Intelligent Systems

Exercise 2. Formulation of Intelligent Agents

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In this exercise, you are requested to describe the nature of the environment and the type of program for an intelligent agent. To do this, you must specify the task environment by its PEAS description, categorize the properties of the environment in different dimensions, and select a basic kind of program for the intelligent system.

This exercise must be done in **teams of 2 or 3 members**.

Read carefully and answer as requested.

Team members

Write the student id, name and campus of each member in a different line.

Member 1: A00828174 mty

Member 2: A01137566 mty

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Informal description of the desired agent

The agent is an intelligent driving assistant that will interact with the driver of a car to plan the routes between origins and destinations defined by the driver and will monitor the route to dynamically give feedback to the driver, based on driving conditions, distance, and traffic. The driver can change his destination at any time and the assistant can modify the route according to the conditions of the journey and the new orders.

PEAS description

This description will help to evaluate the rationality if the agent and should be used to support some of your answers in the following sections.

Agent Type	Performance Measure	Environment	Actuators	Sensors
Driving Assistant	Safe, fast, legal, comfortable trip, the happiness of the driver	Roads, other traffic, Weather	Screen, Maps, audio	GPS, internet connection, touchscreen, voice input

1. **Agent type**

   Write a very short description (title) of the type of agent-based on what it does.

   it is a utility-based agent because it is trying to find the best route for the driver based on several features of the possible routes to reach the destination. The agent's function is to make the driver as "happy" as possible instead of just giving instructions on how to go from the origin to the destination (that would be goal-based).

2. **Performance measure**

   List the desired qualities to which you think the agent should aspire.

   - The agent shows a correct path from A to B
   - Least time to get from point A to point B
   - Least amount of traffic en route
   - avoid dirt and unsafe roads
   - the agent shows legal routes

3. **Environment**

   List the elements of the environment that the agent will face.

   - Roads (streets, dirt roads, highways, etc)
   - Traffic Jams
   - Traffic lights
   - Tolls

The environment in which the agent will unfold consists in a cyberspace of internet GPS applications (such as google maps for example). In this environment the agent will have to interact with information regarding streets, roads and highways, with information concerning other vehicles (as in traffic), with weather conditions and with the driver of the car himself as well as its current location.

4. **Actuators**

   List the devices that the agent will use to act in its environment and modify it.

   - Screen to display information (selected route, other options, ETA, whether there are tolls, etc)
   - Audio output. To notify the user about upcoming turns, traffic conditions, change of routes, etc.

5. **Sensors**

   List the devices that the agent will use to detect and respond to some type of inputs in its environments.

   - GPS to know the current location of the driver
   - Internet connection to communicate with the app, get informed about weather conditions, know the average speed of drivers on route to identify traffic jams, etc.
   - A touch screen to accept user input

Properties of the Task Environment

You must select an option for each dimension and describe some reasons behind your selection. The reasons should be supported by the informal description of the agent, the PEAS descriptions, and some reasonable assumptions of your own.

1. How much of the state can the agent perceive?

- ☐ *Unobservable environment*
- ☐ *Partially observable environment*
- ☐ ***Fully observable environment***

Justify your answer:

We may say that the environment is fully observable for the intelligent driving assistant. Thanks to satellite imaginary, the system can know the full layout of the world prior to assisting any trip. There might be some changes in the layout of streets and roads "in real life" that are not reflected in the cyberspace accessible to the agent due to update issues, but for practical purposes it is safe to assume that the GPS provides an accurate and complete view of the environment at any given time.

2. Should the agent consider other object in the environment as agents?

- ☐ ***Single agent environment***
- ☐ *Multi agent environment*

Justify your answer:

We think that for this particular case the environment could be treated as a single agent environment. Since the agent is only a driving assistant, it is not directly interacting with other vehicles or pedestrians in general. The latter is done directly by the human driver. Other vehicles in this case can be modeled as one more "natural force" just like the weather for example (rain or snow affecting a route).

