelligence (AI) is a broad and complex field that involves creating systems capable of performing tasks that typically require human intelligence. These tasks include problem-solving, understanding natural language, recognizing patterns, learning from experience, and making decisions. Here's a detailed breakdown of the key components and processes involved in AI:

1. Data Collection and Preparation

AI systems rely heavily on data. The first step in creating an AI model is collecting relevant data. This data can come from various sources, such as sensors, databases, websites, and user inputs. Once collected, the data must be cleaned and preprocessed to ensure it's in a suitable format for training.

This involves:

- Data Cleaning: Removing or correcting errors, duplicates, and inconsistencies.
- Data Transformation: Converting data into a format that can be used by the AI model (e.g., normalizing numerical values, encoding categorical variables).
- Data Augmentation: Generating additional data samples by modifying existing data (e.g., rotating images, adding noise to audio).

2. Choosing the Right Model

There are various types of AI models, each suited for different tasks. Some of the most common types include:

- Supervised Learning Models: These models are trained on labeled data, meaning each training example is paired with an output label. Common algorithms include linear regression, decision trees, and neural networks.
- Unsupervised Learning Models: These models are trained on unlabeled data and must find patterns and structures within the data. Common algorithms include k-means clustering and principal component analysis (PCA).
- Reinforcement Learning Models: These models learn by interacting with an environment and receiving feedback in the form of rewards or punishments. They are commonly used in robotics and game playing.

3. Model Training

Training an AI model involves feeding the preprocessed data into the chosen algorithm and adjusting the model's parameters to minimize error. This process can be computationally intensive and often requires powerful hardware, such as GPUs or TPUs. Key steps in model training include:

- Initializing the Model: Setting initial values for the model parameters.
- Forward Propagation: Passing the input data through the model to generate prediction.
- Calculating the Loss: Comparing the model's predictions to the actual labels to compute the error.
- Backward Propagation: Adjusting the model's parameters based on the error using optimization algorithms like gradient descent.
- Iteration: Repeating the forward and backward propagation steps for many iterations (epochs) until the model converges to a minimum error.

4. Model Evaluation

Once trained, the model needs to be evaluated to ensure it performs well on unseen data. This involves:

- Splitting the Data: Dividing the dataset into training, validation, and test sets.
- Validation: Using the validation set to tune hyperparameters and prevent overfitting.
- Testing: Assessing the model's performance on the test set using metrics such as accuracy, precision, recall, F1 score, and mean squared error.

5. Deployment and Inference

After evaluation, the model is deployed into a production environment where it can start making predictions on new, unseen data.

6. Continuous Learning and Maintenance

AI models are not static; they need to be updated and maintained over time to ensure they remain accurate and relevant.

7. Fine-tuning will involve procedures like

- Feedback Incorporation: Adjusting the model based on user feedback, performance metrics, and new requirements. This might involve tweaking hyperparameters, modifying the architecture, or retraining specific parts of the model.

8. Regular Monitoring

- Performance Tracking: Implementing systems to regularly monitor the performance of the AI model in production. This includes tracking metrics such as accuracy, precision, recall, and F1-score.

9. Scalability

- Infrastructure Management: Ensuring that the infrastructure can handle the computational requirements of retraining and deploying updated models.
- Cloud and Edge Solutions: Leveraging cloud computing or edge computing to manage large-scale data processing and real-time inference needs.
- Resource Optimization: Optimizing the use of computational resources to balance performance and cost.

