

# ARTIFICIAL INTELLIGENCE

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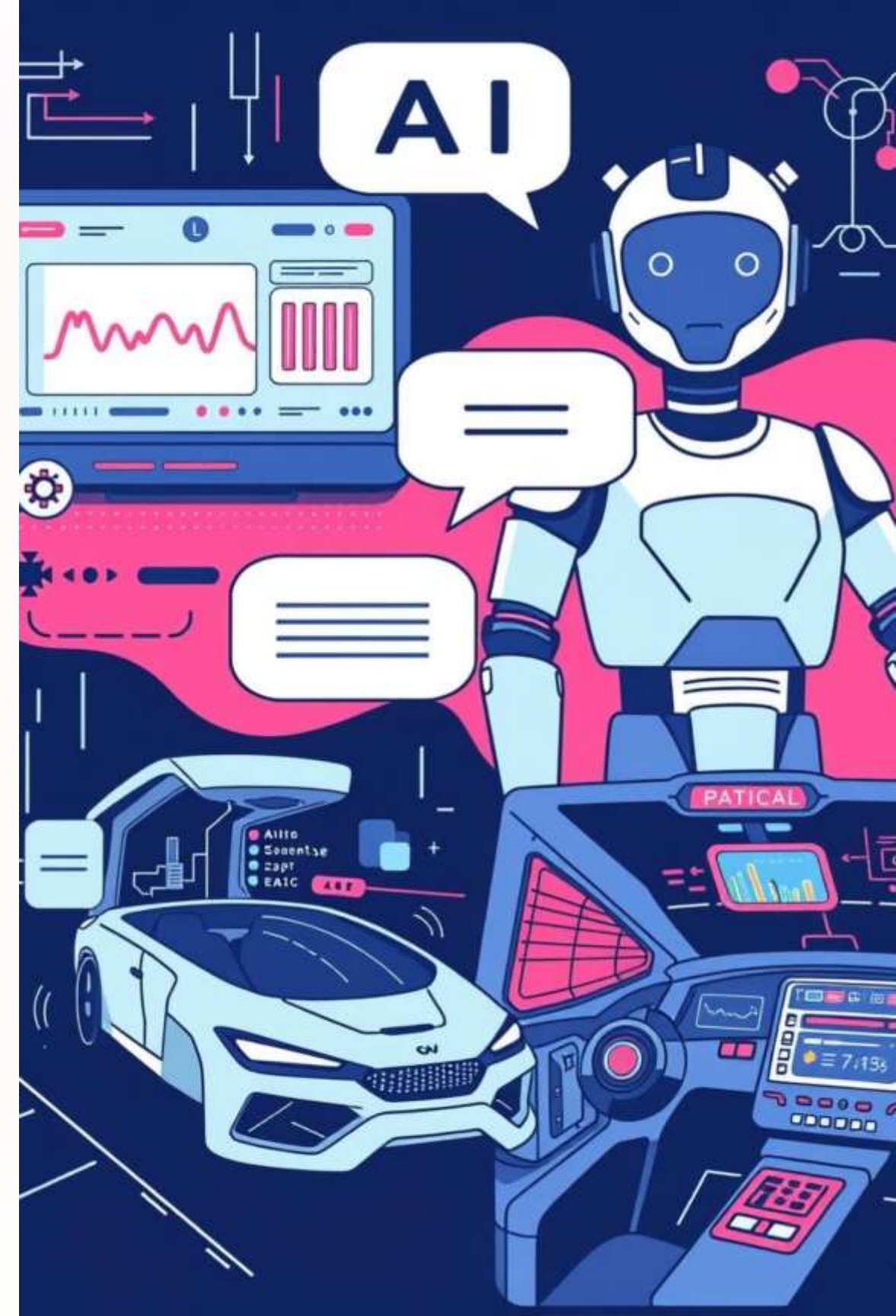
# Introduction to AI

