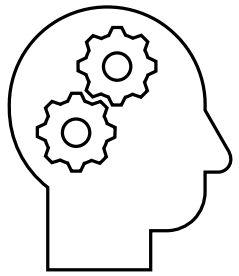
# AI AGENTS

Definition, Types, and Use Cases

# AGENDA

- Introduction to AI Agents
- Definition and Core Characteristics of AI Agents
- Types of AI Agents
- Examples of AI Agents
- Distinguishing Characteristics of Non-Agents
- Controversy and Complexity in AI Agents
- Broader Implications and Future Trends
- Use Cases of AI Agents
- Conclusion

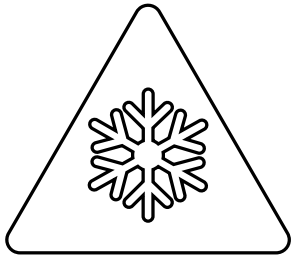
# WHAT IS AN AGENT?



## Definition of an Agent

A system that senses its environment

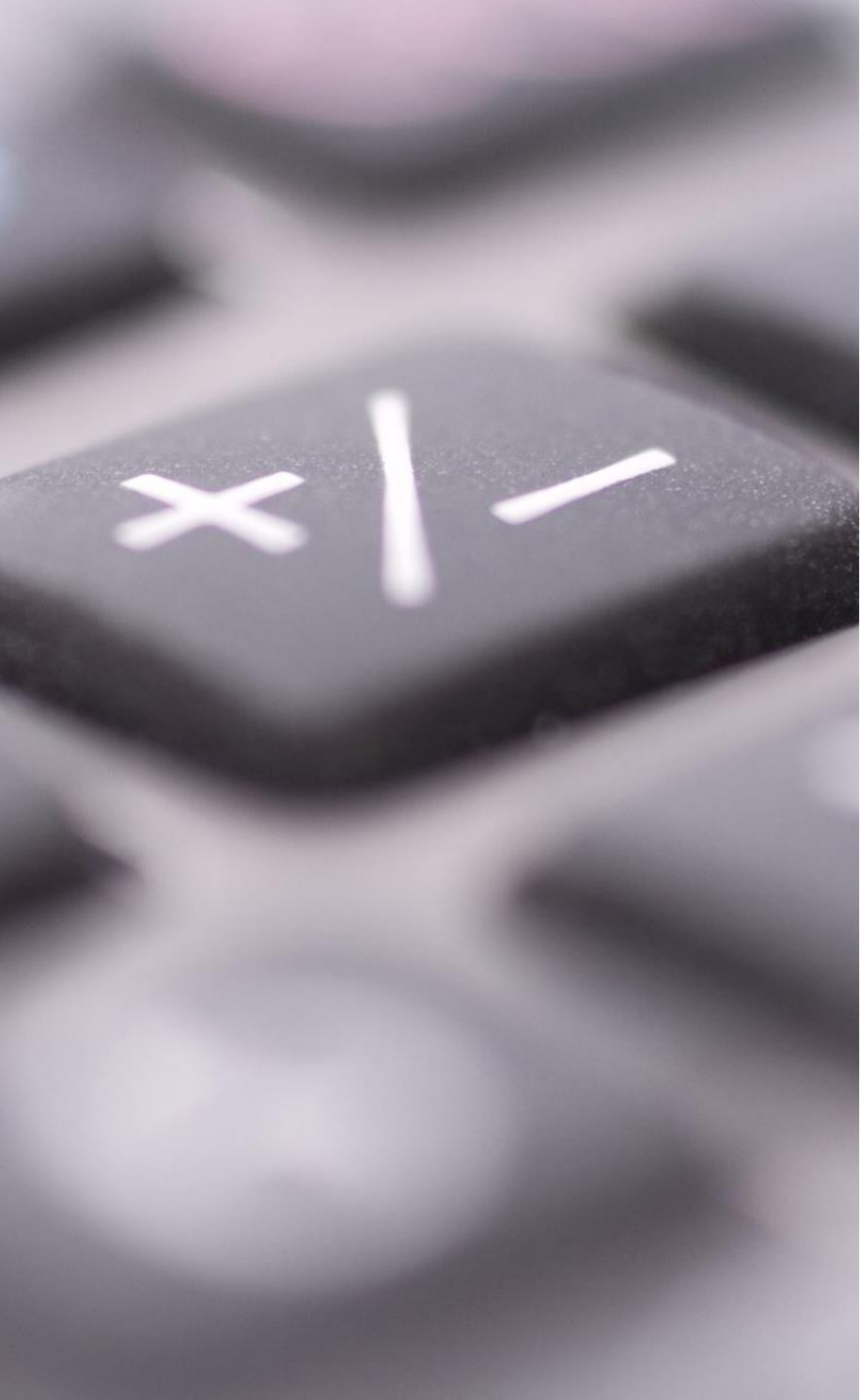
Processes information to take actions



## Examples of Agents

Thermostat: Senses temperature and adjusts heat

