Artificial Intelligence
AI 2002

Lecture 1

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INTRODUCTION TO ARTIFICAL INTELLIGENCE

INTELLIGENCE

The ability to learn and solve problems

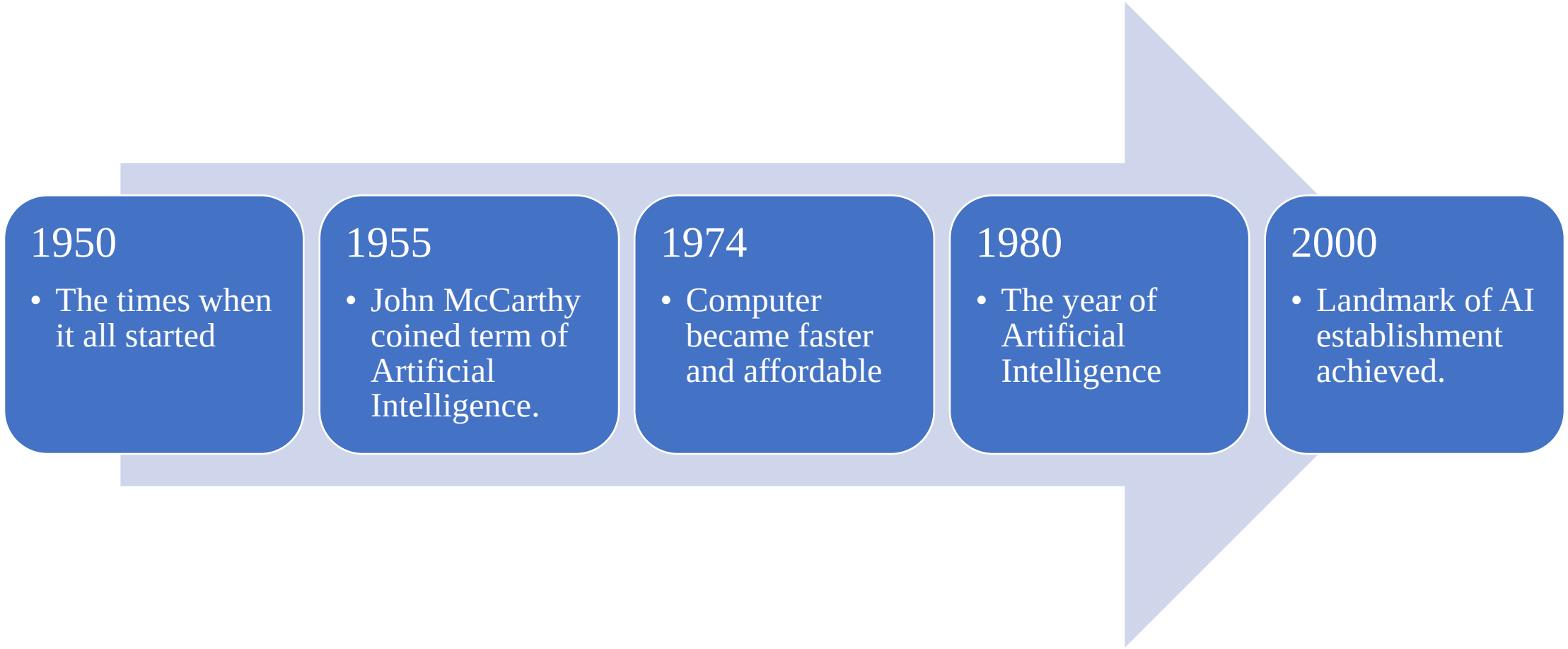
ARTIFICAL INTELLIGENCE:

The capacity given by human to machine to memorize and learn from experience, to think to create, to judge and make decision.

