



(Subjective-CS607 ARTIFICIAL INTELLIGENCE)
(From Final Term Papers “No repeated Questions”) June 2014

What is hypothesis space?

Answer:-

The hypothesis space used by a machine learning system is the set of all hypotheses that might possibly be returned by it. It is typically defined by a hypothesis language, possibly in conjunction with a language bias.

2. What is machine learning?

Answer:- (Page 160)

Generally speaking, the goal of machine learning is to build computer systems that can learn from their experience and adapt to their environments. Obviously, learning is an important aspect or component of intelligence.

3. What is a strip?

Answer:- (Page 197)

STRIP is one of the founding languages developed particularly for planning. Let us understand planning to a better level by seeing what a planning language can represent.

4. What is differing between height and depth of a tree?

Answer:- [click here for details](#)

Height and depth of a tree is equal but height and depth of a node is not equal because the height is calculated by traversing from leaf to the given node depth is calculated from traversal from root to the given node.

2. What do you know about Mamdani’s fuzzy inference method?

Answer:- (Page 153)

Mamdani's fuzzy inference method is the most commonly seen fuzzy methodology. Mamdani's method as among the first control systems built using fuzzy set theory. It was proposed in 1975 by Ebrahim Mamdani as an attempt to control a steam engine and boiler combination by synthesizing a set of linguistic control rules obtained from experienced human operators. Mamdani's effort was based on Lotfi Zadeh's 1973 paper on fuzzy algorithms for complex systems and decision processes.



What is the basic key of candidate elimination algorithm?

Answer:- (Page 173)

The key idea in Candidate-Elimination algorithm is to output a description of the set of all hypotheses consistent with the training examples. This subset of all hypotheses is actually the version space with respect to the hypothesis space H and the training examples D , because it contains all possible versions of the target concept.

Predicate action?

Answer:- (Page 198)

Action is a predicate used to change states. It has three components namely, the predicate itself, the precondition, and post-condition predicates. For example, the action to buy something item can be represented as,

Action:

buy(X)

Pre-conditions:

at(Place) \wedge sells(Place, X)

Post-conditions/Effect:

have(X)

Differ between supervised and unsupervised learning? 5 marks

Answer:-

Unsupervised Learning

- The model is not provided with the correct results during the training.
- Can be used to cluster the input data in classes on the basis of their statistical properties only.
- Cluster significance and labeling.
- The labeling can be carried out even if the labels are only available for a small number of objects representative of the desired classes.



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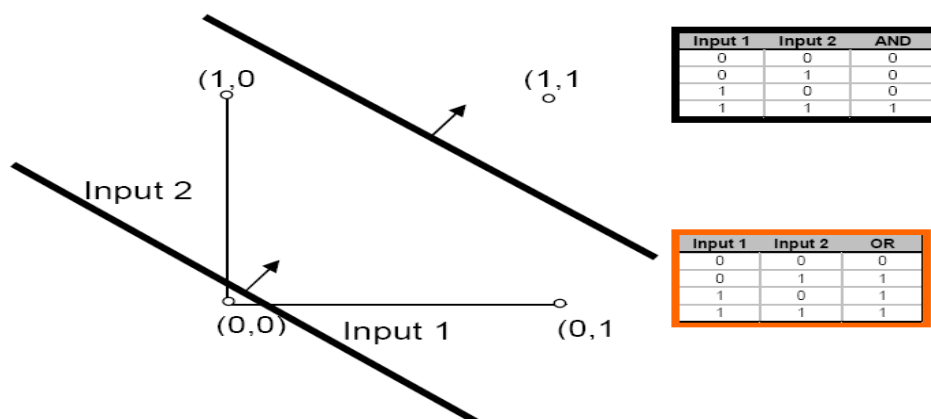
Supervised Learning

- Training data includes both the input and the desired results.
- For some examples the correct results (targets) are known and are given in input to the model during the learning process.
- The construction of a proper training, validation and test set (Bok) is crucial.
- These methods are usually fast and accurate.
- Have to be able to generalize: give the correct results when new data are given in input without knowing a priori the target.

What are the linear separable line and non linear separable line?5

Answer:- (Page 184)

There is a whole class of problems which are termed as linearly separable. This name is given to them, because if we were to represent them in the input space, we could classify them using a straight line. The simplest examples are the logical AND or OR. We have drawn them in their input spaces, as this is a simple 2D problem. The upper sloping line in the diagram shows the decision boundary for AND gate, above which, the output is 1, below is 0. The lower sloping line decides for the OR gate similarly.

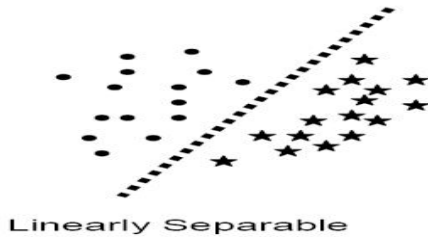


A single perception simply draws a line, which is a hyper plane when the data is more than 2 dimensional. Sometimes there are complex problems (as is the case in real life). The data for these problems cannot be separated into their respective classes by using a single straight line. These

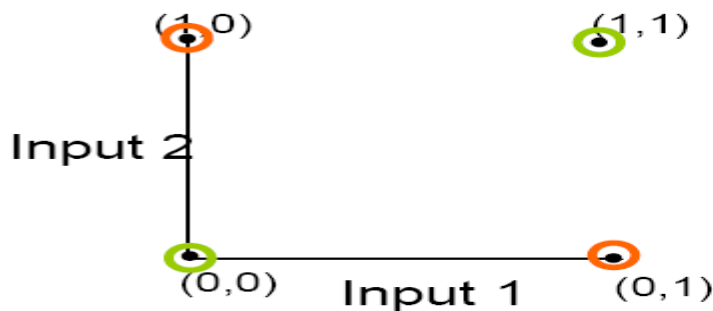


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problems are not linearly separable.



Another example of linearly non-separable problems is the XOR gate (exclusive OR). This shows how such a small data of just 4 rows, can make it impossible to draw one line decision boundary, which can separate the 1s from 0s.



Input 1	Input 2	Output
0	0	1
0	1	0
1	0	0
1	1	1

Generic Algorithms?

Answer:- (Page 77)

The genetic algorithm technology comes from the concept of human evolution. Genetic Algorithms is a search method in which multiple search paths are followed in parallel. At each step, current states of different pairs of these paths are combined to form new paths. This way the search paths don't remain independent, instead they share information with each other and thus try to improve the overall performance of the complete search space.

Write different knowledge Acquisition techniques.

Answer:- (Page 184)

- Knowledge elicitation by interview



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- Brainstorming session with one or more experts. Try to introduce some structure to this session by defining the problem at hand, prompting for ideas and looking for converging lines of thought.
- Electronic brainstorming
- On-site observation
- Documented organizational expertise, e.g. troubleshooting manuals

Out of different general components of and AI cycle which two components are best closed coupled.

Answer:- (Page 89)

Knowledge representation (KR) and reasoning are closely coupled components; each is intrinsically tied to the other.

How can you elaborate the condition predicate in STRIPS.

Answer:- (Page 197)

Condition predicates are the predicates that define states. For example, a predicate that specifies that we are at location „X“ is given as.

at(X)

Define deductive learning.

Answer:- (Page 162)

Deductive learning works on existing facts and knowledge and deduces new knowledge from the old. This is best illustrated by giving an example. For example, assume:

A = B

B = C

Then we can deduce with much confidence that:

C = A



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Difference between fuzzy logic and Crisp value.

Answer:- [click here for details](#)

The input variables in a fuzzy control system are in general mapped by sets of membership functions similar to this, known as "fuzzy sets". The process of converting a crisp input value to a fuzzy value is called

"fuzzification".

How does neural network resemble the human brain?

Answer:- (Page 187)

It resembles the brain in two respects:

- Knowledge is acquired by the network through a learning process (called training)
- Interneuron connection strengths known as synaptic weights are used to store the knowledge

Write down fuzzy statement in everyday life.

Answer:-

Fuzziness can be found in many areas of daily life, such as in engineering, medicine, meteorology, manufacturing and others. It is particularly frequent in all areas in which human judgment, evaluation and decision are important. These are the areas of decision making, reasoning, and learning and so on.

