TU Wien:Einführung in die Künstliche Intelligenz VU (Eiter, Tompits)/Prüfung 2012-10-02 Ausarbeitung

< TU Wien:Einführung in die Künstliche Intelligenz VU (Eiter, Tompits)

Fragen übernommen aus dem Informatik-Forum (http://www.informatik-forum.at/showthread.php?95401-After-test-2012-10-02).

Contents

Planning

Write a STRIPS action

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Drive(car, from, to)
PRECOND (at(car, from), car(car), Location(from), location(to))
EFFECT (at(car, to), not at(car, from))
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What is a consistent plan? What is a solution?

A consistent plan is: A plan with **no cycles in the ordering constraints** and **no conflicts with the causal links**

A solution is: A consistent plan with no open preconditions

Describe the two possible ways in state space search

- progression planning (forward state-space search) - from initial state to goal
- regression planning (backward state-space search) - from goal to initial state

Multiple choice ADL/STRIPS

- Does ADL allow equality? - Yes
- Does STRIPS allow Conjunctions in goals? - Yes, but no disjunction.

Given a Lottery L, ...

A expected monetary value EMV(L) and Utility Function U(L), a risk-averse agent would

- prefere U(L) > U(S(EMV(L))
- prefere U(L) < U(S(EMV(L))

where S(EMV(L)) is the state of having money EMV(L).

Describe 3 Axioms of Utility theory: Orderability, Continuity and Monotonicity

- **Orderability:** Given any two lotteries, a rational agent cannot avoid deciding which one it prefers, or whether it is indifferent between them.
  - Exactly one of $(A \prec B), (B \prec A), (A \sim B)$ holds.
- **Continuity:** If some lottery B is between A and C in preference, then:
  - there is some probability p for which the agent will be indifferent between getting B for sure and the lottery that yields A with probability p and C with probability $1 - p$.
    - $A \prec B \prec C \Rightarrow \exists p [p, A; 1 - p, C] \sim B$
- **Monotonicity:** Suppose two lotteries have the same possible outcomes A and B.
  - If an agent prefers A to B, then the agent must prefer precisely the lottery that has a higher probability for outcome A.
  - $A \prec B \Rightarrow (p < q \Leftrightarrow [p, A; 1 - p, B] \prec [q, A; 1 - q, B])$

Describe the components of a decision network

- **Chance nodes (ovals):** represent random variables.
  - E.g., the agent is uncertain about construction costs, the level of air traffic, the potential for litigation.
  - There are also the Deaths, Noise, and Cost variables, depending on the site chosen.
  - Chance nodes are associated with a conditional probability distribution that is indexed by the state of parent nodes.
- **Decision nodes (rectangles):** represent points where decision maker has a choice of actions; e.g., the choice of an airport site influences the cost, noise, etc.

- **Utility nodes (diamonds):** represent the agent's utility function.
  - It has as parents all variables describing the outcome that directly affect utility.

Searches

a small tree is given. Give the order in that nodes are expanded for all 5 uninformed search algorithms (5 points)

Given admissible heuristics (h1, h2,... hn). Which possible (new) heuristic is best?

Admissible heuristics have a problem with graph search. Which? How can this be changed?

Even if h is admissible, A*-Search can reach goals in graph search with non optimal costs. To fix this problem we can change the algorithm and add complicated bookkeeping (might ruin run time) or impose a stronger restriction on h: consistence (f-value is non-decreasing on every path)

Learning from Observation

What is inductive learning?

Given a training set (x1, y1) ... (xn, yn) of examples find a function h that approximates f. h is then called hypothesis and must be from a restricted class of functions (hypothesis space). If h = f is possible then the learning problem is realizable. Consider Ockham's razor when creating this function "maximise simplicity under consistency"

What is a learning curve? Which correlation is described by it? Which two circumstances have negative effect on the learning curve?

% correct on test set as a function of training set size (x-axis: size of training set, y-axis: % correct on test set) Describes correlation between test set size and % of correct outcomes Depends on realizability (non realizable through missing attributes or too restrictive hypothesis space) and redundant expressiveness (due to loads of irrelevant attributes)

Describe a learning agent + diagram

learning element: make improvements

performance element: select external actions

critic: performance, result assessment

problem generator: suggest actions for new experiences

Construct a neural network that represents a half adder: two inputs (I1, I2), two outputs (C = I1 & I2, S = I1 xor I2)

Advantages & Disadvantages of neural networks (or learning by observation)

PROs

- less need for determining relevant input factors
- inherent parallelism
- easier to develop than statistical methods
- capability to learn and improve
- good for complex pattern recognition tasks
- usable for unstructured and difficult input (like images)
- fault tolerance

CONs

- choice of parameters (layers, units) requires skill
- requires sufficient training material
- resulting hypothesis cannot be understood easily
- knowledge implicit (subsymbolic representation)
- verification, behaviour prediction difficult