In other words,

1. The ability to solve problem.
2. The ability to act rationally.
3. The ability to act human.

HISTORY OF AI



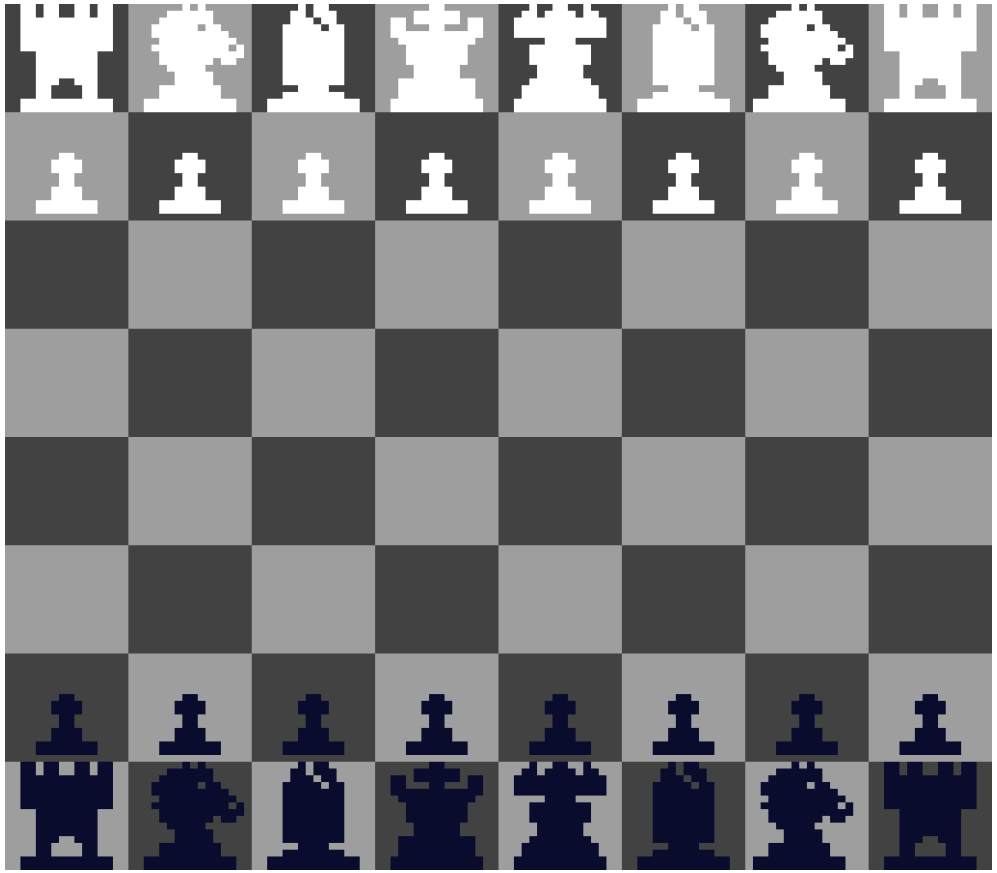
AI TYPES

There are four basic types of AI

- Reactive Machine
- Limited Memory
- Theory of Mind
- Self Awareness

AI TYPES (Cont…)