Write down the task/application for which "connectionist" approach is well suited? 5

Answer:- (Page 181)

Tasks for which connectionist approach is well suited include:

- Classification
- Fruits - Apple or orange
- Pattern Recognition
- Finger print, Face recognition



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- Prediction
- Stock market analysis, weather forecast

How can you elaborate the conflict resolution strategies?

Answer:- (Page 125)

To overcome the conflict problem stated above, we may choose to use on of the following conflict resolution strategies:

- Fire first rule in sequence (rule ordering in list). Using this strategy all the rules in the list are ordered (the ordering imposes prioritization). When more than one rule matches, we simply fire the first in the sequence
- Assign rule priorities (rule ordering by importance). Using this approach we assign explicit priorities to rules to allow conflict resolution.
- More specific rules (more premises) are preferred over general rules. This strategy is based on the observation that a rule with more premises, in a sense, more evidence or votes from its premises, therefore it should be fired in preference to a rule that has less premises.
- Prefer rules whose premises were added more recently to WM (timestamping). This allows prioritizing recently added facts over older facts.
- Parallel Strategy (view-points). Using this strategy, we do not actually resolve the conflict by selecting one rule to fire. Instead, we branch out our execution into a tree, with each branch operation in parallel on multiple threads of reasoning. This allows us to maintain multiple view-points on the argument concurrently

What is Mean Squared error? 2 marks

Answer:- (Page 189)

The most common technique for measuring the total error in each iteration of the neural network (epoch) is Mean Squared Error (MSE).



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What is state in STRIP? Give Example? 2 marks

Answer:- (Page 197)

State is a conjunction of predicates represented in well-known form, for example, a state where we are at the hotel and do not have either cash or radio is represented as,

at(hotel) \wedge \neg have(cash) \wedge \neg have(radio)

Five parts of fuzzy inference process? 5 marks

Answer:- (Page 154)

- Fuzzification of the input variables
- Application of fuzzy operator in the antecedent (premises)
- Implication from antecedent to consequent
- Aggregation of consequents across the rules
- Defuzzification of output

Find S, candidate elimination and decision tree representation, from these algorithms which algorithm is best? 5 marks

Answer:- (Page 172)

FIND-S finds the maximally specific hypothesis possible within the version space given a set of training data. How can we use the general to specific ordering of hypothesis space to organize the search for a hypothesis consistent with the observed training examples? One way is to begin with the most specific possible hypothesis in H, then generalize the hypothesis each time it fails to cover an observed positive training example. (We say that a hypothesis “covers” a positive example if it correctly classifies the example as positive.)

The key idea in Candidate-Elimination algorithm is to output a description of the set of all hypotheses consistent with the training examples. This subset of all hypotheses is actually the version space with respect to the hypothesis space H and the training examples D, because it contains all possible versions of the target concept.



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The Candidate-Elimination algorithm represents the version space by storing only its most general members (denoted by G) and its most specific members (denoted by S). Given only these two sets S and G, it is possible to enumerate all members of the version space as needed by generating the hypotheses that lie between these two sets in general-to-specific partial ordering over hypotheses.

Decision trees give us disjunctions of conjunctions, that is, they have the form: (A AND B) OR (C AND D)

Where A, B, C and D are the attributes for the problem. This tree gives a positive output if either A AND B attributes are present in the instance; OR C AND D attributes are present. Through decision trees, this is how we reach the final hypothesis. This is a hypothetical tree. In real problems, every tree has to have a root node. There are various algorithms like ID3 and C4.5 to find decision trees for learning problems.

What is usage of math and biology in AI? 2marks

Answer:- (Page 9)

From over 400 years of mathematics we have formal theories of logic, probability, decision-making and computation.

From biology we have information about the network structure of a human brain and all the theories on functionalities of different human organs.

What is validation and training? 2 Marks

Answer:- (Page 160)

Training: a training set of examples of correct behavior is analyzed and some representation of the newly learnt knowledge is stored. This is often some form of rules.

Validation: the rules are checked and, if necessary, additional training is given. Sometimes additional test data are used, but instead of using a human to validate the rules, some other automatic knowledge based component may be used. The role of tester is often called the critic.



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Steps of ESDLC? 5 Marks.

Answer:- (Page 129)

- Feasibility study
- Rapid prototyping
- Alpha system (in-house verification)
- Beta system (tested by users)
- Maintenance and evolution

Steps of back ward chaining? 5 Marks.

Answer:- (Page 126)

1. Start with the goal.
2. Goal may be in WM initially, so check and you are done if found!
3. If not, then search for goal in the THEN part of the rules (match conclusions, rather than premises). This type of rule is called goal rule.
4. Check to see if the goal rule's premises are listed in the working memory.
5. Premises not listed become sub-goals to prove.
6. Process continues in a recursive fashion until a premise is found that is not supported by a rule, i.e. a premise is called a primitive, if it cannot be concluded by any rule
7. When a primitive is found, ask user for information about it. Back track and use this information to prove sub-goals and subsequently the goal.

Advantages of neural network

Answer:- (Page 187)

- Excellent for pattern recognition
- Excellent classifiers



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- Handles noisy data well
- Good for generalization

What is the difference between knowledge analysis and evaluation function ?

Answer:- (Page 79 & 131)

An evaluation function is the criteria that check various individuals/ solutions for being better than others in the population. Notice that mutation can be as simple as just flipping a bit at random or any number of bits. The goal of knowledge analysis is to analyze and structure the knowledge gained during the knowledge acquisition phase.

4- Steps of knowledge elicitation

Answer:- [click here for details](#)

- ❑ Divide and conquer.
- ❑ Configuration of an adequate model set for a specific application.
- ❑ Models evolve through well defined states.
- ❑ The model set supports project management.
- ❑ Model development is driven by project objectives and risk.
- ❑ Models can be developed in parallel.

FIS applications

Answer:- (Page 153)

Fuzzy inference system (FIS) is the process of formulating the mapping from a given input to an output using fuzzy logic. This mapping then provides a basis from which decisions can be made, or patterns discerned

Fuzzy inference systems have been successfully applied in fields such as automatic control, data classification, decision analysis, expert systems, and computer vision. Because of its multidisciplinary nature, fuzzy inference systems are associated with a number of names, such as fuzzy-rule-based systems, fuzzy expert systems, fuzzy modeling, fuzzy associative memory, fuzzy



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logic controllers, and simply (and ambiguously !!) fuzzy systems. Since the terms used to describe the various parts of the fuzzy inference process are far from standard, we will try to be as clear as possible about the different terms introduced in this section.

CNF conversion

Answer:- (Page 107)

Resolution requires all sentences to be converted into a special form called conjunctive normal form (CNF). A statement in conjunctive normal form (CNF) consists of ANDs of Ors.

What is the prime role of expert system designer? 2 marks

Answer:- (Page 117)

One of the prime roles of the expert system designer is to act as a knowledge engineer. As a knowledge engineer, the designer must overcome the knowledge acquisition bottleneck and find an effective way to get information from the expert and encode it in the knowledge base, using one of the knowledge representation techniques we discussed in KRR.

What is inductive learning? 2 marks

Answer:- (Page 162)

Inductive learning takes examples and generalizes rather than starting with existing knowledge. For example, having seen many cats, all of which have tails, one might conclude that all cats have tails.

Among Entropy and information gain which is the best to measure effectiveness? 2 marks

Answer:- (Page 177)

Information gain

Why clustering algorithm are categorized as unsupervised? 2 marks

Answer:- (Page 190)



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- A cluster represents some specific underlying patterns in the data
- Useful for finding patterns in large data sets

Among Mutation, crossover and combination of both which is the best strategy to get our desired result sets?

Answer:- (Page 82)

The best technique in general turns out to be a combination of both, i.e., crossover with mutation.

Which term is best suited for a function that is used specially to drive out the degree of truth in fuzzy sets? Write its two characteristics. 3 marks

Answer:- (Page 149)

The degree of truth that we have been talking about, is specifically driven out by a function called the membership function.

Some characteristics of the membership functions are:

- It is represented by the Greek symbol μ
- Truth values range between 0.0 and 1.0
- o Where 0.0 normally represents absolute falseness 0 And 1.0 represent absolute truth

What is Clustering? 3 marks

Answer:- (Page 205)

Clustering is a form of unsupervised learning, in which the training data is available but without the classification information or class labels. The task of clustering is to identify and group similar individual data elements based on some measure of similarity.