## Definition of Artificial Intelligence

*Artificial Intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems.*

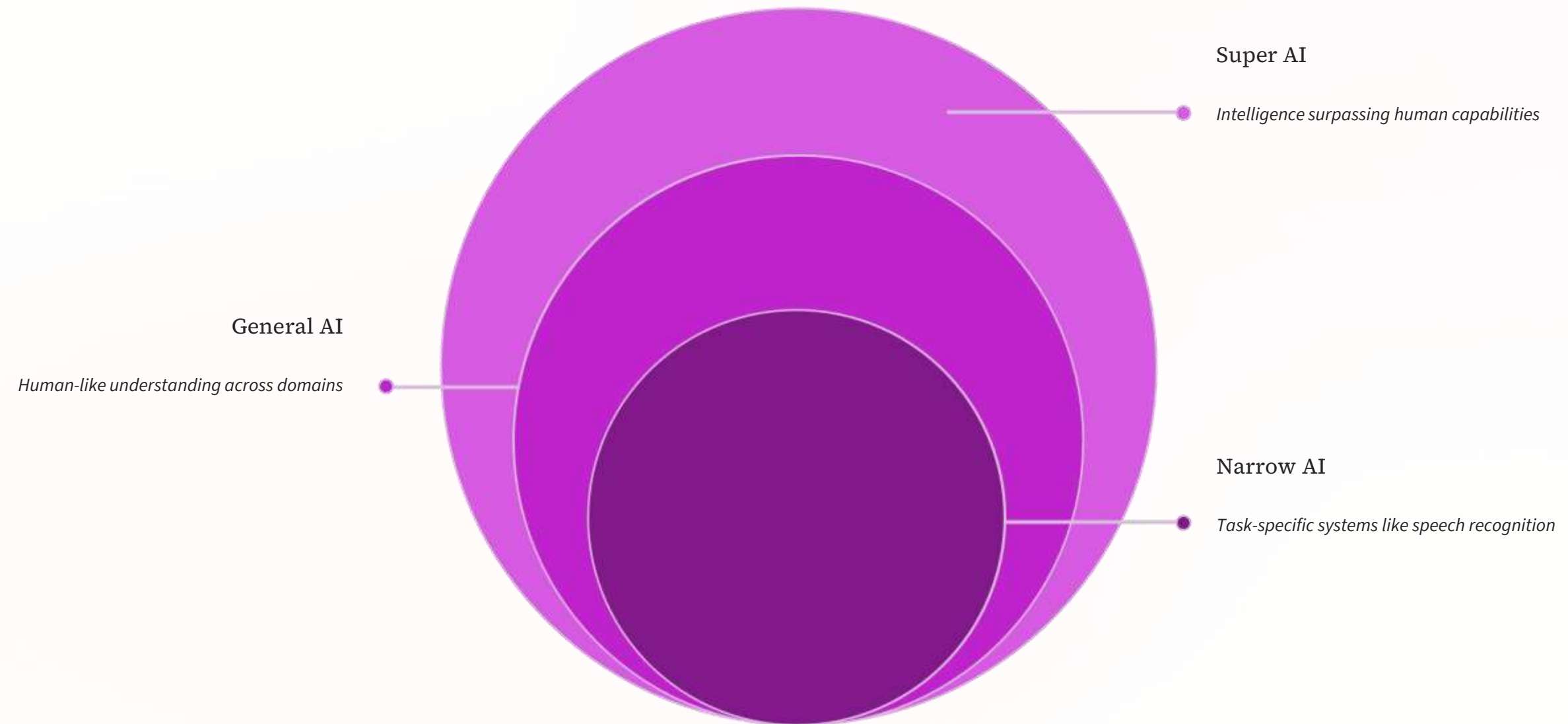
## Applications

- *robotics*
- *data analysis*
- *NLP*
- *gaming*
- *perception*



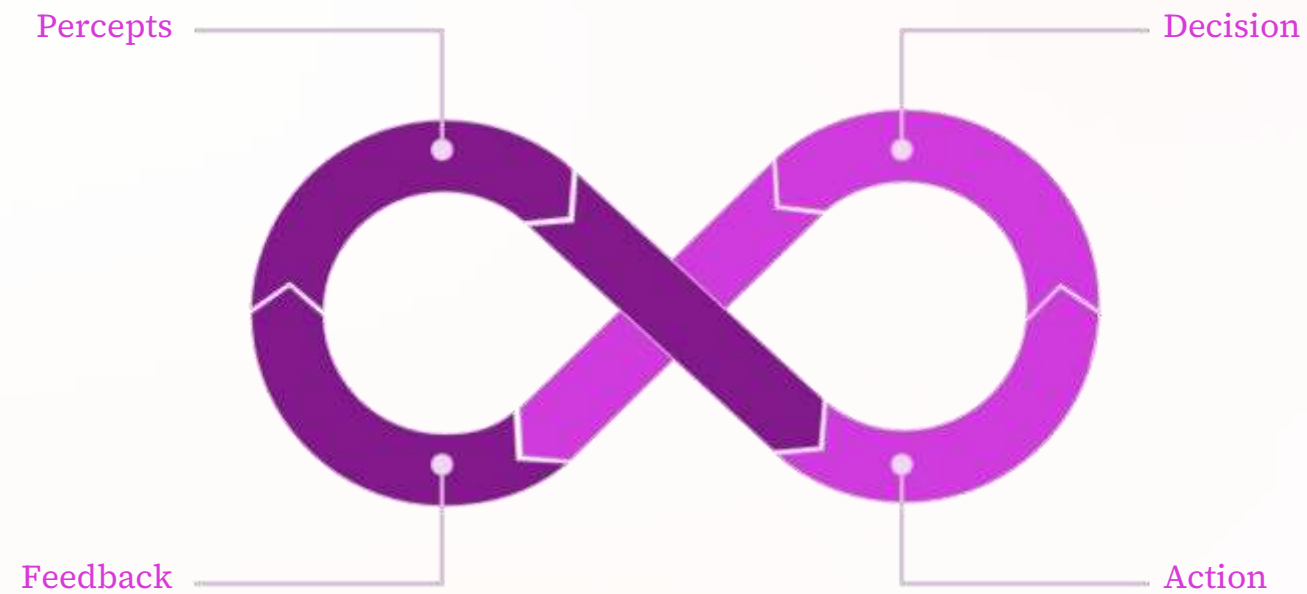


# Types of AI



# Intelligent Agents

*Intelligent agents perceive their environment and take actions that maximize their chance of successfully achieving their goals.*

