Tutorial 1 - Solutions

We have discussed various AI techniques such as expert systems, neural networks, amongst others. For each of the following state which AI technique or combination of AI techniques will be the most appropriate to solve the problem. Substantiate your choice in each case:

1. Develop a program that identifies South African bird species. The program must take in characteristics of the bird identified, e.g. colour of feathers, and output the species of the bird (3 marks).

   Sol: *The problem can be solved using an Expert System (2) emulating a South African bird ornithologist. The system input requires very specific bird species characteristics which only an expert would know hence the justification on the application of an expert system. The system will use the characteristics which are specific domain knowledge and cannot be generalised from and thus requires deductive reasoning to arrive at conclusions(1).*

2. Develop a program that recognises musical symbols that have been scanned in from a hand-written music sheet. This program will form a component of a system to convert hand-written musical sheets to digital form (3 marks).

   Sol: *A possible solution to this problem is an expert system (2) as it would require an expert in who is able to decipher the meaning of musical symbols(1). Hence domain knowledge is a requirement.*

3. Develop an intelligent computer technician tutor component which generates solutions to problems presented to students. There are two types of questions that students are tested on. The first is of a diagnostic nature, given a particular scenario regarding a computer problem, the student must explain in detail how the problem can be solved. The second type of problem requires the student to produce an algorithm in a programming language to perform a particular task, given a programming problem specification. (4 marks).

   Sol: *The system should be able to emulate the functionality of a tutor hence an intelligent tutoring system(2) would be required which could be hybrid with an experts system(2) as concrete knowledge would be required from the area of being a computer technician. Thus Human modelling.*

4. Develop a program that recognizes different species of flowers that are scanned in from photographs of the flowers. For each photograph the system must output the type of the flower, e.g. rose, azalea. (3 marks).

   Sol *Any system that is able to perform classification (1) should be suitable for this task. Examples of these are decision trees or Neural networks (2)*

5. Develop a program for Malware detection. Malware detection involves determining whether a piece of software (submitted as a file) is malicious or not. The program will firstly be trained using a training set. The training set will contain software and an indication whether the software is malicious or not. The program must learn from this training set and be able to predict whether new software presented to the system is malicious or not. (3 marks).

   Sol *The requirement here is also a system that is able to perform classification as it should be able to classify any form of software as normal or malicious based on learned patterns from training data. The training data will present patterns which the system should be then be able to identify on unseen data.(1) Neural networks are good at learning patterns, aswell as evolutionary algorithms. (2)*

6. Develop a program for a logistics company that works out a schedule for deliveries for each of the drivers. The program will be used on a hand-held device. This company services the entire country and each driver works in a particular region. Each schedule derived by the program should specify stay-overs and minimize the amount of time the drive spends on the road. The program should also provide a route finding facility that helps the driver plan out the route that will be taken. (4 marks).

   Sol *This is a planning and scheduling problem that requires tools capable of applied in planning.(1) Because of the multiple paths that may be available the solution requires systems that are able to work with estimates in optimising a solution such as evolutionary algorithms (2). Inductive learning is applied as the system is likely to improve as it is applied it will learn.(1)*

7. For each of the following determine as required. (7 marks)

   i) The left-handed golfers I know use left-handed golf clubs. Therefore all left-handed golfers use left-handed golf clubs. **Inductive**.

   ii) Simba is a free range lion. Simba is happy. All free range lions are happy. **Inductive**.

iii) Simba is a free range lion. All free range lions are happy. Therefore Simba is happy. **Deductive**.

iv) All of our rain comes from the north. Its raining now. The rain came from the north. **Deductive**..

v) Most of our rain comes from the north. Its raining now. The rain must have come from the north. **Inductive**.

vi) All kids like ice-cream. Anele likes milkshakes. Anele is not a kid. **Invalid**

vii) All actors are handsome. Johannes is handsome. Johannes is an actor. **Invalid**

8. Given that a robot that has been built to climb an artificial tree has 2 sensors. A sensor that detects the brightness level at the current branch and a sensor that detects if the current branch is the branch where a bag of gold is hung on. The brightness level of a branch is related to the proximity of the bag of gold as follows: Branches having a distance of 3 steps or less from the bag of gold have a brightness level of 5. All other branches have a brightness level of 0.

Given the above scenario, is the environment: (4 marks)

a) static or dynamic ? **Static**

b) deterministic or non-deterministic ? **deterministic**

c) discrete or continuous ? **discrete**

d) observable or partially-observable ? **partially-observable**