Does Alpha Beta pruning evaluate each and every node in the tree? 5 marks

Answer:- (Page 64)



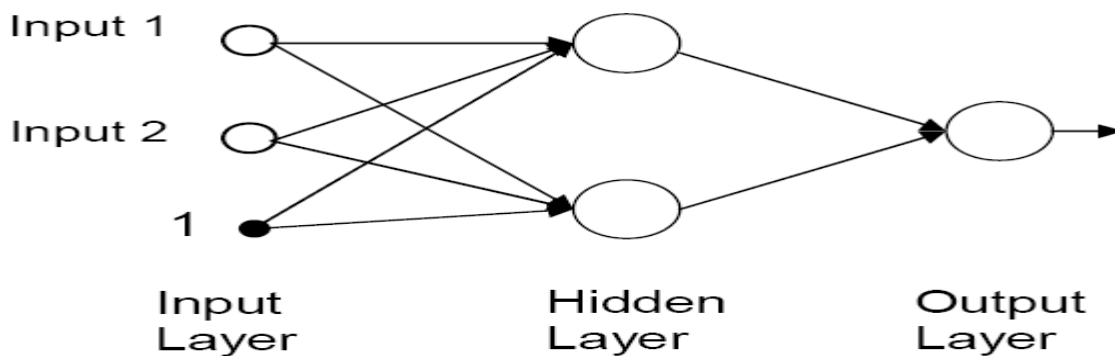
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All nodes/situations have not yet been previously evaluated for their static evaluation score. Only two leaf nodes have been evaluated so far. It is a procedure that reduces both the tree branches that must be generated and the number of evaluations. This procedure is called Alpha Beta pruning which “prunes” the tree branches thus reducing the number of static evaluations.

In a situation we have four neurons in a hidden layer then how many lines should we draw in order to classify the data in a linearly non separable problem? 5 marks

Answer:- (Page 64)

Multiple layer perceptrons achieve this task by the introduction of one or more hidden layers. Each neuron in the hidden layer is responsible for a different line. Together they form a classification for the given problem.



Each neuron in the hidden layer forms a different decision line. Together all the lines can construct any arbitrary non-linear decision boundaries. These multilayer perceptrons are the most basic artificial neural networks.

Define vision space. 2 marks

Answer:- (Page 170)

Version space is a set of all the hypotheses that are consistent with all the training examples. When we are given a set of training examples D , it is possible that there might be more than one hypotheses from the hypothesis space that are consistent with all the training examples.

How expert system work 3 marks

Answer:- (Page 114)



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Expert systems may be used in a host of application areas including diagnosis, interpretation, prescription, design, planning, control, instruction, prediction and simulation.

How to lead machine learning in developing the expert system 5 marks

Answer:- (Page 163)

Many AI applications are built with rich domain knowledge and hence do not make use of machine learning. To build such expert systems, it is critical to capture knowledge from experts. However, the fundamental problem remains unresolved, in the sense that things that are normally implicit inside the expert's head must be made explicit. This is not always easy as the experts may find it hard to say what rules they use to assess a situation but they can always tell you what factors they take into account. This is where machine learning mechanism could help. A machine learning program can take descriptions of situations couched in terms of these factors and then infer rules that match expert's behavior.

Write disadvantages of Artificial Neural Networks. 5marks

Answer:- (Page 187)

- The power of ANNs lie in their parallel architecture
- Unfortunately, most machines we have are serial (Von Neumann architecture)
- Lack of defined rules to build a neural network for a specific problem
- Too many variables, for instance, the learning algorithm, number of neurons per layer, number of layers, data representation etc
- Knowledge is implicit
- Data dependency

BIKE is heavy is this statement contain uncertain facts?

Answer:- (Page 94)

It is fuzzy fact.



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Fuzzy facts are ambiguous in nature, e.g. the book is heavy/light. Here it is unclear what heavy means because it is a subjective description. Fuzzy representation is used for such facts. While defining fuzzy facts, we use certainty factor values to specify value of “truth”. We will look at fuzzy representation in more detail later.

Which measurement issued as tool error for the stopping criteria in neural network for epochs

Answer:- (Page 190)

- Done through MSE. We define a low threshold usually 0.01, which if reached stops the training data.
- Another stopping criterion is the number of epochs, which defines how many maximum times the data can be presented to the network for learning.

In soft computing the most combinations are of

- I) genetic -fuzzy system
- II) neural-fuzzy system
- III) genetic algorithm -neural network

The question was identify and describe which combination is best suited 5 marks

Answer:- (Page 205)

Softcomputing is naturally applied in machine learning applications. For example one usage of geneticfuzzy system is of „searching“ for an acceptable fuzzy system that conforms to the training data. In which, fuzzy sets and rules combined, are encoded as individuals, and GA iterations refine the individuals i.e. fuzzy system, on the basis of their fitness evaluations. The fitness function is usually MSE of the individual fuzzy system on the training data. Very similar applications have been developed in the other popular neuro-fuzzy systems, in which neural networks are used to find the best fuzzy system for the given data through means of classical ANN learning algorithms.

“Boolean logic is a subset of fuzzy logic.” Do you agree with the statement or not? Give reason to support your answer.(Marks 3)

Answer:- (Page 147)



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Fuzzy logic is a superset of conventional (Boolean) logic that has been extended to handle the concept of partial truth -- truth values between "completely true" and "completely false".

For example, There are two persons. Person A is standing on the left of person B. Person A is definitely shorter than person B. But if Boolean gauge has only two readings, 1 and 0, then a person can be either all or short. Let's say if the cut off point is at 5 feet 10 inches then all the people having a height greater than this limit are taller and the rest are short.

Write down the name of category with which these algorithms belong to and also describe that category briefly. These algorithms are listed below:

- 1) Self-organizing maps (SOM)
- 2) k-means
- 3) Linear vector quantization (Marks 3)

Answer:- (Page 205)

These algorithms are belongs to clustering.

Clustering is a form of unsupervised learning, in which the training data is available but without the classification information or class labels. The task of clustering is to identify and group similar individual data elements based on some measure of similarity. So basically using clustering algorithms, classification information can be „produced“ from a training data which has no classification data at the first place. Naturally, there is no supervision of classification in clustering algorithms for their learning/clustering, and hence they fall under the category of unsupervised learning.

Information gain is a measure of the impurity in a collection of training examples. Do you agree with the statement or not? If not, then write a correct statement. (Marks 3).

Answer:- (Page 177)

Disagree. Entropy as a measure of the impurity in a collection of training examples. In order to define information gain precisely, we begin by defining a measure commonly used in statistics and information theory, called entropy, which characterizes the purity/impurity of an arbitrary collection of examples.



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What are the three phases of machine learning?(Marks 3)

Answer:- (Page 160)

1. Training
2. Validation
3. Application

Machine learning typically follows three phases according to Finlay, [Janet Finlay, 1996]. They are as follows:

1. Training: a training set of examples of correct behavior is analyzed and some representation of the newly learnt knowledge is stored. This is often some form of rules.
2. Validation: the rules are checked and, if necessary, additional training is given. Sometimes additional test data are used, but instead of using a human to validate the rules, some other automatic knowledge based component may be used. The role of tester is often called the critic.

Which term is best suited for a situation in which we perform unsupervised learning on training data without having classification information or class labels? (Marks 2)

Answer:- (Page 205)

Clustering is a form of unsupervised learning, in which the training data is available but without the classification information or class labels. The task of clustering is to identify and group similar individual data elements based on some measure of similarity.

Out of different characteristics that an intelligent machine will show which two characteristics do you think are most important as compare to other characteristics for making that machine more artificially intelligent?(Marks 2)

Answer:- (Page 14)

To create intelligent machines we first need to understand how the real brain functions.

Draw the truth table (for two operands A and B) for Fuzzy operator AND. (Marks 2)



Answer:- (Page 150)

A	B	A and B
0	0	0
0	1	0
1	0	0
1	1	1

AND

Write advantages of Artificial Neural Networks. (3 Marks)

Answer:- (Page 187)

Advantages of Artificial Neural Networks:

Excellent for pattern recognition

Excellent classifiers

Handles noisy data well

Good for generalization

What intelligence ability is better in living species than in computers. Why it is better

Answer:- [click here for details](#)

Computers are better than people are at remembering things exactly and at performing complex numeric calculations with speed. But human brains still beat computers in a number of ways. For one, humans can integrate information from many different variables and stimuli, and they can learn by experience, observation and experimentation. Computers can't easily adapt to changing situations. Sure, they can be programmed to perform outstandingly in a particular field, but they are not able to function in multiple disciplines. Moreover, the things that make humans truly unique (emotion, empathy, self-awareness, ambition) are beyond the capacity of computers.



