

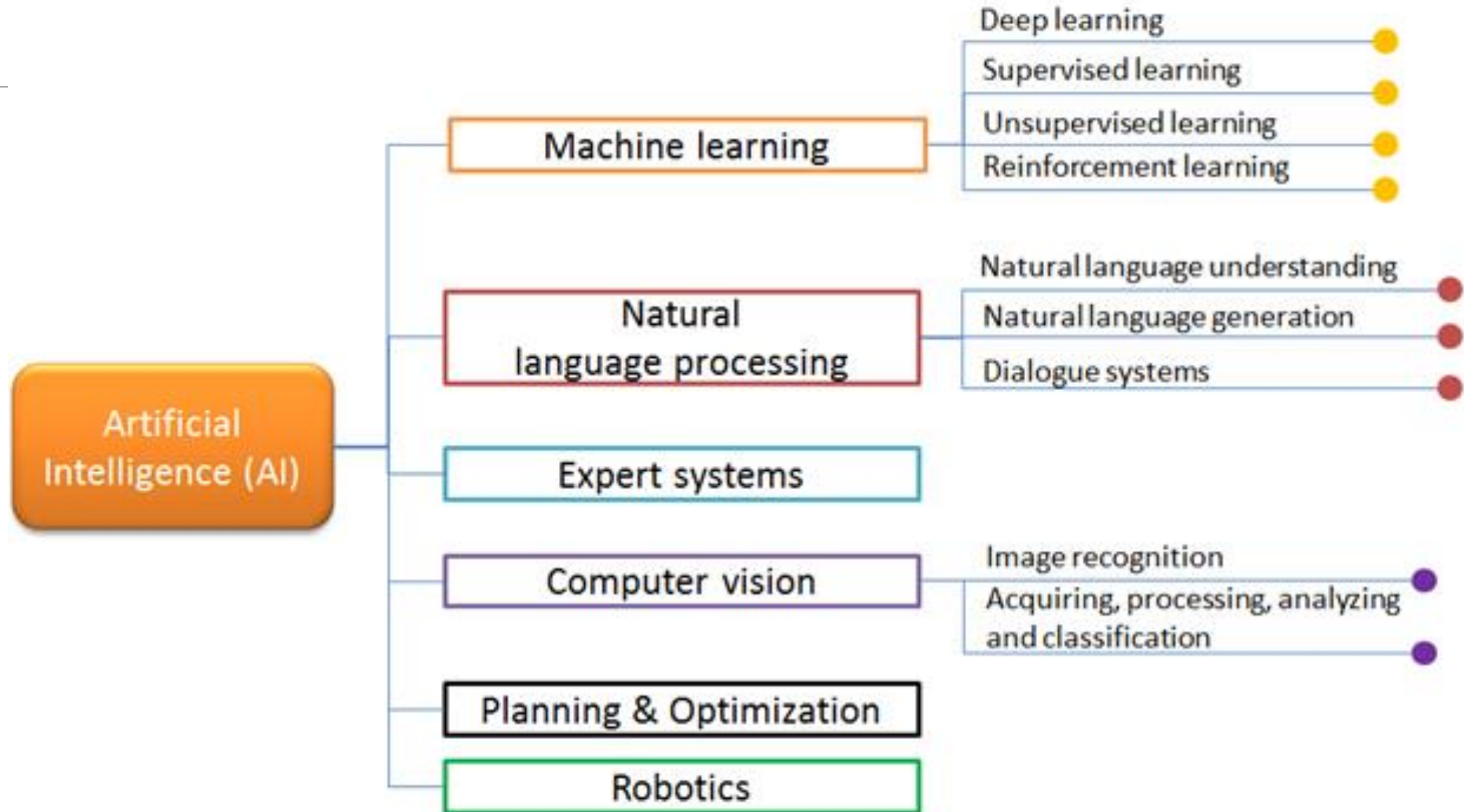
CS341

Artificial Intelligence

Lecture 2

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Areas of AI Research



Agents

An **agent** is anything that can be viewed as **perceiving** its **environment** through **sensors** and **acting** upon that environment through **actuators**

Human agent:

eyes, ears, and other organs for sensors;

hands, legs, mouth, and other body parts for actuators

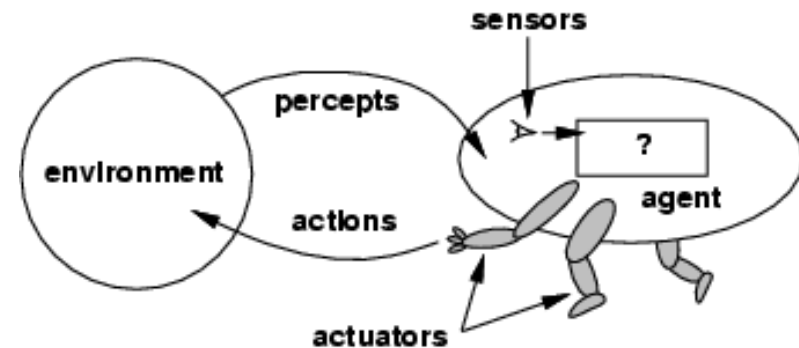
Robotic agent:

cameras and infrared range finders for sensors; various motors for actuators

Agents and environments

The **agent function** maps from percept histories to actions:

