Assignment 5: MEDIA ADVISOR Expert System using PROLOG/CLISP

Concept of Media Advisor

A decision-support system called MEDIA ADVISOR provides advice on selecting a medium for delivering a training program based on the trainee's job. For example, if a trainee is a mechanical technician responsible for maintaining hydraulic systems, an appropriate medium might be a workshop, where the trainee could learn how basic hydraulic components operate, how to troubleshoot hydraulics problems and how to make simple repairs to hydraulic systems. On the other hand, if a trainee is a clerk assessing insurance applications, a training program might include lectures on specific problems of the task, as well as tutorials where the trainee could evaluate real applications. For complex tasks, where trainees are likely to make mistakes, a training program should also include feedback on the trainee's performance.

Knowledge base

Rule: 1

if   the environment is papers

or   the environment is manuals

or   the environment is documents

or   the environment is textbooks

then   the stimulus_situation is verbal

Rule: 2

if   the environment is pictures

or   the environment is illustrations

or   the environment is photographs

or   the environment is diagrams

then   the stimulus_situation is visual

Rule: 3

if   the environment is machines

or   the environment is buildings

or   the environment is tools

then   the stimulus_situation is 'physical object'

Rule: 4

if   the environment is numbers

or   the environment is formulas

or   the environment is 'computer programs'

then   the stimulus_situation is symbolic

Knowledge base

Rule: 5
if   the job is lecturing
or   the job is advising
or   the job is counselling
then   the stimulus_response is oral

Rule: 6
if   the job is building
or   the job is repairing
or   the job is troubleshooting
then   the stimulus_response is 'hands-on'

Rule: 7
if   the job is writing
or   the job is typing
or   the job is drawing
then   the stimulus_response is documented

Rule: 8
if   the job is evaluating
or   the job is reasoning
or   the job is investigating
then   the stimulus_response is analytical

Rule: 9
if   the stimulus_situation is 'physical object'
and   the stimulus_response is 'hands-on'
and   feedback is required
then   medium is workshop

Rule: 10
if   the stimulus_situation is symbolic
and   the stimulus_response is analytical
and   feedback is required
then   medium is 'lecture – tutorial'

Rule: 11
if   the stimulus_situation is visual
and   the stimulus_response is documented
and   feedback is not required
then   medium is videocassette

Rule: 12
if   the stimulus_situation is visual
and   the stimulus_response is oral
and   feedback is required
then   medium is 'lecture – tutorial'

Knowledge base

Rule: 13
if   the stimulus_situation is verbal
and   the stimulus_response is analytical
and   feedback is required
then medium is 'lecture – tutorial'

Rule: 14
if   the stimulus_situation is verbal
and   the stimulus_response is oral
and   feedback is required
then medium is 'role-play exercises'

/* The SEEK directive sets up the goal of the rule set

seek medium

All facts are placed in the database

Object	Allowed values	Object	Allowed values
environment	papers	job	lecturing
	manuals		advising
	documents		counselling
	textbooks		building
	pictures		repairing
	illustrations		troubleshooting
	photographs		writing
	diagrams		typing
	machines		drawing
	buildings		evaluating
	tools		reasoning
	numbers		investigating
	formulas		
	computer programs	stimulus_ response	oral
			hands-on
			documented
			analytical
stimulus_situation	verbal		
	visual		
	physical object	feedback	required
	symbolic		not required

Goal

- The final goal of the rule-based expert system is to produce a solution to the problem based on input data. In MEDIA ADVISOR, the solution is a medium selected from the list of four options:

medium is workshop
medium is 'lecture – tutorial'
medium is videocassette
medium is 'role-play exercises'

Dialogue

- In the dialogue shown below, the expert system asks the user to input the data Needed to solve the problem (the environment, the job and feedback). Based on the answers supplied by the user (answers are indicated by arrows), the expert system applies rules from its knowledge base to infer that the stimulus_situation is physical object, and the stimulus_response is hands-on. Rule 9 then selects one of the allowed values of medium.

What sort of environment is a trainee dealing with on the job?
⇒ **machines**

Rule: 3
if   the environment is machines
or   the environment is buildings
or   the environment is tools
then the stimulus_situation is 'physical object'

In what way is a trainee expected to act or respond on the job?
⇒ **repairing**

Rule: 6
if   the job is building
or   the job is repairing
or   the job is troubleshooting
then the stimulus_response is 'hands-on'

Is feedback on the trainee's progress required during training?
⇒ **required**

Rule: 9

if   the stimulus_situation is 'physical object'
and   the stimulus_response is 'hands-on'
and   feedback is required
then   medium is workshop

medium is workshop

Inference techniques

- The standard inference technique in Leonardo is backward chaining with opportunistic forward chaining, which is the most efficient way to deal with the available information. However, Leonardo also enables the user to turn off either backward or forward chaining, and thus allows us to study each inference technique separately. Forward chaining is data-driven reasoning, so we need first to provide some data. Assume that

Forward Chaining

the environment is **machines**

        '**environment**' instantiated by user input to '**machines**'

the job is **repairing**

        '**job**' instantiated by user input to '**repairing**'

feedback is **required**

        '**feedback**' instantiated by user input to '**required**'

The following process will then happen:

Rule: 3 fires   '**stimulus_situation**' instantiated by Rule: 3 to '**physical object**'
Rule: 6 fires   '**stimulus_response**' instantiated by Rule: 6 to '**hands-on**'
Rule: 9 fires   '**medium**' instantiated by Rule: 9 to '**workshop**'
No rules fire   stop

Backward chaining

'medium' is 'workshop'

Pass 1
Trying Rule: 9   Need to find object '**stimulus_situation**'
Rule: 9 stacked   Object '**stimulus_situation**' sought as '**physical object**'

Pass 2
Trying Rule: 3   Need to find object '**environment**'
Rule: 3 stacked   Object '**environment**' sought as '**machines**'

ask environment
⇒**machines**   '**environment**' instantiated by user input to '**machines**'

Trying Rule: 3   '**stimulus_situation**' instantiated by Rule: 3 to '**physical object**'

Pass 3
Trying Rule: 9   Need to find object '**stimulus_response**'
Rule: 9 stacked   Object '**stimulus_response**' sought as '**hands-on**'

Backward chaining

Pass 4
Trying Rule: 6   Need to find object 'job'
Rule: 6 stacked   Object 'job' sought as 'building'

ask job
⇒ **repairing**   'job' instantiated by user input to 'repairing'

Trying Rule: 6   'stimulus_response' instantiated by Rule: 6 to
                                'hands-on'

Pass 5
Trying Rule: 9   Need to find object 'feedback'
Rule: 9 stacked   Object 'feedback' sought as 'required'

ask feedback
⇒ **required**   'feedback' instantiated by user input to 'required'

Trying Rule: 9   'medium' instantiated by Rule: 9 to 'workshop'

medium is workshop

Tree diagram for the rule-based expert system MEDIA ADVISOR