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Discuss ID3 in decision tree representation(5marks)

Answer:- (Page 177)

ID stands for interactive dichotomizer. The first step of ID3 is to find the root node. It uses a special function GAIN, to evaluate the gain information of each attribute. For example if there are 3 instances, it will calculate the gain information for each. Whichever attribute has the maximum gain information, becomes the root node. The rest of the attributes then fight for the next slots.

ESDLC stages (5marks)

Answer:- (Page 129)

Feasibility study
Rapid prototyping
Alpha system (in-house verification)
Beta system (tested by users)
Maintenance and evolution

Discuss POP algorithm(5 mrks)

Answer:- (Page 198)

The partial-order planning algorithm - POP:

POP(initial_state, goal, actions) returns plan

Begin

Initialize plan 'p' with initial_state linked to goal state with two special actions, start and finish

Loop until there is not unsatisfied pre-condition

Find an action 'a' which satisfies an unachieved pre-condition of some action 'b' in the plan

Insert 'a' in plan linked with 'b'

Reorder actions to resolve any threats

End

In POP algorithm pre-conditions of finish action are not met. We just backtrack by adding actions that meet these unsatisfied pre-condition predicates. New unsatisfied preconditions will be generated for each newly added action. Then we try to satisfy those by using appropriate actions. We keep on doing that until there is no unsatisfied precondition.

Linear model's phases any 5(3 marks)

Answer:- (Page 129)

The main phases of the linear sequence are

Planning

Knowledge acquisition and analysis Knowledge design

Code

Knowledge verification

System evaluation



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What is robotics? Write the name of different active areas involved in robotics?(3 marks)

Answer:- (Page 204)

Robotics:

Robotics is the highly advanced and totally hyped field of today. Literally Speaking, robotics is the study of robots. Robots are complex combination of hardware and intelligence, or mechanics and brains.

Active areas involved in robotics:

robotics is truly a multi-disciplinary area, having active contributions from, physics, mechanics, biology, mathematics, computer science, statistics, control theory, philosophy, etc.

Differentiate find s and candidate elimination algorithms (2marks)

Answer:- [click here for details](#)

Find-S :

Find-S is guaranteed to output the most specific hypothesis h that best fits positive training examples. The hypothesis h returned by Find-S will also fit negative examples as long as training examples are correct.

Candidate-Elimination: Candidate-Elimination gives Outputs a description of set of all hypotheses consistent with the training examples.

Why we need hypothesis space (2 marks)

Answer:- (Page 168)

All problem discuss in the Ai are real world example/cases where concept space consists of larger number of attributes. So the learner has to apply some hypothesis, which has either a search or the language bias to reduce the size of the concept space. This reduced concept space becomes the hypothesis space.

What do you know about Mandani's fuzzy inference (3Marks)

Answer:- (Page 153)

Mamdani's fuzzy inference method is the most commonly seen fuzzy methodology. It was among the first control systems built using fuzzy set theory. Ebrahim Mamdani proposed it in 1975 by as an attempt to control a steam engine and boiler combination by synthesizing a set of linguistic control rules obtained from experienced human operators.

What is the consequent?

Answer:- (Page 95)

Consequent is the component of rule and it make the conclusion or the THEN part of the RULE.



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What is MSE? 2Marks

Answer:- (Page 189)

MSE is the most common technique for measuring the total error in each iteration of the neural network.

How does the search paths don't remain independent in Genetic algorithm? 2 Marks

Answer:- (Page 177)

In GA, At each step, current states of different pairs of these paths are combined to form new paths. This way the search paths don't remain independent, instead they share information with each other and thus try to improve the overall performance of the complete search space.

What is State in Strips? Give an example. 2 Marks

Answer:- (Page 197)

STRIPS is one of the founding languages developed particularly for planning, and State is a conjunction of predicates represented in well-known form,

Example,

a state where we are at the hotel and do not have either cash or radio is represented as,
 $at(hotel) \wedge \neg have(cash) \wedge \neg have(radio)$

Briefly explain the different phases of machine learning? 3 Marks

Answer:- (Page 160)

1. Training: a training set of examples of correct behavior is analyzed and some representation of the newly learnt knowledge is stored. This often defines form of rules.
2. Validation: the rules are checked and, if necessary, additional training is given. Sometimes additional test data are used, but instead of using a human to validate the rules, some other automatic knowledge based component may be used. The role of tester is often called the critic.
3. Application: the rules are used in responding to some new situations.

How problem solution constitute the problem solving? 3 Marks

Answer:- (Page 17)

In problem solving, this should be known that what will be out ultimate aim. i.e., what should be the output of our procedure in order to solve the problem?

For example in the case of mouse, the ultimate aim is to reach the cheese. The state of world when mouse will be beside the cheese and probably eating it defines the aim. This state of world is also referred to as the Goal State or the state that represents the solution of the problem.



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Write down the name of the some of the fuzzy logic applications? 3 Marks

Answer:- (Page 147)

- Automobile engine controls
- Anti-lock braking systems
- Color film developing systems
- Subway control systems

Planning phase of the linear model?

Answer:- (Page 129)

The planning phase of the linear model involves the following steps

Feasibility assessment

Resource allocation

Task phasing and scheduling

Requirements analysis

Explain Learning?

Answer:- (Page 159)

A relatively permanent change that occurs in behavior as a result of experience. Learning occurs in various regimes. For example, it is possible to learn to open a lock as a result of trial and error; possible to learn how to use a word processor as a result of following particular instructions.

There's no proper definition of learning but here are some as:

- "Learning denotes changes in a system that ... enables a system to do the same task more efficiently the next time." --Herbert Simon
- "Learning is constructing or modifying representations of what is being experienced." --Ryszard Michalski
- "Learning is making useful changes in our minds." --Marvin Minsky.

Explain Planning?

Answer:- (Page 196)

Planning is an advanced form of problem solving which generates a sequence of operators that guarantee the goal. Furthermore, such sequence of operators or actions is called a plan. It is based on logic representation

What Is Information Gain?

Answer:- (Page)

Information gain is the expected reduction in entropy caused by partitioning the examples according to its attribute. i.e, if we use the attribute with the maximum information gain as the



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node, then it will classify some of the instances as positive or negative with 100% accuracy, and this will reduce the entropy for the remaining instances.

2 main functions of brain in human system.

Answer:- (Page 177)

Introspection: that is trying to catch out own thoughts as they go by.

Psychological Experiments: that concern with the study of science of mental life.

Why clustering is the example of unsupervised?

Answer:- (Page 205)

In Unsupervised learning the data have no target attribute. We want to explore the data to find some intrinsic structures in them. Clustering is often called an unsupervised learning task as no class values denoting a prior grouping of the data instances are given, which is the case in supervised learning. There is no supervision of classification in clustering algorithms for their Learning/clustering, and hence they fall under the category of unsupervised learning.

Application of the fuzzy operators to antecedent?

Answer:- (Page 152)

Antecedents can have multiple parts:

- If wind is mild and racquets are good then playing badminton is fun In this case all parts of the antecedent are resolved simultaneously and resolved to a single number using logical operators

Machine Learning in Expert system? 5 marks

Answer:- (Page 162)

The primary application of machine learning in expert systems is to attempt to solve the knowledge acquisition bottleneck. Mostly Inductive and deductive learning phases from machine learning took part in expert system. The job of the learning algorithm is to find suitable rules that are correct with respect to the examples and existing knowledge. Inductive learning is based on the knowledge that if something happens a lot it is likely to be generally true. While Deductive learning working on existing facts and knowledge and deduces new knowledge from the old. In contrast, inductive learning uses examples and generates hypothesis based on the similarities between them.

Robot features? 5 marks

Answer:- (Page 204)

The features that constitute a robot are:

Mobility



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Perception
Planning
Searching
Reasoning
Dealing with uncertainty
Vision
Learning
Autonomy
Physical Intelligence

What is Fuzzy logic?

Answer:- (Page 147)

Fuzzy logic is a superset of conventional (Boolean) logic that has been extended to handle the concept of partial truth -- truth values between "completely true" and "completely false".