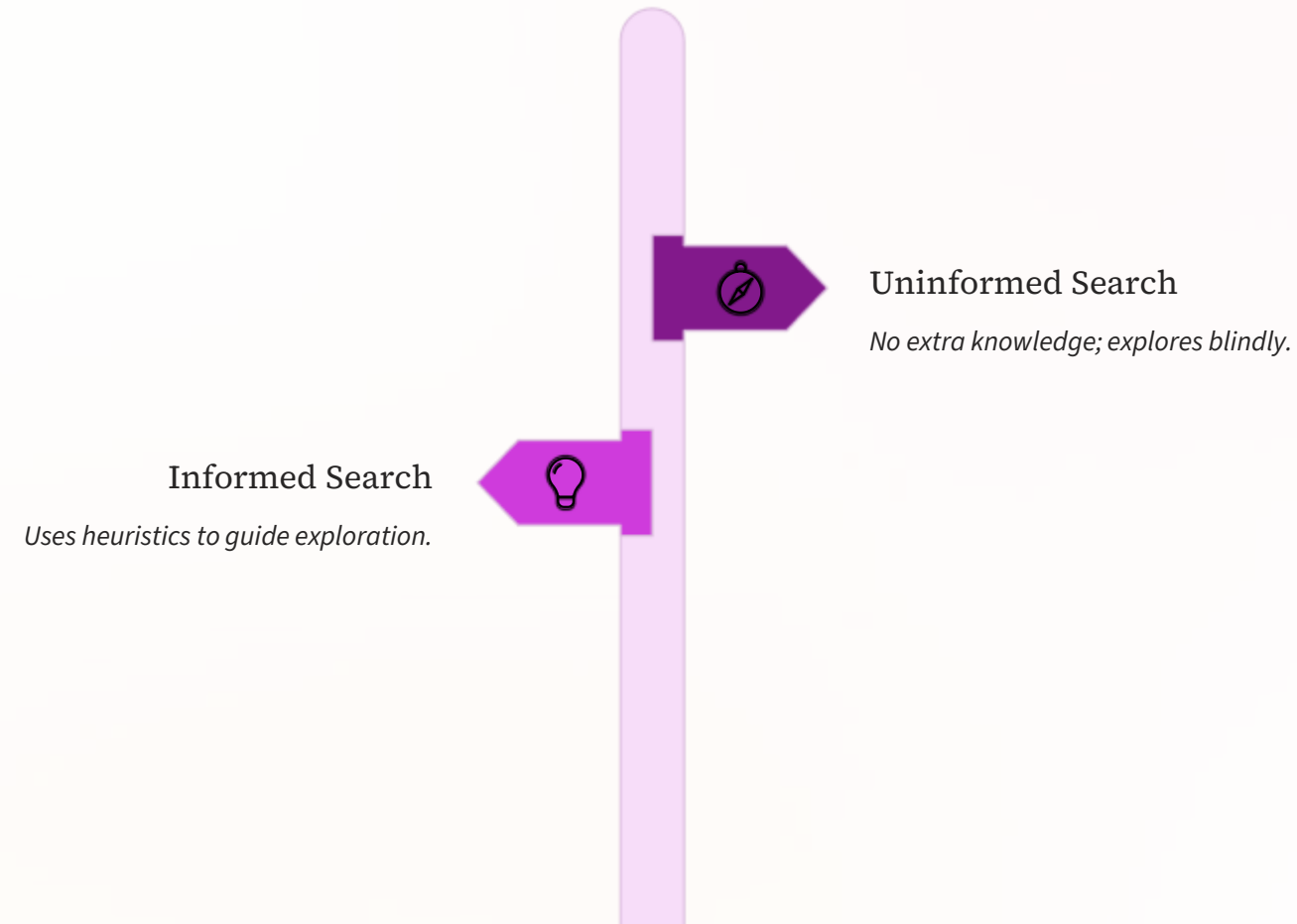


## Agent types:

- *Simple Reflex*
- *Model-Based*
- *Goal-Based*
- *Utility-Based*

# Search Strategies Overview

*The importance of search: search is the foundation of AI problem-solving.*








## Uninformed

*Search algorithms that have no additional information about the goal state.*

## Informed Search

*Search algorithms that use knowledge (heuristics) to guide the search process.*

# Uninformed Search Techniques

-  Breadth-First Search (BFS)
-  Depth-First Search (DFS)
-  Iterative Deepening Search (IDS)
-  Bidirectional Search
-  Depth-Limited Search (DLS)

# Informed Search Techniques



Heuristic Search



Best-First Search



AO\* Algorithm



Beam Search



# Game Playing in AI

*Used for strategic decision-making in games*

## Core algorithms:

### Minimax Algorithm

*A decision rule used in artificial intelligence, decision theory, game theory, and statistics for minimizing the possible loss for a worst-case (maximum loss) scenario.*