Chatbot: Reads messages and responds



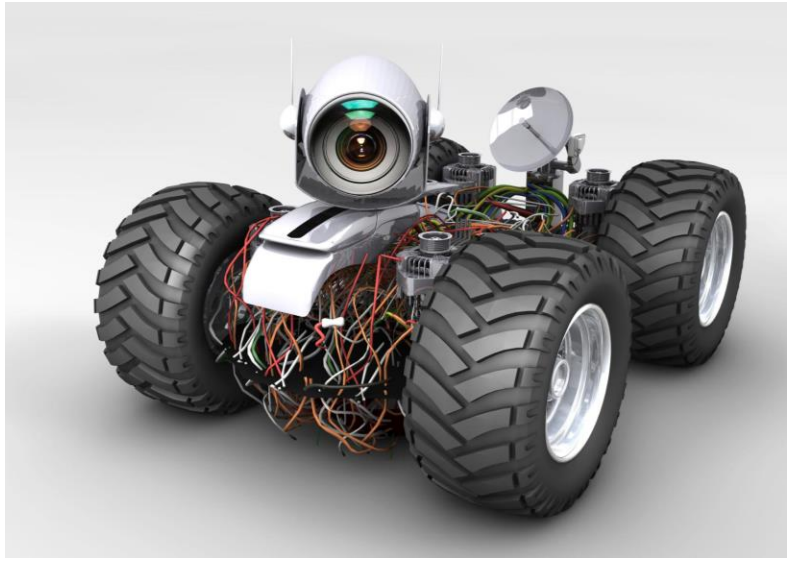
# WHAT ARE NOT AGENTS?

- Definition of Non-Agents
  - Entities lacking abilities to sense, act, or perceive
- Examples of Non-Agents
  - Rocks: Do not sense or act
  - Static Webpages: Display information without interaction
  - Simple Calculators: Process numbers without independent action or environmental perception

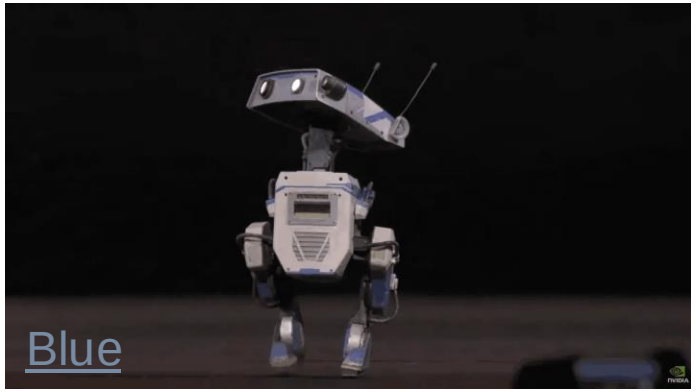
# UNEXPECTED DETAIL

- Simple Systems as Agents
  - Motion-activated lights as an example
  - Sense motion and turn on
  - **Often not considered as agents**