Write the Predicate Action?

OR

Write the name of predicate action?

Answer:- (Page 198)

Action is a predicate used to change states. It has three components namely, the predicate itself, the pre-condition, and post-condition predicates. For example, the action to buy something item can be represented as,

Action:
buy(X)

Pre-conditions:

$at(Place) \wedge sells(Place, X)$

Post-conditions/Effect:
have(X)

Weak AI and Strong AI with example?

Answer:- (Page 206)



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AI is classified differently by two major schools of thought. One school classifies AI as study of systems that think like humans i.e. strong AI and the other classifies AI as study of systems that act like humans i.e. weak AI.

Where the machine learning is used : examples

Answer:- (Page 208)

vision, robotics, soft-computing and clustering.

What is the Linear Separable line?

Answer:- (Page 184)

If we represent whole class of problems in the input space, and we could classify them using a straight line. It is known as the Linear Separable line The simplest examples are the logical AND or OR.

Genetic algorithms are Geniality use for what?

Answer:- (Page 205)

GA is naturally applied in machine learning applications. For example one usage of genetic-fuzzy system is of ‘searching’ for an acceptable fuzzy system that conforms to the training data. In which, fuzzy sets and rules combined, are encoded as individuals, and GA iterations refine the individuals i.e. fuzzy system, on the basis of their fitness evaluations.

Write the Find(s) algorithm.

Answer:- (Page 172)

Initialize h to the most specific hypothesis in H

For each positive training instance x

For each attribute constraint a_i in h

If the constraint a_i is satisfied by x

Then do nothing

Else

Replace a_i in h by the next more general constraint that is satisfied by x

Output hypothesis h

Discuss the POP Algorithms?

Answer:- (Page 198)

POP(initial_state, goal, actions) returns plan

Begin

Initialize plan ‘p’ with initial_state linked to goal state with two special actions, start and finish

Loop until there is not unsatisfied pre-condition



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Find an action ‘a’ which satisfies an unachieved pre-condition of some action ‘b’ in the plan
Insert ‘a’ in plan linked with ‘b’
Reorder actions to resolve any threats
End

What is planning?

Answer:- (Page 196)

Planning is an advanced form problem solving which generates a sequence of operators that guarantee the goal. Furthermore, such sequence of operators or actions (commonly used in planning literature) is called a plan.

What is information gain?

Answer:- (Page 177)

Information gain is simply the expected reduction in entropy caused by partitioning the examples according to this attribute. That is, if we use the attribute with the maximum information gain as the node, then it will classify some of the instances as positive or negative with 100% accuracy and this will reduce the entropy for the remaining instances.

What is clustering ?

Answer:- (Page 205)

Clustering is a form of unsupervised learning, in which the training data is available but without the classification information or class labels. The task of clustering is to identify and group similar individual data elements based on some measure of similarity. So basically using clustering algorithms, classification information can be ‘produced’ from a training data which has no classification data at the first place. Naturally, there is no supervision of classification in clustering algorithms for their learning/clustering, and hence they fall under the category of unsupervised learning.

Define Defuzzing ?

Answer:- (Page 157)

The aggregate of a fuzzy set encompasses a range of output values, and so must be defuzzified in order to resolve a single output value from the set. The input for the defuzzification process is a fuzzy set (the aggregate output fuzzy set) and the output is a single number. As much as fuzziness helps the rule evaluation during the intermediate steps, the final desired output for each variable is generally a single number.

Machine learning in developing expert systems?

Answer:- (Page 163)

Many AI applications are built with rich domain knowledge and hence do not make use of machine learning. To build such expert systems, it is critical to capture knowledge from experts. However, the fundamental problem remains unresolved, in the sense that things that are normally implicit



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inside the expert's head must be made explicit. This is not always easy as the experts may find it hard to say what rules they use to assess a situation but they can always tell you what factors they take into account. This is where machine learning mechanism could help. A machine learning program can take descriptions of situations couched in terms of these factors and then infer rules that match expert's behavior.

Concept learning Two question of Connectionist?

Answer:- (Page 181)

Although ID3 spanned more of the concept space, but still there is a possibility that the true concept is not simply a mixture of disjunctions of conjunctions, but some more complex arrangement of attributes.

(Artificial Neural Networks) ANNs can compute more complicated functions ranging from linear to any higher order quadratic, especially for non-Boolean concepts. This new learning paradigm takes its roots from biology inspired approach to learning. Its primarily a network of parallel distributed computing in which the focus of algorithms is on training rather than explicit programming. Tasks for which connectionist approach is well suited include:

- Classification
- Fruits - Apple or orange
- Pattern Recognition
- Finger print, Face recognition
- Prediction
- Stock market analysis, weather forecast

Names of clustering Algorithm?

Answer:- (Page 205)

The famous clustering algorithms are Self-organizing maps (SOM), k-means, linear vector quantization, Density based data analysis, etc.

Artificial Neural Networks unsupervised step?

Answer:- (Page 188)

Given a set of examples with no labeling, group them into sets called clusters

How is the consequent affected by the antecedent?

Answer:- (Page 152)

The consequent specifies that a fuzzy set be assigned to the output. The implication function then modifies that fuzzy set to the degree specified by the antecedent. The most common ways to modify the output fuzzy set are truncation using the min function (where the fuzzy set is "chopped off").

Is a computer vision possible without AI techniques?



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Answer:- (Page 203)

No, computer vision is not possible without AI techniques. It is a subfield of Artificial Intelligence. The purpose of computer vision is to study algorithms, techniques and applications that help us make machines that can "understand" images and videos. Computer vision finds its applications in medicine, military, security and surveillance, quality inspection, robotics, automotive industry and many other areas. Few areas of vision in which research is being actively conducted throughout the world are as follows:

1. The detection, segmentation, localisation, and recognition of certain objects in images (e.g., human faces)
2. Tracking an object through an image sequence
3. Object Extraction from a video sequence
4. Automated Navigation of a robot or a vehicle
5. Estimation of the three-dimensional pose of humans and their limbs
6. Medical Imaging, automated analysis of different body scans (CT Scan, Bone Scan, X-Rays)
7. Searching for digital images by their content (content-based image retrieval)
8. Registration of different views of the same scene or object .

Intelligence increases by age? Write comments.

Answer:- [click here for details](#)

Intelligence does not increase with age, but increases with one's exposure to facts around and accumulation of information and capacity to correlate, assimilate and apply the information acquired. As with increasing age, exposure increases, and worldly wisdom acquired, it is normally said that intelligence increases with age, however a peak is reached and the increase in intelligence is halted or sometimes with fading memory with age a downward trend is observed.

Write down the names of some areas where clustering is beneficial.

Answer:- [click here for details](#)

Marketing, insurance, biology. Libraries, city planning, earthquake studies, WWW: document classification

Comparison between brain and computer. 3 marks

Answer:- [click here for details](#)

Pattern recognition in computer vision

Computer vision encompasses topics from pattern recognition, machine learning, geometry, image processing, artificial intelligence, linear algebra and other subjects. Apart from its applications, computer vision is itself interesting to study. Many detailed tutorials regarding the field are freely available on the internet. Readers of this text are encouraged to read through these tutorials to get in-depth knowledge about the limits and contents of the field.



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Genetic Algorithm is inspired by the structure and/or functional aspects of the biological neural networks and it consist of an interconnected group of artificial neurons. Do you agree or not? 5 marks

Answer:- (Page 207)

Genetic algorithms are inspired by the biological theory of evolution and provide facilities of parallel search agents using collaborative hill climbing. We have seen that many otherwise difficult problems to solve through classical programming or blind search techniques are easily but undeterministically solved using genetic algorithms.

What is Goal in Strips? Give an example. (2 Marks)

Answer:- (Page 197)

Goal is also represented in the same manner as a state. For example, if the goal of a planning problem is to be ,at the hotel with radio, it is represented as,at(hotel) ^ have(radio)

Fields are the main types of fields/tokens

Write two fields or data types of CLIPS? (2 Marks)

Answer:- (Page 134)

That can be used with clips. They can be:

1. Numeric fields: consist of sign, value and exponent
 - Float .e.g. 3.5e-10
 - Integer e.g. -1 , 3
2. Symbol: ASCII characters, ends with delimiter. e.g. family
3. String: Begins and ends with double quotation marks, “Ali is Ahmed’s brother”

What is Knowledge elicitation? (2 Marks)

Answer:- (Page 130)

Getting knowledge from the expert is called knowledge elicitation vs. the broader term knowledge acquisition.