### Alpha-Beta Pruning

*An optimization technique for the minimax algorithm that reduces the number of nodes evaluated in the search tree.*





# Constraint Satisfaction Problems (CSP)

*CSP involves finding a state that satisfies a given set of constraints or conditions.*

## Examples:

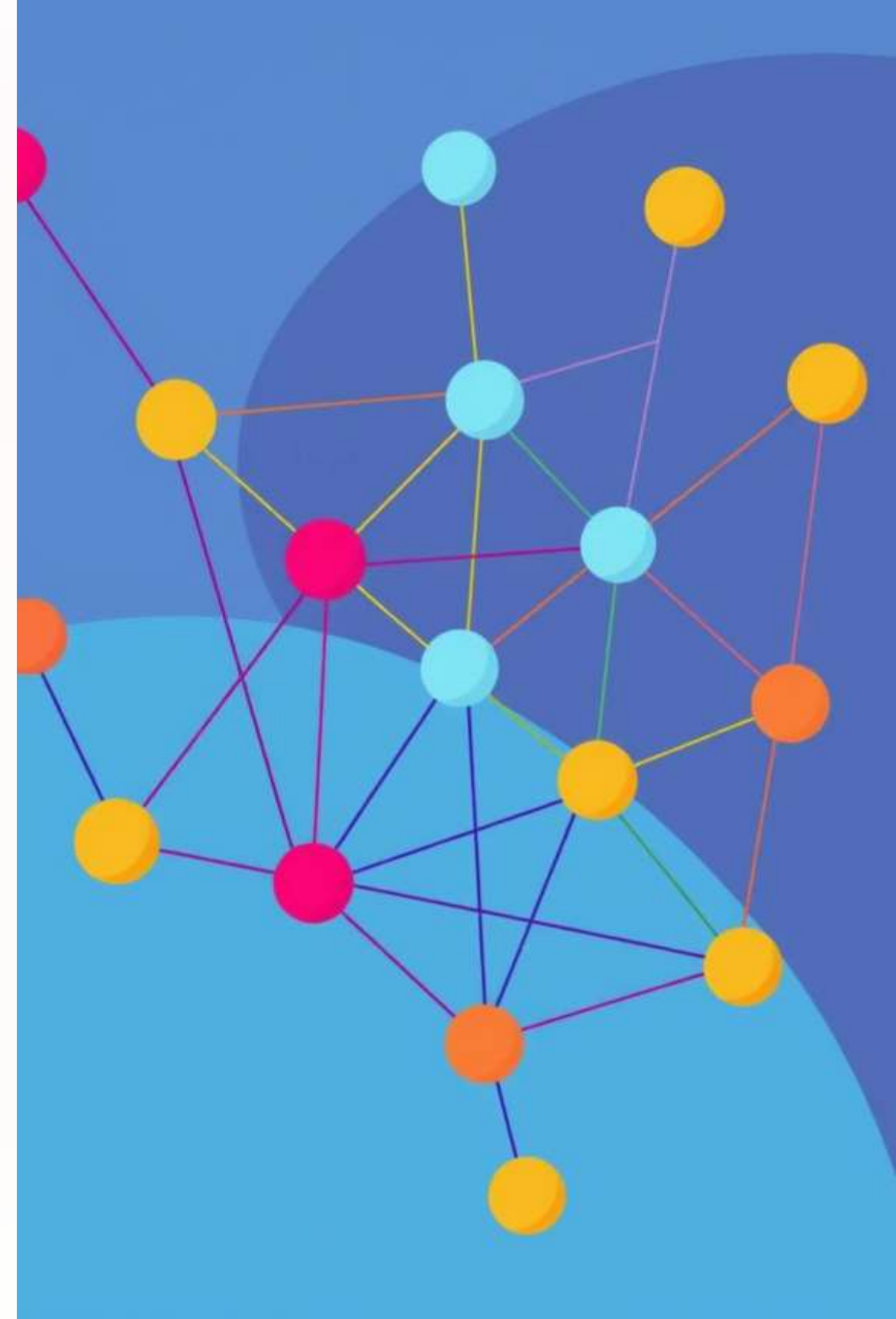
- *Graph Coloring*
- *N-Queens Problem*

## Algorithm:

*Branch and Bound*

## Consistency levels:

- *Local*
- *Path*
- *k-*
- *Global*



# Knowledge Representation and Reasoning

AI systems require structured ways to store and manipulate information to make intelligent decisions, forming the bedrock of their cognitive abilities.