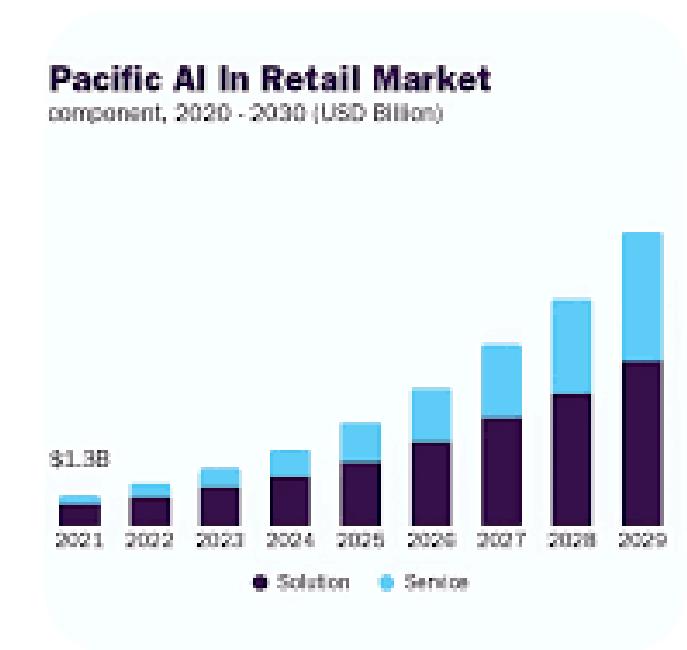
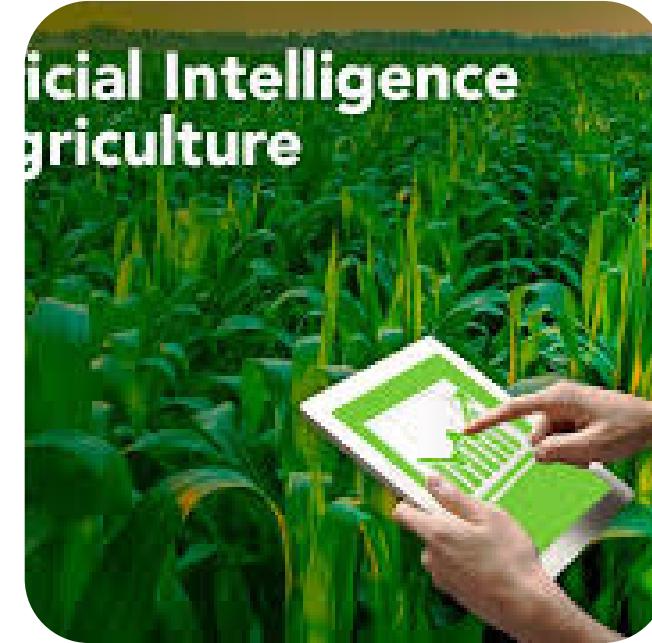
10. Documentation

- Documentation: Keeping thorough documentation of the model's development, updates, and performance evaluations. This helps in maintaining transparency and aiding future developments.

11. Compliance and Security

- Regulatory Compliance: Ensuring that the model adheres to relevant regulations and standards, which may vary across regions and industries.

Applications of AI In real life



Medicine

AI algorithms analyze patient data, including genetics, lifestyle, and environment, to develop personalized treatment plans. This leads to more effective therapies with fewer side effects.

Finance

AI systems analyze transaction patterns to detect fraudulent activities in real-time, safeguarding financial institutions and customers from significant losses.

Agriculture

AI analyzes soil, weather, and crop data to provide farmers with insights for optimizing planting schedules, irrigation, and fertilization, increasing yield and sustainability.

Transportation

AI powers self-driving cars, enhancing road safety by reducing human error. These vehicles use sensors and machine learning to navigate and respond to dynamic environments.

Retail

AI optimizes inventory by predicting demand trends, reducing overstock and stockouts. This leads to cost savings and improved customer satisfaction.

Ethical consideration of AI

1. Bias and Fairness:

AI algorithms are only as good as the data they're trained on. Unfortunately, biased data can lead to biased AI systems that perpetuate discrimination.

Imagine an AI-powered resume screening tool that inadvertently favors resumes with certain keywords, potentially excluding qualified candidates from diverse backgrounds

2. Job Displacement:

Automation powered by AI has the potential to displace jobs in certain sectors.

While AI might create new jobs, the transition could be disruptive for many. To address this challenge, we need to:

- Invest in retraining and reskilling programs for workers.

3. Algorithmic Transparency:

The inner workings of some AI algorithms can be complex and opaque. This lack of transparency makes it difficult to understand how AI systems arrive at decisions, potentially leading to unfair or discriminatory outcomes. To address this, we need to:

- Promote explainable AI (XAI) techniques that make AI decision-making processes more transparent.

As we reach the conclusion of this presentation, let's take a moment to recap the exciting potential of Artificial Intelligence and the ethical considerations that require our attention. By harnessing AI responsibly, we can unlock a future filled with innovation and progress, ensuring that AI serves humanity for the greater good.