3. Is the environment completely determined by the current state and the action executed by the agent?

- ☐ *Deterministic environment*
- ☐ ***Stochastic environment***

Justify your answer:

The environment is definitely not deterministic as sudden changes like car accidents can modify the current state of routes at any given time without any sort of previous announcement. We say that this environment is better described as stochastic because the next state of the environment is not fully determined by the current state and the action of the agent. A route that was good when the agent suggested the driver to take it can turn bad if a sudden

accident ensues on it independently from how it was before and from the agent's previous suggestion.

4. Could the current decision of the agent affect its future decisions?

- ☐ *Episodic environment*
- ☐ ***Sequential environment***

Justify your answer:

Most definitely yes, this is in fact a sequential environment given the layout of the cities and roads. If a certain highway which has no exits for several kilometers is suggested by the agent and taken by the driver, then the next suggestion of the agent is bounded to its previous decision of suggesting such highway as other non-related routes become inaccessible from the current location.

5. Is the environment changing while the agent is choosing an action?

- ☐ *Static environment*
- ☐ ***Dynamic environment***
- ☐ *Semidynamic environment*

Justify your answer:

It is dynamic as the state of the different routes available is constantly updating and changes frequently. For example, even if the assistant suggests a given route and the driver takes it, the agent needs to still check the status of the current route and deliberate if its worth to stay in the current route or change to a seemingly better one.

6. How are the elements of the task environment represented?

- ☐ *Discrete state of the environment*
- ☐ *Continuous state of the environment*

Justify your answer:

The state could be formulated in a continuous manner taking in consideration the current location of the driver (coordinates) and the "ranks" of the different potential routes in function of their estimated time from current location to destination. There are certainly some other aspects of the state of the environment that could be modeled discretely such as traffic intensity (with for example, a color-based system) or the weather (e. i. Rainy, snow, etc.). We believed a mixed representation would be more adequate for this problem.

- ☐ *Discrete time handling*
- ☐ ***Continuous time handling***

Justify your answer:

Time handling in this environment is continuous. The time it takes to get from origin to destination will be handled in standard hours, minutes, seconds manner serving as both an estimate of a given trip or as a potential performance measure for the agent.

- ☐ *Discrete percepts*
- ☐ *Continuous percepts*

Justify your answer:

There exist both discrete and continuous percepts arising from this environment. Discrete ones include traffic information (mild, mid or intense) and weather-like information (flooded street, street under repair works). Continuous percepts include the coordinates of the current location as well as the coordinates of the destination.

- ☐ ***Discrete actions***
- ☐ *Continuous actions*

Justify your answer:

Actions can be described as discrete for this environment as the final output of the agent is a route suggestion. The set of all possible actions is as well discrete.

7. How much the agent (or designer of the agent) does knows about how the environment works?

- ☐ ***Known environment***
- ☐ *Unknown environment*

Justify your answer:

It is known as GPS systems usually provide information regarding which streets or roads are accessible from a given location. The latter refers to allowed turns and u-turns in order to respect traffic signals independently of the connections between streets and roads. The latter means that the “rules of the game” are indeed known to the agent in general.

Basic Type of Agent Program

Taking into account the informal description of the agent and your answers to the previous sections, choose a basic type of program for the agent.

1. Does the task environment requires a simple reflex agent?

- ☐ Yes
- ☐ **No**

Justify your answer:

No. If our agent would react only to its current state it would not be able to evaluate for a complete route to get from point A to point B, let alone discover the best route.

2. Does the task environment require a model-based reflex agent?

- ☐ Yes
- ☐ **No**

Justify your answer:

No. Having a fully-observable environment would make a model-based agent not a good option for this task environment. The functionality of our agent does not depend on an internal state from which it could make decisions but from the discrete and continuous perceptions of the environment.

3. Does the task environment require a goal-based agent?

- ☐ *Yes*
- ☐ ***No***

Justify your answer:

No. While a goal-based agent would be a good way to provide a route to get from point A to point B, we want our agent to provide the most desirable option based on pre-defined performance measures that, when satisfied, will make the user 'happier'.

4. Does the task environment require a utility-based agent?

- ☐ ***Yes***
- ☐ *No*

Justify your answer:

Yes. Through a utility-based agent, we could provide the best route to get from point A to point B according to different performance criteria. An utility-based agent would be able to process discrete and continuous inputs to adjust the route if necessary, considering the dynamic environment upon which it will perform.