## Semantic Networks

*Represent knowledge as a graph of nodes and labeled edges, showing relationships between concepts.*



## Frames

*Structured representation with "slots" holding attributes, values, and procedures, defining objects or concepts.*



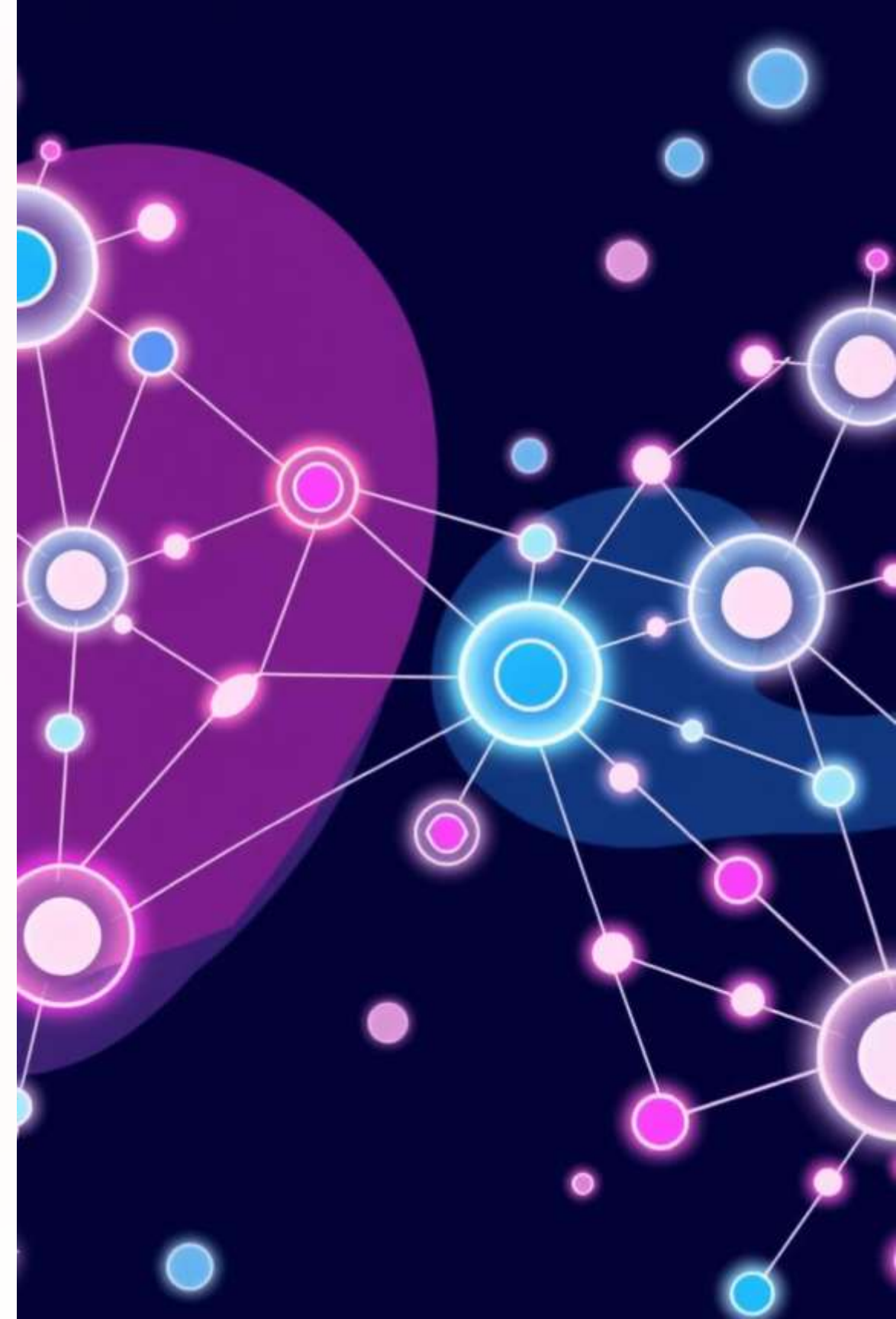
## Ontologies

*Formal specifications of shared conceptualizations, defining terms and their relationships within a domain.*



## Logical Reasoning

*Using formal logic (e.g., propositional, first-order) to infer new facts from existing knowledge.*



# Machine Learning Fundamentals

*Machine Learning, a subset of AI, enables systems to learn from data without explicit programming.*

## Types of Machine Learning



### Supervised Learning

*Learns from labeled data to make predictions or classifications (e.g., spam detection).*



### Unsupervised Learning

*Discovers patterns and structures in unlabeled data for tasks like customer segmentation.*



### Reinforcement Learning

*Agent learns by performing actions in an environment to maximize cumulative rewards.*