# DEFINITION OF AI AGENTS



- Definition of an Agent
  - System capable of perceiving its environment
  - Processes information to make decisions
  - Acts upon the environment to achieve goals
- Examples of Agents
  - Robots with cameras and wheels
  - Software programs like virtual assistants
  - Recommendation systems



# CORE CHARACTERISTICS OF AI AGENTS

- Perception
  - Sensing the environment through physical sensors or virtual inputs
  - Examples: cameras for robots, user messages for chatbots
- Decision-Making
  - Processing information to determine actions
  - Range from simple rule-based decisions to complex reasoning
  - Examples: thermostats, self-driving cars
- Action
  - Capacity to affect the environment
  - Examples: turning on a heater, navigating roads

# SIMPLE REFLEX AGENTS


Simple Reflex Agents

- React based on current perception
- Follow pre-set rules
- Example: When I enter into my room, my air condition, oven and computer might turn on and other electric devices might not get activated


# MODEL-BASED REFLEX AGENTS

- Model-Based Reflex Agents
  - Use a mental map of their environment
  - Make choices based on the map
  - Useful in situations where not everything is visible
  - Example: Robot vacuum navigating around furniture

# GOAL-BASED AGENTS

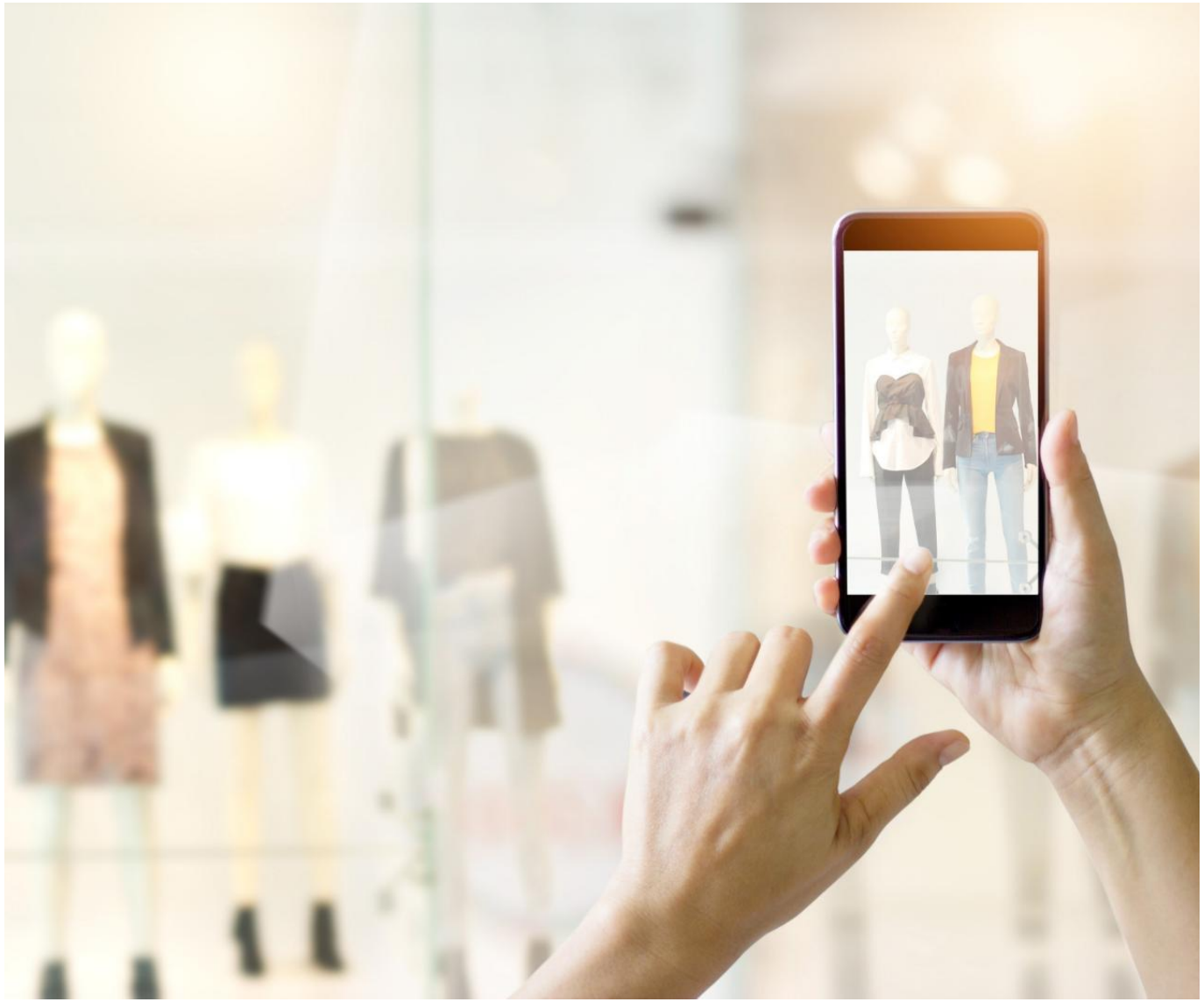
- Goal-Based Agents
  - Have specific goals
  - Plan actions to achieve goals
  - Example: Navigation app finding the fastest route