Reactive Machine

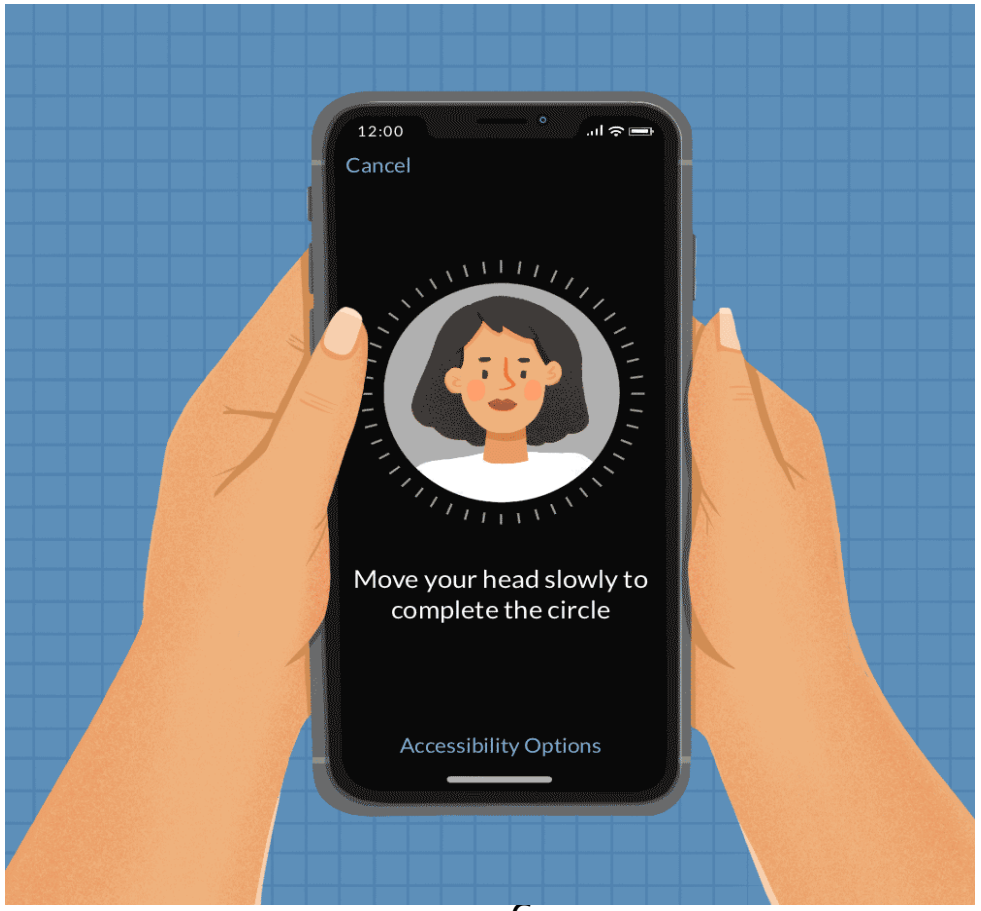


Limited Memory

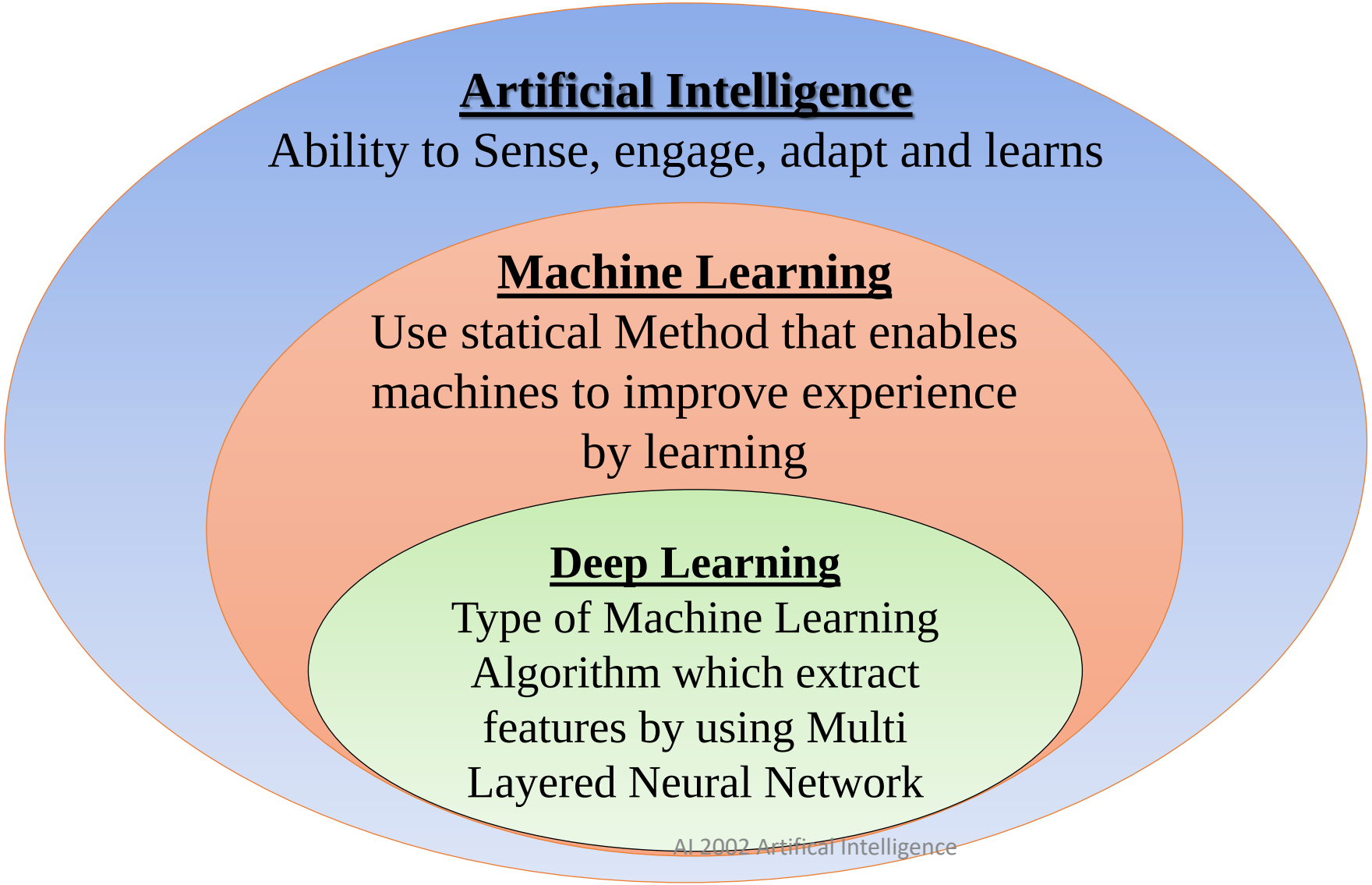
AI TYPES (Cont…)

Theory of Mind

Self Awareness



FAMILY OF LEARNING ALGORITHM



Agents and environments

An agent is anything that;

- can be viewed as perceiving its environment
- through sensors.

and acting upon that environment through effectors (actuators).

