Covenant University

Raising a new Generation of Leaders

CSC415 – ARTIFICIAL INTELLIGENCE

Lecture materials adapted and modified from:

1. David L. Poole and Alan K. Mackworth (2017) Artificial Intelligence: Foundations of Computational Agents, 2nd Edition, Cambridge University Press [Main Text]

2. Stuart J. Russell and Peter Norvig (2016), Artificial Intelligence – A Modern Approach, Global Edition, Pearson Education Limited [Alternate Main Text]

Lecturer: Omogbadegun, Zacchaeus Oni (PhD)

Lecture Overview

- What is Artificial Intelligence? Agents acting in an environment
- Learning objectives: at the end of the class, you should be able to
  - describe what an intelligent agent is
  - identify the goals of Artificial Intelligence
  - classify the inputs and the outputs of various agents

What is Artificial Intelligence?

- Artificial Intelligence is the synthesis and analysis of computational agents that act intelligently.
- An agent is something that acts in an environment. An agent acts intelligently if:
  - its actions are appropriate for its goals and circumstances
  - it is flexible to changing environments and goals
  - it learns from experience
  - it makes appropriate choices given perceptual and computational limitations

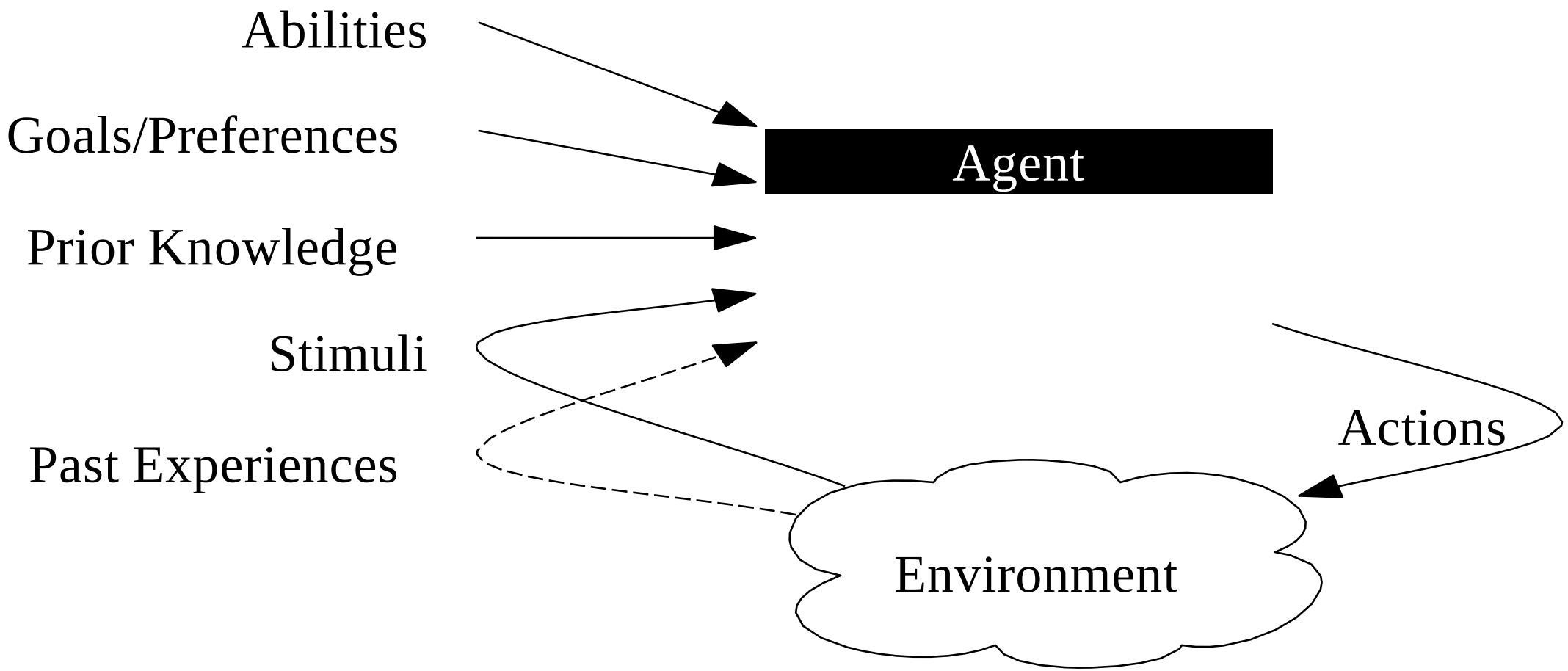
Examples of Agents

- Organisations Microsoft, Covenant University, Government of Nigeria, CIS Dept,...
- People teacher, physician, stock trader, engineer, researcher, travel agent, farmer, waiter...
- Computers/devices thermostat, user interface, airplane controller, network controller, game, advising system, tutoring system, diagnostic assistant, robot, Google car, Mars rover...
- Animals dog, mouse, bird, insect, worm, bacterium, bacteria... book(?), sentence(?), word(?), letter(?)
- Can a book or article *do* things?
- Convince? Argue? Inspire? Cause people to act differently?

Goals of Artificial Intelligence

- Scientific goal: to understand the principles that make intelligent behavior possible in natural or artificial systems.
  - „ analyze natural and artificial agents
    - „ formulate and test hypotheses about what it takes to construct intelligent agents
    - „ design, build, and experiment with computational systems that perform tasks that require intelligence
- Engineering goal: design useful, intelligent artifacts.
- Analogy between studying flying machines and thinking machines.

Agents acting in an environment



Inputs to an agent

- Abilities — the set of possible actions it can perform
- Goals/Preferences — what it wants, its desires, its values,...
- Prior Knowledge — what it comes into being knowing, what it doesn't get from experience,...
- History of stimuli
  - (current) stimuli — what it receives from environment now (observations, percepts)