## Key Algorithms



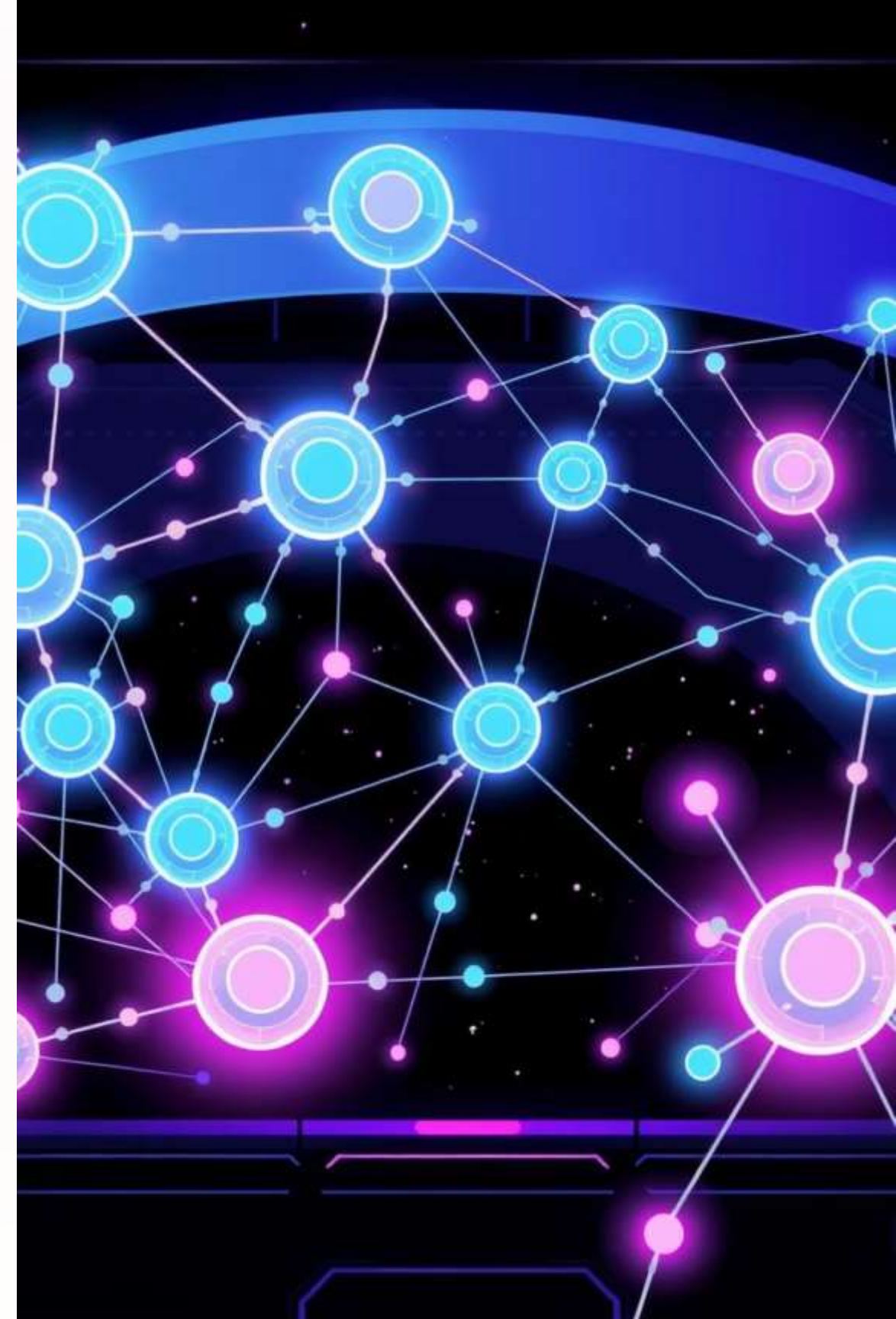
### Neural Networks

*Interconnected nodes, inspired by the human brain, form the basis of deep learning.*



### Decision Trees

*Tree-like models of decisions and consequences for classification or outcome prediction.*





# Natural Language Processing (NLP)

Natural Language Processing (NLP) enables computers to understand, interpret, and generate human language, bridging the gap between human communication and machine comprehension.



## Text Analysis

*Extracting meaningful information, patterns, and insights from unstructured text data.*



## Language Understanding

*Interpreting the semantics and context of human language to grasp its true meaning.*



## Speech Recognition

*Converting spoken words into written text, a foundation for voice assistants and dictation tools.*



## Machine Translation

*Automatically translating text or speech from one natural language to another.*





# Computer Vision

*Computer Vision equips machines with the ability to "see" and interpret the visual world, transforming raw image and video data into meaningful insights.*