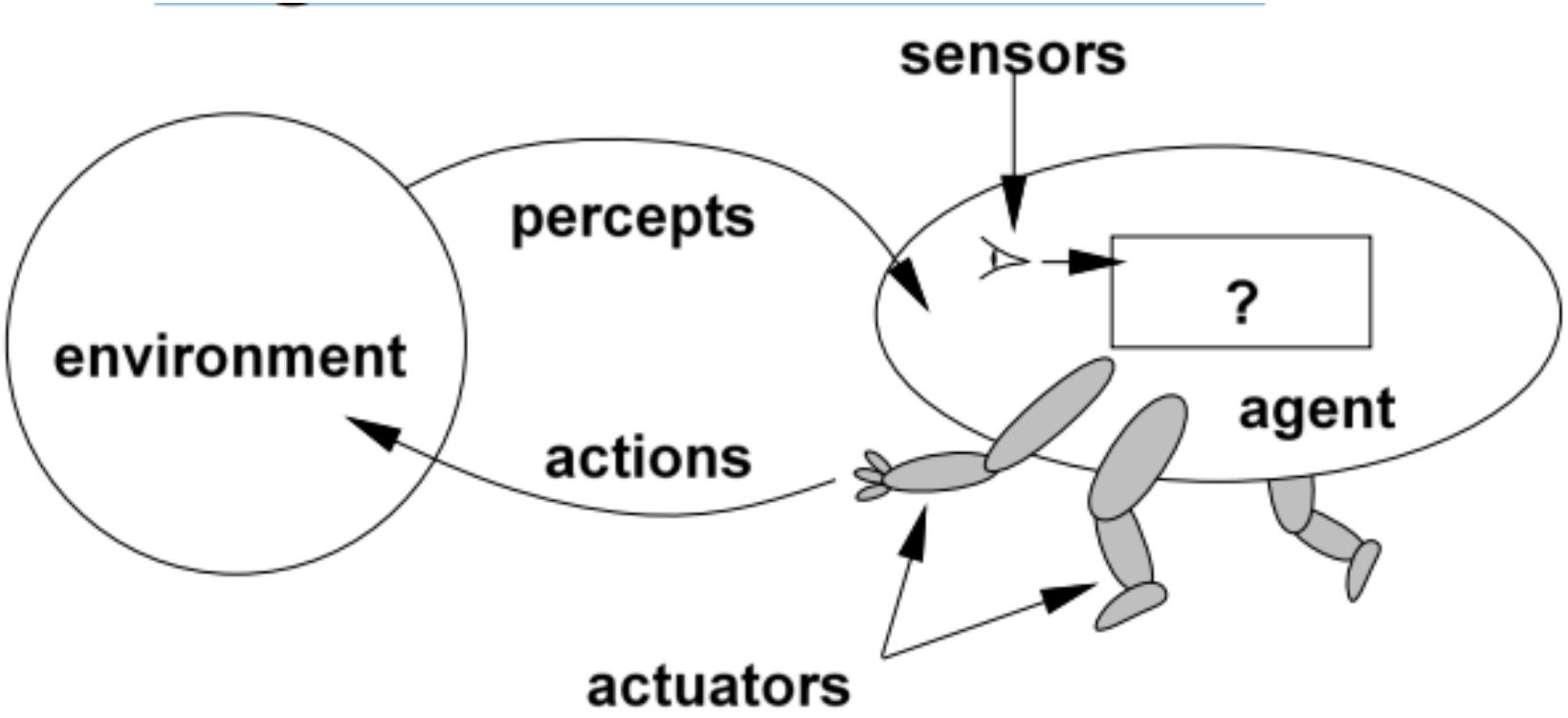
A human agent has eyes, ears, and other organs for sensors.

hands, legs, mouth, and other body parts for effectors.

Example

- A robotic agent substitutes cameras and infrared range finders for the sensors.
  - - various motors for the effectors.

Agents and environments



Components of an AI System (Intelligent Agent)

- An agent perceives its environment through sensors and acts on the environment through actuators.

1. Human: (sensors) are eyes, ears, actuators (effectors) are hands, legs, mouth.
2. Robot: (sensors) are cameras, sonar, lasers, bumble-bee, (effectors) are grippers, manipulators, motors

How Agents should Act?

- An agents includes factor known as; - a rational agent that does the right thing. (what is this?)
  - - Obviously, this is better than doing the wrong thing, but what does it mean?

1. As a first approximation, we will say that the right action is the one that will cause the agent to be most successful.
2. That leaves us with the problem of deciding “how” and “when” to evaluate the agent's success.

Solution

- A fixed performance measure evaluates the sequence of observed action effects on the environment.

Example

- Consider the case of an agent that is supposed to vacuum a dirty floor

Basic Factors :

- In case of “How” work with the evaluating performance measure.
- The “when” of evaluating performance measure is also important.

How and When?

- In case of “How” work with the evaluating performance measure.
  1. First, the **performance measure would be the amount of dirt** cleaned up in a single eight-hour shift.
  2. Second, performance measure would factor **in the amount of electricity consumed** and the amount of noise generated as well.
  3. performance measure might give highest marks to an agent that not only **cleans the floor quietly** and also efficiently.

- In case of “How” work with the evaluating performance measure.
  1. If we measured how much dirt the agent had cleaned up in the first hour of the day.
  2. either we query for appreciation or punishment to get positive results.

Example 2:

- Consider the case of an agent in which Taxi driver cover a reasonable distance ????