  - past experiences — what it has received in the past

Example agent: autonomous car

- abilities: steer, accelerate, brake
- goals: safety, get to destination, timeliness,...
- prior knowledge: what signs mean, what to stop for
- stimuli: vision, laser, GPS...
- past experiences: streetmaps, how breaking, steering affects direction..

Example agent: robot

- abilities: movement, grippers, speech, facial expressions,...
- goals: deliver food, rescue people, score goals, explore,...
- prior knowledge: what is important feature, categories of objects, what a sensor tell us,...
- stimuli: vision, sonar, sound, speech recognition, gesture recognition,...
- past experiences: effect of steering, slipperiness, how people move,...

Example agent: teacher

- abilities: present new concept, drill, give test, explain concept,. . .
- goals: particular knowledge, skills, inquisitiveness, social skills,. .
- . .
- prior knowledge: subject material, teaching strategies,. . .
- stimuli: test results, facial expressions, errors, focus,. . .

  past experiences: prior test results, effects of teaching strategies, . . .

Example agent: thermostat for heater

- abilities: turn heater on or off
- goals: conformable temperature, save fuel, save money prior knowledge: 24 hour cycle, weekends
- stimuli: temperature, set temperature, who is home, outside temperature
- past experiences: when people come and go, who likes what temperature

In-class Exercises

- Complete the following for each of: student, medical doctor, Covenant University, a pilot to prove examples of agent

- abilities:
- goals:
- prior knowledge:
- stimuli:
- past experiences:

Examples of agent types and their PEAS descriptions (Russell and Norvig, 2016)

Agent Type	Performance Measure	Environment	Actuators	Sensors
Medical diagnosis system	Healthy patient, reduced costs	Patient, hospital, staff	Display of questions, tests, diagnoses, treatments, referrals	Keyboard entry of symptoms, findings, patient's answers
Satellite image analysis system	Correct image categorization	Downlink from orbiting satellite	Display of scene categorization	Color pixel arrays
Part-picking robot	Percentage of parts in correct bins	Conveyor belt with parts; bins	Jointed arm and hand	Camera, joint angle sensors
Refinery controller	Purity, yield, safety	Refinery, operators	Valves, pumps, heaters, displays	Temperature, pressure, chemical sensors
Interactive English tutor	Student's score on test	Set of students, testing agency	Display of exercises, suggestions, corrections	Keyboard entry

Other Agents

- user interface bee
- smart home
- …
- abilities:
- goals:
- prior knowledge: stimuli:
- past experiences:
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Agents acting in an environment