# UTILITY-BASED AGENTS

- Utility-Based Agents
  - Pick actions that offer the best outcome
  - Consider factors like time or cost
  - Example: Choosing a route that saves fuel and avoids tolls

# LEARNING AGENTS

- Learning Agents
  - Improve over time by learning from experience
  - Example: Recommendation systems on shopping sites



# MULTI-AGENT SYSTEMS

- Multi-Agent Systems
  - Multiple AI agents working together
- Hierarchical Agents
  - Organized in levels for complex task coordination
  - Sometimes seen as separate concepts

# EXAMPLES OF SIMPLE REFLEX AGENTS

- Thermostats
  - React based on temperature
  - Turn on heater if below set point
  - Turn off heater if above set point
- Automatic Doors
  - React based on person detection
  - Open door if person detected
  - Keep door closed if no person detected
- Vacuum Cleaner Agent
  - React based on dirt detection
  - Suck up dirt when detected

# EXAMPLES OF MODEL-BASED REFLEX AGENTS

- Agents and Internal State
  - Track environment using internal state
  - Handle partially observable settings by inferring current world state
- Examples of Agents
  - Roomba vacuum cleaner
    - Builds a map to clean efficiently
    - Remembers cleaned areas and obstacles
  - Wumpus World agents
    - Track visited squares and percepts
    - Infer safe paths

# EXAMPLES OF GOAL-BASED AGENTS

- Perception-Decision-Action Framework
  - Applies to both simple and complex systems
  - Examples include thermostats and self-driving cars
- Goal-Based Agents
  - Focus on achieving specific goals
  - Evaluate actions to find the best outcome
  - Use search or planning algorithms
- Examples of Goal-Based Agents
  - Route planning apps like Google Maps
  - Pac-Man search agents
- Resources for Learning
  - CS188 Pac-Man Projects

# EXAMPLES OF UTILITY-BASED AGENTS

- Types of Agents
  - Simple systems like thermostats
  - Complex systems like self-driving cars
- Decision-Making Process
  - Maximize expected utility
  - Weigh outcomes based on preferences
  - Suitable for complex decision-making with trade-offs
- Examples
  - Financial trading bots
  - Game-playing agents using minimax
- Resources
  - CS188 Pac-Man Projects for Project 2 on multiagent search

# EXAMPLES OF LEARNING AGENTS

- CS188 Pac-Man Projects
  - Project 3 on reinforcement learning
  - Agents learn from rewards
- Perception-Decision-Action Framework
  - Simple systems like thermostats
  - Complex systems like self-driving cars
- Improving Performance Over Time
  - Learning from experience
  - Using machine learning techniques
- Recommendation Systems
  - Netflix learns user preferences
- Reinforcement Learning Agents