What do you know about Training Process? (2 Marks)

Answer:- (Page 161)

Real learning involves some generalization from past experience and usually some coding of memories into a more compact form. Achieving this generalization needs some form of reasoning.

“Planning predicate is a predicate that define states and condition is a predicate that is used to change states”. Do you agree with the statement or not? (5 Marks)

Answer:- (Page 198)

Action is a predicate used to change states. It has three components namely, the predicate itself, the pre-condition, and post-condition predicates.



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$(P \rightarrow Q) \wedge \neg (P \wedge (Q \wedge \neg R))$ Convert into Conjunctive Normal Form (CNF)? (5 Marks)

Answer:- (Page 107)

$(\neg P \vee Q) \wedge (\neg P \vee (\neg Q \vee R))$ -----final form

Computer vision

Answer:- (Page 203)

It is a subfield of Artificial Intelligence. The purpose of computer vision is to study algorithms, techniques and applications that help us make machines that can "understand" images and videos.

How decision tree and candidate elimination algorithm work with disjunctions of conjunctions,? (3Marks)

Answer:- (Page 173)

Candidate-Elimination algorithm begins by initializing the version space to the set of all hypotheses in H ; that is by initializing the G boundary set to contain the most general hypothesis in H , for example for the SICK problem, the G_0 will be: $G_0 = \{ \langle ?, ? \rangle \}$

The S boundary set is also initialized to contain the most specific (least general) hypothesis:

$S_0 = \{ \langle \emptyset, \emptyset \rangle \}$

Concept space or instance space ka difference tha

Answer:- (Page 167)

A concept is the representation of the problem with respect to the given attributes, instance space: How many distinct instances can the concept sick have? Since there are two attributes: T and BP, each having 3 values, there can be a total of 9 possible distinct instances in all. If we were to enumerate these, we'll get the following table:

Which term is best suited for a situation in which data problem cannot be separated into their respective classes by using a simple line?2

Answer:- (Page 185)

Linearly separable problems: A single perceptron simply draws a line, which is a hyper plane when the data is more than 2 dimensional. Sometimes there are complex problems (as is the case in real life). The data for these problems cannot be separated into their respective classes by using a single straight line. These problems are not linearly separable.

Disjunctive space

Answer:- (Page 176)

If we could use these kind of OR statements, we'd have a better chance of finding the true concept, if the concept does not lie in the conjunctive space. These are also called disjunctive spaces.



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Define domain of problem.

Answer:- (Page 166)

The solution to any problem is a function that converts its inputs to corresponding outputs. The domain of a problem or the problem space is defined by them elements explained in the following paragraphs. These new concepts will be best understood if we take one example and exhaustively use it to justify each construct.

Example:

Let us consider the domain of HEALTH. The problem in this case is to distinguish, between a sick and a healthy person. Suppose we have some domain, knowledge; keeping a simplistic approach, we say that two attributes are, necessary and sufficient to declare a person as healthy or sick. These two, attributes are: Temperature (T) and Blood Pressure (BP). Any patient coming into, the hospital can have three values for T and BP: High (H), Normal (N) and Low (L). Based on these values, the person is to be classified as Sick (SK). SK is a Boolean concept, SK = 1 means the person is sick, and SK = 0 means person is healthy. So the concept to be learnt by the system is of Sick, i.e., SK=1.

Which term is best suited for a situation in which we try to find out a relationship between input and output of a function (concept)?

Answer:- (Page 190)

Application Testing

- A network is said to generalize well when the input-output relationship computed by the network is correct (or nearly so) for input-output pattern (test data) never used in creating and training the network.

Which application field of a Genetic algorithm do you think belong with this situation?

Answer:- (Page 207)

Genetic Algorithms

A genetic algorithm is a modern advancement to the hill climbing search based problem solving. Genetic algorithms are inspired by the biological theory of evolution and provide facilities of parallel search agents using collaborative hill climbing. We have seen that many otherwise difficult problems to solve through classical programming or blind search techniques are easily but undeterministically solved using genetic algorithms

Difference between finds and candidate elimination algorithm. 3 Marks

Answer:- (Page 172)

FIND-S finds the maximally specific hypothesis possible within the version space given a set of training data. How can we use the general to specific ordering of hypothesis space to organize the search for a hypothesis consistent with the observed training examples? One way is to begin with the most specific possible hypothesis in H, then generalize the hypothesis each time it fails to cover an observed positive training example. (We say that a hypothesis “covers” a positive example if it correctly classifies the example as positive.) To be more precise about how the partial ordering



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is used, consider the FIND-S algorithm:

To illustrate this algorithm, let us assume that the learner is given the sequence of following training examples from the SICK domain:

D T BP SK
x1 H H 1
x2 L L 0
x3 N H 1

The first step of FIND-S is to initialize h to the most specific hypothesis in H : $h = \langle \emptyset, \emptyset \rangle$. Upon observing the first training example $\langle \langle H, H \rangle, 1 \rangle$, which happens to be a positive example, it becomes obvious that our hypothesis is too specific. In particular, none of the “ \emptyset ” constraints in h are satisfied by this training example, so each \emptyset is replaced by the next more general constraint that fits this particular example; namely, the attribute values for this very training example:

$h = \langle H, H \rangle$

This is our h after we have seen the first example, but this h is still very specific. It asserts that all instances are negative except for the single positive training example we have observed.

Upon encountering the second example; in this case a negative example, the algorithm makes no change to h . In fact, the FIND-S algorithm simply ignores every negative example. While this may at first seem strange, notice that in the current case our hypothesis h is already consistent with the new negative example (i.e. h correctly classifies this example as negative), and hence no revision is needed. In the general case, as long as we assume that the hypothesis space H contains a hypothesis that describes the true target concept Initialize h to the most specific hypothesis in H

For each positive training instance x

For each attribute constraint a_i in h

If the constraint a_i is satisfied by x

Then do nothing

Else

Replace a_i in h by the next more general constraint that is satisfied by x Output hypothesis h

Replacement of expert

Answer:- (Page 113)

This proposition raises many eyebrows. It is not very practical in some situations, but feasible in others. Consider drastic situations where safety or location is an issue, e.g. a mission to Mars. In such cases replacement of an expert may be the only feasible option. Also, in cases where an expert cannot be available at a particular geographical location e.g. Volcanic areas, it is expedient to use an expert system as a substitute.

An example of this role is a France based oil exploration company that maintains a number of oil wells. They had a problem that the drills would occasionally become stuck. This typically occurs when the drill hits something that prevents it from turning. Often delays due to this problem cause huge losses until an expert can arrive at the scene to investigate. The company decided to deploy an expert



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system so solve the problem. A system called ‘Drilling Advisor’ (Elf-Aquitane 1983) was developed, which saved the company from huge losses that would be incurred otherwise.

Differentiate briefly and precisely in perception and Knowledge presentation? 2mark

Answer:- (Page 89)

Perception component that allows the system to get information from its environment
Knowledge representation maybe static or it may be coupled with a learning component that is adaptive and draws trends from the perceived data.

Write command to remove specific facts in clips. 2 marks

Answer:- (Page 134)

The retract command is used to remove or retract facts. For example:

(retract 1) removes fact 1

(retract 1 3) removes fact 1 and 3

Write windows used by CLIPS. Any 3? 3marks

Deductive reasoning is based on forming, or inducing a “generalization” from a limited set of observations. Is it true or false? Justify? 3marks

Answer:- (Page 102)

No, because inductive reasoning is based on forming, or inducing a “generalization” from a limited set of observations.

Draw the truth table (for two operands A and B) for Fuzzy operator AND. (Marks 2)

Answer:- (Page 150)

Table: Logical Operators

A	B	A and B
0	0	0
0	1	0
1	0	0
1	1	1

AND

A	B	A or B
0	0	0
0	1	1
1	0	1
1	1	1

OR

A	not A
0	1
1	0

NOT



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Table: Fuzzy Operators

A	B	min(A,B)
0	0	0
0	1	0
1	0	0
1	1	1

AND

A	B	max(A,B)
0	0	0
0	1	1
1	0	1
1	1	1

OR

A	1 - A
0	1
1	0

NOT

Which is best technique to go from $h\langle?,?\rangle$ to $h\langle f_i, f_i \rangle$ (2marks)

[Answer:- \(Page \)](#)

Candidate-Elimination algorithm is best technique to go from $h\langle?,?\rangle$ to $h\langle f_i, f_i \rangle$ because FIND-S, that, it assumes the consistency within the training set.

