

CSE140: Introduction to Intelligent Systems

Quiz 2

All questions are mandatory and you have 60 minutes to submit your solution sheet.

1. What is the difference between Rules and IF-conditions? 1 Point

Rules have a derived conclusion, a logically derived fact (or state) while If-Else is just a condition evaluator

2. Given the statements below express using forward and backward chaining 2 Points
If a person is running, he will sweat. Tom is running. Tom is sweating

3. What is difference between Learning and Reasoning in context of AI 2 Points

Human-like common sense is discussed in machine reasoning, where concepts and ideas are encoded as symbols in a computer network. Then logic or rules are employed to integrate those symbols to arrive at a conclusion. Reasoning Machines, train on and learn from available data, like Learning systems, but can tackle new problems with a deductive and inductive reasoning approach e.g., manipulating previously acquired knowledge in order to answer a new question. Learning is best characterized as the application of advanced statistical methods to uncover subtle patterns in very big data sets. If there are few or no structured inputs to extract patterns, Learning systems can't solve a new problem that has no apparent relation to its prior knowledge.

4. What is the difference between inductive and deductive reasoning 1 Point

Deductive reasoning, is making an inference based on widely accepted facts or premises. If a beverage is defined as “drinkable through a straw” one could use deduction to determine soup to be a beverage. Inductive reasoning, or induction, is making an inference based on an observation, often of a sample. You can induce that the soup is tasty if you observe all of your friends consuming it. Abductive reasoning, or abduction, is making a probable conclusion from what you know. If you see an abandoned bowl of hot soup on the table, you can use abduction to conclude the owner of the soup is likely to returning soon or has left the restaurant. Inductive reasoning is a bottom-up approach, while deductive reasoning is top-down.

5. Can you use logistic regression for classification between more than two classes? If Yes How? If No Why? 2 Points

Yes, by using one-vs-rest classification paradigm

6. Compare Mean absolute error (MAE) and Mean squared error (MSE) loss in context of linear regression 2 Points

MSE is more sensitive to outliers. If our model makes a single very bad prediction, the squaring part of the function magnifies the error. Unlike MSE, MAE fails to punish large errors in prediction. The large errors coming from the outliers end up being weighted the exact same as lower errors. Both MAE and MSE are positive losses and are differentiable except for when $y_{\text{pred}}=y_{\text{true}}$ in case of MAE

7. Consider the rule base

5 Points

Rule 1: $\text{Temp} < 20 \wedge \text{humidity in air} \rightarrow \text{There are changes of rain}$

Rule 2: $\text{Sun behind the clouds} \wedge \text{Air is cold} \rightarrow \text{Temp} < 20$

Rule 3: $\text{Air is heavy} \rightarrow \text{humidity in air}$

Given the facts: 1) Sun is behind the clouds. 2) Air is heavy and cold. Use forward and backward chaining (show step by step) to conclude that there are chances of rain.

8. Which Statements are True and Why

- (a) If the facts that you have or may establish may lead to a large number of conclusions, but the number of ways to reach the particular conclusion in which you are interested is small, and you should typically use forward chaining.
- (b) If you have not yet gathered any facts, and you are interested in only whether one of many possible conclusions is true, use forward chaining.
- (c) The backward chainer tries rules in the order they appear in the database of rules
- (d) Case based reasoning is inexact and brittle

4 Points

NO, NO, Yes, NO

9. We studied OLS for Regression in class! Why is it called ordinary least squares regression? 1 Point

It is equivalent to minimizing the L2 norm, $\|Y - f(X)\|_2$. It is ordinary because it was the first ever statistical procedure to be developed and the word ordinary helps differentiate it from more advanced methods.

Forward Chaining

First Pass

Rule, premise	Status	Working Memory
1, 1 we suspect temperature is less than 20°	Unknown	a) Sun is behind the clouds. b) Air is very heavy and cool.
1, 2 there is humidity in the air	Unknown	a) Sun is behind the clouds. b) Air is very heavy and cool.
2, 1 Sun is behind the clouds	True	a) Sun is behind the clouds. b) Air is very heavy and cool.
2,2 air is very cool.	True, fire rule	a) Sun is behind the clouds. b) Air is very heavy and cool. c) We suspect temperature is less than 20°

Second Pass

Rule, premise	Status	Working Memory
1, 1 we suspect temperature is less than 20°	True	a) Sun is behind the clouds. b) Air is very heavy and cool. c) We suspect temperature is less than 20°
1, 2 there is humidity in the air	Unknown	a) Sun is behind the clouds. b) Air is very heavy and cool. c) We suspect temperature is less than 20°
3, 1 air is very heavy	True, fire rule	a) Sun is behind the clouds. b) Air is very heavy and cool. c) We suspect temperature is less than 20° d) there is humidity in the air

Third Pass

+
1

Rule, premise	Status	Working Memory
1, 1 we suspect temperature is less than 20°	True	<ul style="list-style-type: none"> a) Sun is behind the clouds. b) Air is very heavy and cool. c) We suspect temperature is less than 20° d) there is humidity in the air
1, 2 there is humidity in the air	True, fire rule	<ul style="list-style-type: none"> a) Sun is behind the clouds. b) Air is very heavy and cool. c) We suspect temperature is less than 20° d) there is humidity in the air e) there are chances of rain

So we have deduced there are chances of rain.

Backward Chaining

Step	Description	Working Memory
1	Goal "There are chances of rain." Not in Working Memory.	
2	Find rules with our goal "There are chances of rain" in conclusion: It is in Rule 1.	
3	Now see if Rule 1, premise 1 is known "we suspect temperature is less than 20°".	
4	This is conclusion of rule 2. So going to Rule 2. The premise 1 of rule 2 is "Sun is behind the clouds".	
5	This is primitive. We ask from user Response: Yes	Sun is behind the clouds.

6	See if Rule 2, premise 2 is known “Air is very cool”.	
7	This is also primitive. We ask its Response: Yes. Both conditions of Rule 2 are met so Fire rule 2	Sun is behind the clouds. Air is very cool. We suspect temperature is less than 20⁰.
8	So Rule 1 premise 1 is in working memory, coming to Rule 1, premise 2 “There is humidity in the air”	Sun is behind the clouds. Air is very cool. We suspect temperature is less than 20⁰.
9	This is conclusion of Rule 3. So see if Rule 3, premise 1 is known “Air is very heavy”.	Sun is behind the clouds. Air is very cool. We suspect temperature is less than 20⁰.

10	This is primitive so asking from user Response: Yes. Fire rule	Sun is behind the clouds. Air is very cool. We suspect temperature is less than 20 ⁰ . There is humidity in the air.
11	Now Rule 1 premise 1 and 2 both are in working memory so fire Rule 1.	Sun is behind the clouds. Air is very cool. Air is very heavy. We suspect temperature is less than 20 ⁰ . There is humidity in the air. There are chances of rain.