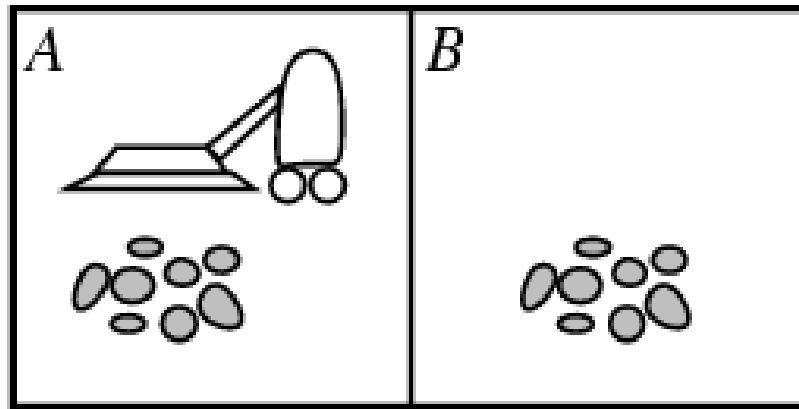
$$[f: \mathcal{P}^* \rightarrow \mathcal{A}]$$



The agent function is implemented by an **agent program** which runs on the physical **architecture** to produce f

agent = architecture + program

Vacuum-cleaner world



Percepts: location and state of the environment, e.g., [A,Dirty], [B,Clean]

Actions: *Left, Right, Suck, NoOp*

Rational agents

Rational Agent: For each possible percept sequence, a rational agent should select an action that is *expected* to maximize its **performance measure**, based on the evidence provided by the percept sequence and whatever built-in knowledge the agent has.

Performance measure: An objective criterion for success of an agent's behavior

E.g., performance measure of a vacuum-cleaner agent could be amount of dirt cleaned up, amount of time taken, amount of electricity consumed, amount of noise generated, etc.

Rational agents

Rational at any given time depends on four things:

- The **performance measure** that defines the criterion of success.
- The **agent's prior knowledge** of the environment.
- The **actions** that the agent can perform.
- The **agent's percept** sequence to date

An agent is **autonomous** if its behavior is determined by its own percepts & experience (with ability to **learn and adapt**) without depending solely on build-in knowledge

Task Environment

Before we design an intelligent agent, we must specify its “task environment”:

PEAS:

Performance measure

Environment

Actuators

Sensors

PEAS

Example: Agent = taxi driver

Performance measure: Safe, fast, legal, comfortable trip, maximize profits

Environment: Roads, other traffic, pedestrians, customers

Actuators: Steering wheel, accelerator, brake, horn

Sensors: Cameras, infrared, speedometer, GPS, engine sensors, keyboard

PEAS

Example: Agent = Medical diagnosis system

Performance measure: Healthy patient, minimize costs

Environment: Patient, hospital, staff

Actuators: Screen display (questions, tests, diagnoses, treatments)

Sensors: Keyboard (entry of symptoms, findings, patient's answers)

PEAS

Example: Agent = Interactive English tutor

Performance measure: Student's score on test

Environment: Set of students, testing agency

Actuators: Display of exercises, suggestions, corrections

Sensors: Keyboard entry

Environment types

Fully observable (vs. **partially observable**): An agent's sensors give it access to the complete state of the environment at each point in time.

Single agent (vs. **multi-agent**): An agent operating by itself in an environment. Does the other agent interfere with my performance measure?

Deterministic (vs. **stochastic**): The next state of the environment is completely determined by the current state and the action executed by the agent. (If the environment is deterministic except for the actions of other agents, then the environment is **strategic**)

Environment types

Episodic (vs. **sequential**): An agent's action is divided into atomic episodes. Decisions do not depend on previous decisions/actions.

Static (vs. **dynamic**): The environment is unchanged while an agent is deliberating. (The environment is **semidynamic** if the environment itself does not change with the passage of time but the agent's performance score does)

Discrete (vs. **continuous**): A limited number of distinct, clearly defined percepts and actions.

task environm.	observable	determ./ stochastic	episodic/ sequential	static/ dynamic	discrete/ continuous	agents
crossword puzzle	fully	determ.	sequential	static	discrete	single
chess with clock	fully	strategic	sequential	semi	discrete	multi
taxi driving	partial	stochastic	sequential	dynamic	continuous	multi
medical diagnosis						
image analysis						
partpicking robot						
refinery controller						
interact. Eng. tutor						