How we can represent fuzzy sets?(2 marks)

[Answer:- \(Page 151\)](#)

Usually a triangular graph is chosen to represent a fuzzy set, with the peak around the mean.

What is computer vision (2 marks)

[Answer:- \(Page 203\)](#)

It is a subfield of Artificial Intelligence. The purpose of computer vision is to study algorithms, techniques and applications that help us make machines that can "understand" images and videos. In other words, it deals with procedures that extract useful information from static pictures and sequence of images. Enabling a machine to see, perceive and understand exactly as humans see, perceive and understand is the aim of Computer Vision.

Elaborate version space?

[Answer:- \(Page 170\)](#)

Version space is a set of all the hypotheses that are consistent with all the training examples.

Why we need validation while training

[Answer:- \(Page 189\)](#)

During training, training data is divided into k data sets; k-1 sets are used for training, and the remaining data set is used for cross validation. This ensures better results, and avoids over-fitting.



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What is ID3

Answer:- (Page 177)

ID stands for interactive dichotomizer. This was the 3rd revision of the algorithm which got wide acclaims. The first step of ID3 is to find the root node. It uses a special function GAIN, to evaluate the gain information of each attribute. For example if there are 3 instances, it will calculate the gain information for each. Whichever attribute has the maximum gain information, becomes the root node. The rest of the attributes then fight for the next slots.

Application area of computer vision

Answer:- (Page 203)

Computer vision finds its applications in medicine, military, security and surveillance, quality inspection, robotics, automotive industry and many other areas. Few areas of vision in which research is being actively conducted throughout the world are as follows:

- _ The detection, segmentation, localisation, and recognition of certain objects in images (e.g., human faces)
- _ Tracking an object through an image sequence
- _ Object Extraction from a video sequence
- _ Automated Navigation of a robot or a vehicle
- _ Estimation of the three-dimensional pose of humans and their limbs
- _ Medical Imaging, automated analysis of different body scans (CT Scan, Bone Scan, X-Rays)
- _ Searching for digital images by their content (content-based image retrieval)
- _ Registration of different views of the same scene or object

Law of excluded middle

Answer:- (Page 145)

‘Law of the Excluded Middle’, which states that any element X, must be either in set A or in set not-A. It cannot be in both. And these two sets, set A and set not-A should contain the entire universe between them.

Steps of unsupervised learning methodology

Answer:- (Page 188)

Given a set of examples with no labeling, group them into sets called clusters

Steps of supervised learning methodology

Answer:- (Page 188)

Given a set of example input/output pairs, find a rule that does a good job of predicting the output associated with a new input.



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How to apply implication method

Answer:- (Page 108)

Implication method can be applied by eliminating arrows.

$$A \rightarrow B = \neg A \vee B$$

Find the entropy of S lec #38 first examples (5Mrks)

Answer:- (Page 177)

$$\text{Entropy}(S) = -p_+ \log_2 p_+ - p_- \log_2 p_-$$

Where p_+ is the proportion of positive examples in S and p_- is the proportion of negative examples in S . In all calculations involving entropy we define $0 \log 0$ to be 0.

To illustrate, suppose S is a collection of 14 examples of some Boolean concept, including 9 positive and 5 negative examples, then the entropy of S relative to this Boolean classification is:

$$\begin{aligned} \text{Entropy}(S) &= - (9/14) \log_2 (9/14) - (5/14) \log_2 (5/14) \\ &= 0.940 \end{aligned}$$

Notice that the entropy is 0, if all the members of S belong to the same class (purity). For example, if all the members are positive ($p_+ = 1$), then $p_- = 0$ and so:

$$\begin{aligned} \text{Entropy}(S) &= -1 \log_2 1 - 0 \log_2 0 \\ &= -1(0) - 0 \text{ [since } \log_2 1 = 0, \text{ also } 0 \log_2 0 = 0] \\ &= 0 \end{aligned}$$

Note the entropy is 1 when the collection contains equal number of positive and negative examples (impurity). See for yourself by putting p_+ and p_- equal to $1/2$.

Otherwise if the collection contains unequal numbers of positive and negative examples, the entropy is between 0 and 1.

How working memory is related to the Expert System? (2Marks)

Answer:- (Page 117)

The working memory is the ‘part of the expert system that contains the problem facts that are discovered during the session’ according to Durkin. One session in the working memory corresponds to one consultation. During a consultation:

- User presents some facts about the situation.
- These are stored in the working memory.
- Using these and the knowledge stored in the knowledge base, new information is inferred and also added to the working memory.

What is the basic task of clustering (3 marks)

Answer:- (Page 205)

The task of clustering is to identify and group similar individual data elements based on some measure of similarity. So basically using clustering algorithms, classification information can be ‘produced’ from a training data which has no classification data at the first place.



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Is here AI brain exists?

Answer:- (Page 187)

A neural network is a massively parallel distributed computing system that has a natural propensity for storing experiential knowledge and making it available for use. It resembles the brain in two respects:

- Knowledge is acquired by the network through a learning process (called training)
 - Interneuron connection strengths known as synaptic weights are used to store the knowledge
- But in real there is no brain exists in AI.

Define the following terms. Give examples to support your definitions:

1. Operator:
2. Static Evaluation

Answer:- (Page 63)

1. Operator:

The traveling inside a solution space requires something called as “operators”. In case of the mouse example, turn left, turn right, go straight are the operators which help us travel inside the solution space. In short the action that takes us from one state to the other is referred to as an operator.

2. Static Evaluation:

We assume that we have a situation analyzer that converts all judgments about board situations into a single, overall quality number. This situation analyzer is also called a static evaluator and the score/ number calculated by the evaluator is called the static evaluation of that node.

Positive numbers, by convention indicate favor to one player. Negative numbers indicate favor to the other player. The player hoping for positive numbers is called maximizing player or maximizer. The other player is called minimizing player or minimizer. The maximizer has to keep in view that what choices will be available to the minimize on the next step. The minimizer has to keep in view that what choices will be available to the maximizer on the next step.

Why Genetic algorithm is used in the biological theory of Human evolution? Also write its functions?

Answer:- (Page 77)

Genetic algorithms are a modern advancement to the hill climbing search based problem solving. Genetic algorithms are inspired by the biological theory of evolution and provide facilities of parallel search agents using collaborative hill climbing.

The genetic algorithm technology comes from the concept of human evolution. Individuals (animals or plants) produce a number of offspring (children) which are almost, but not entirely, like themselves. Variation may be due to mutation (random changes), or due to inheritance (offspring/children inherit some characteristics from each parent). Some of these offspring may



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survive to produce offspring of their own— some will not. The “better adapted” individuals are more likely to survive. Over time, generations become better and better adapted to survive.

Genetic algorithm functions

Start with a population of randomly generated, (attempted) solutions to a problem

Repeatedly do the following:

Evaluate each of the attempted solutions

Keep the “best” solutions

Produce next generation from these solutions (using “inheritance” and “mutation”)

Quit when you have a satisfactory solution (or you run out of time)

Which term best suited for the: “is a subfield of Artificial Intelligence and study algorithms, techniques and applications that help us make machines that can "understand" images and videos.”

Answer:- (Page 203)

Computer vision

Write add command in CLIPS to add 3 and 4. 2marks

Answer:- (Page 133)

CLIPS> (+ 3 4)

Write down fuzzy statement in everyday life. Elaborate and give reason. (3 Marks)

Answer:- (Page 146)

Take into consideration ‘days of the weekend’. The classical set would say strictly that only Saturday and Sunday are a part of weekend, whereas most of us would agree that we do feel like it’s a weekend somewhat on Friday as well. Actually we’re more excited about the weekend on a Friday than on Sunday, because on Sunday we know that the next day is a working day.

The role Tester is called?

Answer:- (Page 160)

The role of tester is often called the critic.

What does Tester do?

Answer:- (Page 16)

The “Tester” actually checks that either a possible solution from the solution generates solves out problem or not.