# EXAMPLES OF MULTI-AGENT SYSTEMS

- Definition of Multi-Agent Systems
  - Involve multiple agents interacting, cooperating, or competing
  - Effective for complex, distributed tasks
- Examples of Multi-Agent Systems
  - Autonomous vehicle fleets
  - Swarm robotics
- Resources for Multi-Agent Systems
  - ARGoS Simulator for large-scale swarm robotics simulations example
- Range of Agents
  - From simple systems like thermostats to complex systems like self-driving cars
  - Fit the perception-decision-action framework

# ENTITIES THAT ARE NOT AGENTS

- Core Capabilities of Agents
  - Perception
  - Decision-making
  - Action
- Characteristics of Non-Agent Entities
  - Lack of perception
  - Inability to make decisions
  - Inability to take action

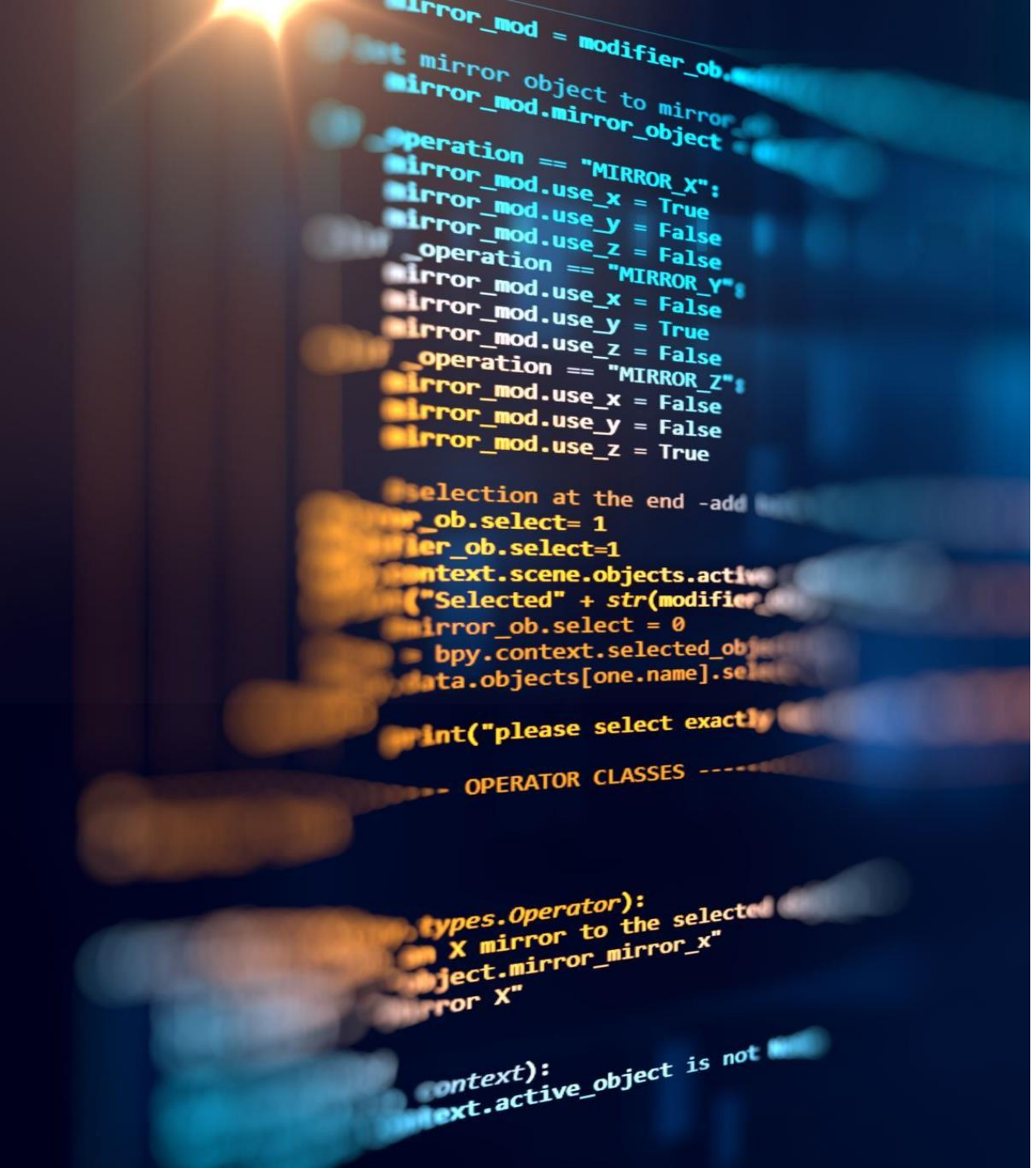
# REASONS WHY THEY ARE NOT AGENTS

- Perception-Decision-Action Loop
  - Entities must engage in this loop to be considered agents
- Non-Agent Examples
  - Thermometer: perceives but does not act
  - Motor: acts but does not perceive
- Static Webpage or Database
  - Lacks autonomous interaction with the environment

| Entity | Description | Reason Not an Agent |
|---|---|---|
| Rock | A passive object with no ability to sense or act. | Lacks perception and action capabilities. |
| Static Webpage | Displays information but does not interact or make decisions. | No perception or action; merely serves content. |
| Simple Calculator | Performs computations based on user input without autonomy or environmental interaction. | Lacks perception of an environment and autonomous action; acts as a tool. |
| Sensor (e.g., Thermometer) | Perceives environmental data (e.g., temperature) but does not act. | Lacks action capability; perception without decision-making or actuation. |
| Actuator (e.g., Motor) | Can act (e.g., move) but does not perceive or decide. | Lacks perception and decision-making; action without autonomy. |
| Database | Stores and retrieves data but does not make decisions or act autonomously. | No perception or action; processes data internally without environmental interaction. |

# DEBATE ON SIMPLE SYSTEMS AS AGENTS

- Definition of Agents
  - Simple systems like motion-activated lights and washing machines fit the technical definition
  - They perceive and act based on certain stimuli
- Common Usage of the Term 'Agent'
  - Often implies a level of intelligence or adaptability
  - Debate exists about the threshold for agency
- Different Perspectives
  - Some sources reserve the term for systems with learning or complex decision-making capabilities
  - Others, like Wikipedia, include even basic systems