## Image Processing

*Techniques to enhance, restore, or transform digital images for analysis.*



## Object Detection

*Identifying and localizing specific objects within an image or video stream.*



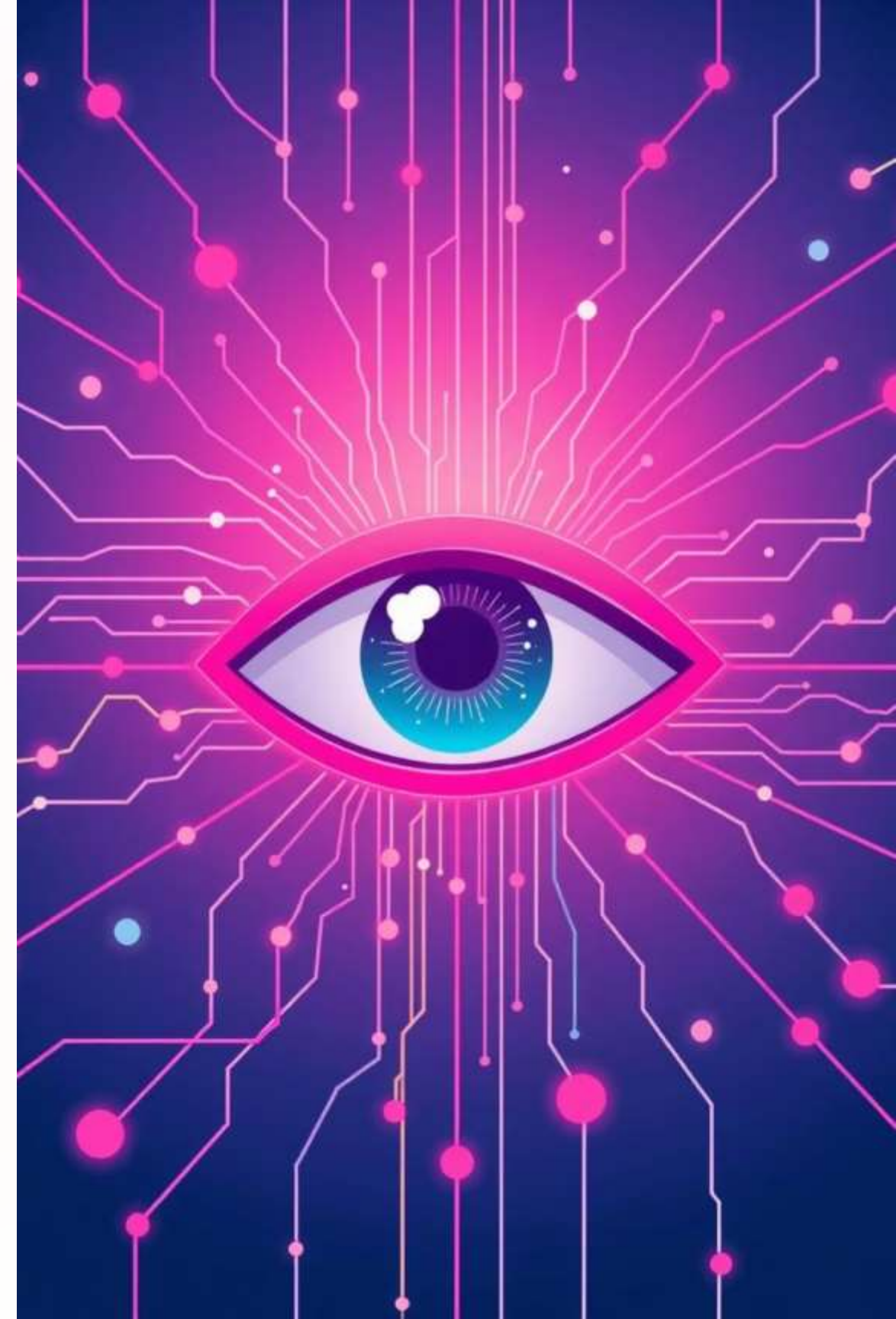
## Facial Recognition

*Technology for identifying or verifying a person from a digital image or a video frame.*



## Image Classification

*Assigning a predefined label or category to an entire image based on its content.*



# Ethical Considerations in AI

*As AI systems become more ubiquitous, addressing their ethical implications is crucial for ensuring fair, safe, and beneficial deployment for society.*



## Bias in Algorithms

*Algorithmic decisions can reflect and amplify societal biases, leading to unfair outcomes in areas like hiring or credit.*



## Privacy Concerns

*Extensive data collection and analysis by AI systems raise significant questions about individual privacy and data security.*



## AI Safety

*Ensuring AI systems operate reliably and predictably, preventing unintended consequences or potential harm to humans.*



## Responsible AI Development

*Implementing ethical guidelines and best practices throughout the AI lifecycle, from design to deployment and monitoring.*





# The Future of AI

*Explore the groundbreaking trends shaping the next generation of artificial intelligence and its transformative impact across industries and society.*



## Quantum AI

*Leveraging quantum mechanics for exponentially faster processing and solving complex problems beyond classical AI capabilities.*



## Autonomous Systems

*Advancements in self-driving vehicles, intelligent robotics, and drones, enabling greater efficiency and safety.*



## Artificial General Intelligence (AGI)

*The long-term goal of developing AI with human-level cognitive abilities, capable of learning and applying intelligence across diverse tasks.*