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Which term is best suited for a situation in which we give a set of example of input/output pairs to find out a rule that does good job of predicting the out associated with a new input?

Answer:- (Page 188)

Supervised (Learning methodology)

Which term is best suited for a person who has specialized knowledge, skill and experience in specific area? Give an example form daily life?

Answer:- (Page 111)

Expert.

Try to think of the various traits you associate with experts you might know, e.g. skin specialist, heart specialist, car mechanic, architect, software designer.

Do you think machine learning helps human being? Justify your answer with solid reasons?

Answer:- (Page 163)

Yes, machine learning helps human being as Many AI applications are built with rich domain knowledge and hence do not make use of machine learning. To build such expert systems, it is critical to capture knowledge from experts. However, the fundamental problem remains unresolved, in the sense that things that are normally implicit inside the expert's head must be made explicit. This is not always easy as the experts may find it hard to say what rules they use to assess a situation but they can always tell you what factors they take into account. This is where machine learning mechanism could help. A machine learning program can take descriptions of situations couched in terms of these factors and then infer rules that match expert's behavior. Machine learning algorithms are being used to recognize faces and to extract valuable information and knowledge from large commercial databases respectively. Some of the applications that use learning algorithms include:

- Spoken digits and word recognition
- Handwriting recognition
- Driving autonomous vehicles
- Path finders
- Intelligent homes

How mechanical intelligence impact the Robot.

Answer:- [click here for details](#)

We developed a snake rescue robot basing on the proposed mechanical intelligence. The mechanical intelligence is designed to avoid obstacles and to realize desired motions when the robot is navigated by a remote force feedback steering wheel interface. We use free joints to connect modules of the snake robot. Modules can freely turn according to their neighbors. An obstacle-avoiding wheel is mounted on the head of the snake robot. When the head encounters an obstacle, the wheel touches it first to transfer the sliding friction between the wheel and the



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obstacle into rolling friction, so that the head avoid the obstacle easily. A metal wire is used to link gears mounted on both sides of each module. When any part of the snake robot's body encounters an obstacle, the wire length of each side varies automatically to change the robot's body shape, so that the snake robot avoids the obstacle. The wire length of each side can also be adjusted by a motor. By adjusting the wire length of each side, the snake robot can move in the desired direction. The mechanical intelligence based snake rescue robot has light body, low cost and low computation cost. Experiment results show that the designed mechanical intelligence is effective in realizing desired robot motions together with the force feedback steering wheel interface.

How does ANNs manage their weights?

Answer:- (Page 190)

ANNs manage their weights by

Supervised (Back propagation algorithm)

Unsupervised(Self-organizing neural networks: clustering, quantization, function approximation, Kohonen maps)

Which term is best suited for a Non Boolean variable whose truth values ranges between 0 and 1?

Answer:- (Page 149)

Fuzzy Logic (Membership Function)

Describe input component on learning system

Answer:- (Page 164)

Distance measure

Given two different inputs, the learner should be able to tell them apart. The distance measure is the procedure that the learner uses to calculate the difference between the two inputs.

Generalization

In the training phase, the learner is presented with some positive and negative examples from which it learns. In the testing phase, when the learner comes across new but similar inputs, it should be able to classify them similarly. This is called generalization. Humans are exceptionally good at generalization. A small child learns to differentiate between birds and cats in the early days of his/her life. Later when he/she sees a new bird, never seen before, he/she can easily tell that it's a bird and not a cat.

Probability and fuzzy logics are same term? Justify your answer'

Answer:- (Page 149)



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It's important to distinguish at this point the difference between probability and fuzzy, as both operate over the same range [0.0 to 1.0]. To understand their differences let's take into account the following case, where Amber is a 20 years old girl. $1OLD(Amber) = 0.2$

In probability theory:

There is a 20% chance that Amber belongs to the set of old people, there's an 80% chance that she doesn't belong to the set of old people.

In fuzzy terminology:

Amber is definitely not old or some other term corresponding to the value 0.2. But there are certainly no chances involved, no guess work left for the system to classify Amber as young or old.

In neural network, some weak signal combined into one strong signal. Name best suited term.

Answer:- (Page 181)

Spatial summation

Difference between ambiguous and unambiguous problems. 2

Answer:- (Page 94,161)

Ambiguous problems are unclear in nature, e.g. the book is heavy/light. Here it is unclear what heavy means because it is a subjective description.

Unambiguous problems it can be assumed that they are a helpful set which cover all the important cases.

How can you elaborate the functioning of unsupervised methodology in neural network? 5

Answer:- (Page 190)

Unsupervised

- Given a set of examples with no labeling, group them into sets called clusters
- A cluster represents some specific underlying patterns in the data
- Useful for finding patterns in large data sets
- Form clusters of input data
- Map the clusters into outputs
- Given a new example, find its cluster, and generate the associated output

Self-organizing neural networks: clustering, quantization, function approximation, Kohonen maps

1. Each node's weights are initialized
2. A data input from training data (vector) is chosen at random and presented to the cluster lattice
3. Every cluster centre is examined to calculate which weights are most like the input vector. The winning node is commonly known as the Best Matching Unit (BMU)



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4. The radius of the neighborhood of the BMU is now calculated. Any nodes found within this radius are deemed to be inside the BMU's neighborhood
5. Each neighboring node's (the nodes found in step 4) weights are adjusted to make them more like the input vector. The closer a node is to the BMU, the more its weights get altered
6. Repeat steps for N iterations.

Out of different design phase of ANN which design phase is best suited for a situation in which training data is divided in to k sets, k-1 sets are used for training and remaining data set is used to ensure better result and to avoid over fitting?

Answer:- (Page 189)

Validation

Which command is used for remove all rules in clips?

Answer:- (Page)

Compare different searches each other and which is best.

Answer:- (Page)

Consider a situation in which we want to find relationship between input and given data by using genetic algorithm. Which application fields of GA this problem belongs to.

Answer:- (Page)

Draw graph and write down steps.

Note: Don't use Matlab and just perform on exams software text area.

Answer:- ()

Prove E by using of PONENS, TOLENS, INTRODUCTION, ELIMINATION Methods

$(A \vee B) \wedge (C \wedge \neg D)$

$\neg E \wedge D$

$A \vee B$

Answer:- (Page)



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Prove E by using Refutation Method.

$(A \vee E) \Rightarrow (-D)$

$-E \Rightarrow D$

Answer:- (Page)

Find S and G and Candidate Elimination Method.

D	A	B	C	YES/NO
D1	G	I	W	1
D2	F	I	W	1
D3	F	J	V	0
D4	G	K	V	1
D5	F	K	W	1

Answer:- (Page)

At the end of a Candidate Elimination run, the sets G and S are given as:

$G = \{(? , X , ? , ?)\}$,

$S = \{(? , X , ? , ?)\}$,

Answer the following by giving arguments in support of your answers.

a) Are these sets possible together?

Answer:- (Page)

b) Which one of the following is the correct interpretation of the state of learning?



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- (i) All concepts between $(?, X, ?, ?)$ and $(P, X, M, ?)$ inclusive, in the generalization hierarchy of all concepts of the particular problem. (ii) (P, X, M, T) is the final concept.
(iii) Learning has converged to the single concept $(?, X, ?, ?)$.
(iv) Candidate Elimination will not converge in learning i.e. would fail.
(v) G and S are empty.

Answer:- (Page)

How many hypothesis(concepts) are possible if we have two attributes that can take 7 values each if we are using conjunctive (AND) logic.

Answer:- (Page)

If we are using “?” and “ Φ ” (phi) as two values then reduce the number we will get in part “a” as much as possible.

Answer:- (Page)

You are given the following statements:

- 1 U
- 2 $\neg V$
3. $(V \rightarrow X) \rightarrow Y$
4. $(Y \wedge U) \rightarrow Z$

Prove E using resolution refutation. Show all steps.

- a) Solve the above Inference problem using the following inference rules: Modus Ponens, Modus Tolens, And-Introduction and And-Elimination.

Answer:- (Page)

- b) Solve the same Inference problem above using resolution refutation. Show all steps.

Answer:- (Page)

Waist is a fuzzy variable with universe of discourse 16 - 54 inches. The membership functions of Waist are Fat, Medium and Thin. Draw these membership functions on three separate graphs.

Answer:- (Page)



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Version space and ID3 are connected with each other, agree or not, give solid reasons.

Answer:- (Page)