# SOFTWARE AGENTS AND CONTEXT IN CLASSIFICATION

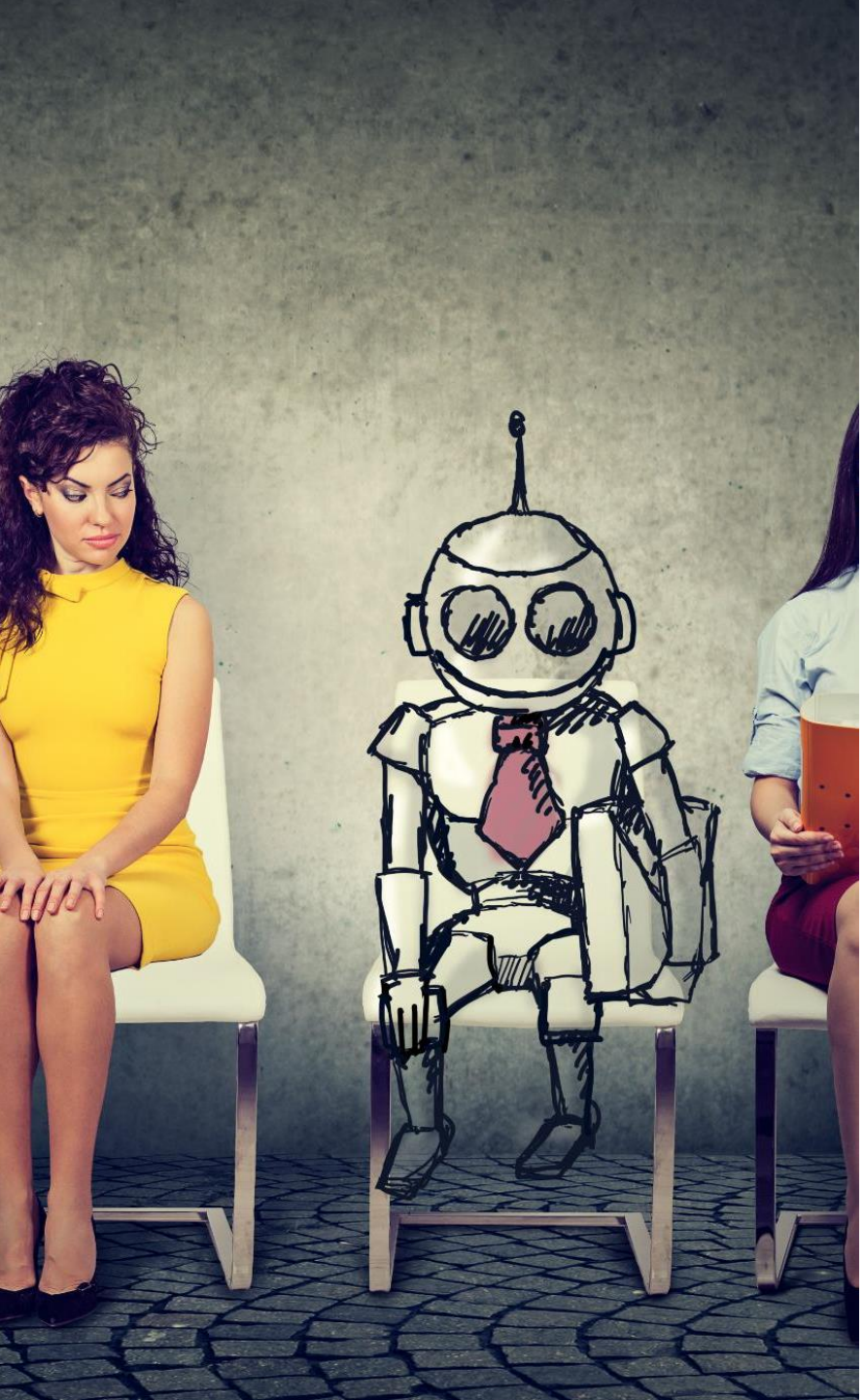
- Software Agents and Environmental Interaction
  - Programs like spam filters are considered agents
  - They perceive emails and act by classifying them
- Simple Scripts
  - Lack environmental interaction
  - May not be classified as agents
- Need for Context in Classification
  - Context is crucial in determining if a program is an agent

# UNEXPECTED DETAIL: SIMPLE SYSTEMS AS AGENTS

- Simple Systems as Agents
  - Motion-activated lights and washing machines can be considered agents
  - They perceive via sensors and act via actuators based on rules
- Challenges Common Perceptions
  - Agents are not necessarily intelligent or software-based
  - Includes everyday devices
- Example: Wumpus World Simulator
  - Simulates simple reflex agents

# HIERARCHICAL AND MULTI-AGENT SYSTEMS IN PRACTICE

- Hierarchical and Multi-Agent Systems
  - Sometimes debated as distinct types
  - Increasingly seen in practice
- Applications in Self-Driving Cars
  - Hybrid intelligent agents
  - Plan routes and react to obstacles
- Advanced Robotic Systems
  - Adapt to changing environments
  - Illustrate practical utility



# CUSTOMER SERVICE

- Customer Service
  - Chatbots handle inquiries efficiently

  - cognigy

# USECASE

- Customer Service
  - Chatbots handle inquiries
- Healthcare
  - Assist with treatment planning and drug management
- Emergency Response
  - Analyze social media for rescue operations during disasters
- Logistics
  - Coordinate tasks like supply chain management
- Software Development
  - Automate tasks like repository queries
- Recruitment
  - Streamline hiring processes

# SOME MORE

- https://www.crewai.com/use-cases

# CONCLUSION

- Transformative Technology
  - AI agents are autonomous task performers
  - They represent a significant technological advancement
- Types of AI Agents
  - Simple reflex systems
  - Hierarchical systems
  - Debate on multi-agent and hierarchical systems
- Diverse Use Cases
  - Customer service
  - Emergency response
  - Unexpected roles in modern industries
- Comprehensive Overview