How Agents Should work?

- Tasks Parameters for Agents to perform accurately
- Environment Parameters for Agents to perform accurately

1. Tasks Parameters for Agents to perform accurately

- Major factors to evaluate the agents actions are;

Use PEAS to describe task

Performance measure

Environment

Actuators

Sensors

Example: Taxi Driver

Performance Measure	Environment	Actuators	Sensors
Safe	Roads	Brake	Engine
Fast	Traffic	Starring	Cameras
Comfortable	Customer	Signal	Speed Meter
		Horn	

2. Environment Parameters for Agents to perform accurately

i) Fully observable vs. partially observable

ii) Deterministic vs. stochastic / strategic

iii) Episodic vs. sequential

iv) Static vs. dynamic

v) Discrete vs. continuous

vi) Single agent vs. multiagent

Fully Observed Vs Partially Observed

monitoring the specific tasks (either Fully or partial).

- agent's sensory apparatus gives it access to the complete/partial state of the environment,

If we completely depend on sensors then its called fully observed other wise partially observed.

Example

Chess

Taxi Driver

Deterministic

- well-known knowledge of particular tasks. (either strategic or stochastic (change with condition)).
- If the next state of the environment is completely determined by the current state then deterministic.
  - Example: pick an object is acting as deterministic).
- If the next state of the environment is previously knowledge-based determined by the current state then Strategic.
  - Example: chess is acting as strategic).
- If the next state of the environment is uncertain situation determined by the current state then Stochastic.
  - Example: driving car is acting as stochastic).

Episodic vs. sequential

- series of separate parts (either sequential or episodic).
- the agent's experience is divided into "episodes.
- Each episode consists of the agent perceiving and then acting.

Lecture Delivering is episodic

Playing chess is Sequential

Static Vs Dynamic

- Static environments are easy to deal with because the agent need not keep looking at the world.
  - Example: Medical diagnosis is acting as static).
- If the environment can change while an agent is deliberating (thinking), then we say the environment is dynamic.
  - Example :driving a car is acting as dynamic).

Discrete vs Continuous

- There are a fixed number of possible moves on each turn, then Discrete.
  - Example: chess is acting as discrete
- Agent receives numerous range of continuous values, then its Continuous.
  - Example: driving car is acting as continuous

Environment Parameters for Agents to perform accurately

- Chess System
- Taxi Driver

Environment Parameters for Agents to perform accurately (cont…)

Environments	Observable	Deterministic	Episodic	Static	Discrete	Agents

Taxi Driver

Environments	Observable	Deterministic	Episodic	Static	Discrete	Agents

Chess Game

Environments	Observable	Deterministic	Episodic	Static	Discrete	Agents

Taxi Driver

Environments	Observable	Deterministic	Episodic	Static	Discrete	Agents
• Taxi Driver	• Partial	• Stochastic	• Sequential	• Dynamic	• Continuous	• Single

Chess Game

Environments	Observable	Deterministic	Episodic	Static	Discrete	Agents
• Playing with clock	• Fully	• Strategy	• Sequential	• Semi Dynamic	• Discrete	• Multi

Examples:

Environments	Observable	Deterministic	Episodic	Static	Discrete	Agents
Chess with a clock	Fully	Strategic	Sequential	Semi	Discrete	Multi
Taxi driving	Partial	Stochastic	Sequential	Dynamic	Continuous	Single
Medical diagnosis	Partial	Stochastic	Episodic	Static	Continuous	Single
Image analysis	Fully	Deterministic	Episodic	Semi	Discrete	Single
Robot part picking	Fully	Deterministic	Episodic	Semi	Discrete	Single
Interactive English tutor	Partial	Stochastic	Sequential	Dynamic	Discrete	Multi

Agent Types

- Five Types of Agents
  - Simple reflex agents
  - Reflex agents with state
  - Goal-based agents
  - Utility-based agents
  - Learning agent.