50.021 Artificial Intelligence

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Homework 1

1 PEAS Description

1. A robotic platform for autonomous cleaning of the floor within a building

- **Performance Measure:** Total number of clean tiles, Percentage of the floor area cleaned, Efficiency in avoiding obstacles
- **Environment:** Rooms, Hallways, Obstacles,
- **Actuators:** Wheels - for movement, Cleaning mechanisms - vacuum, brushes, Navigation system to avoid obstacles, walls or corners
- **Sensors:** Infrared sensor - to detect obstacles, Dust sensor - to locate dusty areas

2. A customer service chatbot for an online retailer

- **Performance Measure:** Conversational Maturity, Maximises autonomous reasoning (no need for human intervention)
- **Environment:** Order Information, Product website, Customer Query Page
- **Actuators:** Algorithm to generate text responses
- **Sensors:** Natural language processing algorithms - to understand customer queries, Access to database for product/order information

3. An automated and unmanned convenience store, like Pick&Go in SUTD

- **Performance Measure:** Minimise bugs and errors, Accuracy of detecting product, Ability to maintain records of products
- **Environment:** Shelves, entry and exit gates, fridges
- **Actuators:** Powered motor that controls motion of the doors, Automated checkout systems
- **Sensors:** Camera and Motion Sensor - to track customers' movement, Pressure Sensor - to track stock on shelves

2 Environment Types

Activity	Observable	Deterministic	Episodic	Static	Discrete	Single-Agent
Playing a massively multiplayer online game, such as World of Warcraft	Partially	Strategic	Episodic	Dynamic	Discrete	Multi-Agent
Enrolling for a course/subject for a new term at SUTD	Partially	Deterministic	Sequential	Dynamic	Discrete	Single-Agent
Purchasing a drink from a vending machine	Fully	Deterministic	Episodic	Static	Discrete	Single-Agent

Assumptions & Explanations

1. Playing an massively multiplayer online game, such as World of Warcraft

In a game like World of Warcraft, there are multiple players [**Multi-Agent**]. A player can only view parts of the game world and actions of the other players which are within their line of sight [**Partially Observable**]. Their action is influenced by

the actions of others [**Strategic**]. The actions taken are more likely linked to what the player currently sees on the screen rather than what actions he took previously [**Episodic**]. As the game progresses, the layout of the game world, quests and player interaction change [**Dynamic**]. As there are game rules and mechanics, players are usually limited to set of predefined possibilities [**Discrete**].

2. Enrolling for a course/subject for a new term at SUTD

It is assumed that there is one student [**Single-Agent**] is enrolling for only 1 course in this example.

When enrolling for 1 course, the student can only view the details for that course and not all the courses offered by SUTD [**Partially Observable**]. Since the student will then choose the cohort class they wish or whether they want to proceed with the course, the state of the enrollment process is determined by their current choice [**Deterministic**]. Since the status of being 'enrolled' is determined by previously choosing the desired course and cohort class, the enrollment process is [**Sequential**]. The course information such as available number of seats changes each time a student enrolls [**Dynamic**]. There is a specific number of steps the student take throughout the whole enrollment process [**Discrete**].

3. Purchasing a drink from a vending machine

There can be only 1 user using a vending machine at a time [**Single-Agent**]. The user can observe all the options available in the vending machine [**Fully Observable**]. The user can only choose between the options available and there is a set number of steps they need to proceed with to complete the purchase [**Discrete**]. While they choose their drink, the vending machine is idle [**Static**]. The choice of drink made determines the price to be paid by the user [**Deterministic**]. This instance of buying a drink is independent of previous and future transactions [**Episodic**].

3 Problem Formulation: The Missionaries and Cannibals Problem

- **State space:** A vector <M, C, S>, where M is the number of missionaries, C is the number of cannibals and S is the right side of the river that the boat is currently on (Right: 0 vs Left: 1)
- **Initial state:** Assuming that they all start on the right side of the river, the initial state is <3,3,0>
- **Goal test:** <0,0,0> : There are no missionaries and cannibals left on the right side of the river
- **Actions:** They are modified through vector additions and subtractions, representing moving missionaries and cannibals between the two sides of the river in the boat
- **Path cost:** Number of vector operations taken to for the 3 missionaries and cannibals to cross the river