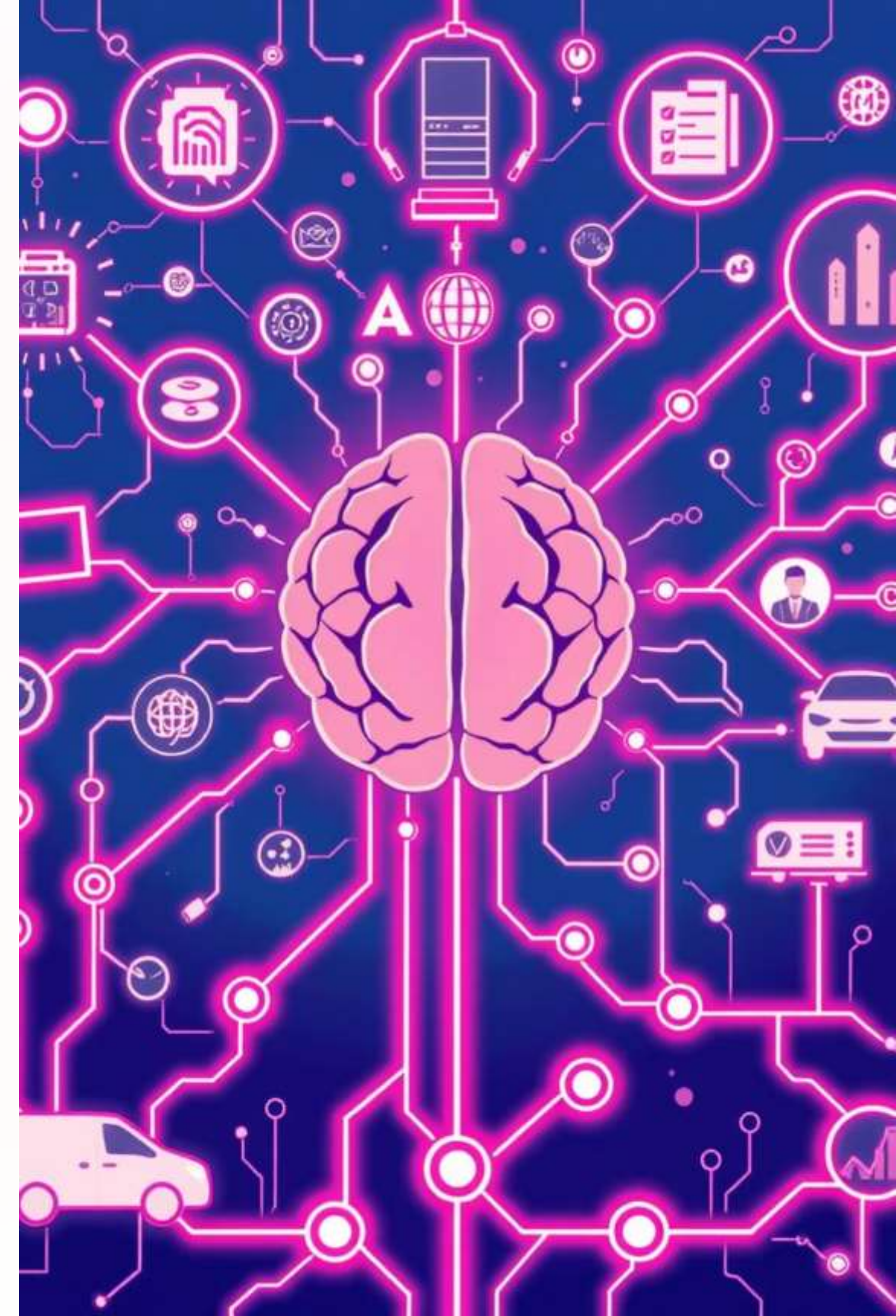
## AI in Healthcare

*Revolutionizing diagnostics, drug discovery, personalized treatment, and patient care through advanced AI algorithms.*



## AI & Climate Change

*Utilizing AI for climate modeling, renewable energy optimization, and sustainable resource management to combat environmental crises.*



# Conclusion: Shaping the Future with AI

*Artificial Intelligence stands as a pivotal force, redefining possibilities across every sector. Its continuous evolution promises transformative breakthroughs, yet demands a steadfast commitment to responsible development.*

## Transformative Power

*AI is a fundamental paradigm shift, driving efficiency, insight, and innovation across industries, from healthcare to entertainment.*

## Pervasive Applications

*From Machine Learning to NLP and Computer Vision, AI's diverse branches are creating intelligent solutions that enhance daily life.*

## Ethical Imperative

*Bias, privacy, and accountability are not afterthoughts but core considerations essential for building trustworthy and beneficial AI systems.*

## Continuous Evolution

*The journey towards more advanced AI, including AGI, is ongoing, requiring interdisciplinary collaboration and forward-thinking governance.*





# Thank You & Your Next Steps in AI

Thank you for embarking on this journey through the world of Artificial Intelligence. As we've seen, AI is a rapidly evolving and transformative force. Your curiosity and engagement are vital as we collectively shape its future.

## Key Takeaways

### Diverse Landscape

AI is a broad field, encompassing powerful sub-disciplines like Machine Learning, Natural Language Processing, and Computer Vision.

### Ubiquitous Impact

AI is already reshaping industries, driving innovation, and becoming integrated into our daily lives in countless ways.

### Ethical Responsibility

Addressing bias, ensuring privacy, and prioritizing safety are paramount for developing AI that benefits all of humanity.

## Continue AI Exploration



### Deep Dive into Specifics

Explore resources like online courses, academic papers, and industry blogs on areas that piqued your interest, such as generative AI or reinforcement learning.



### Experiment & Build

Start small personal projects using open-source AI tools and libraries. Practical application is the best way to solidify your understanding.



### Stay Informed & Question

Keep abreast of new developments, ethical discussions, and regulatory changes in the AI landscape to foster responsible innovation.

