UNIT-1 AI

what is AI, goal, Application, elements

⇒ In AI, the artificial refers to the "man made" and the intelligent refers to the "thinking power".

⇒ AI is an branch of Computer science by which we can create intelligent machine which can behave like a human, think like a human, and able to make decision

~~⇒ AI is can study of how to make Computers~~

Goal of AI

* Replicate human intelligent :

We know ~~AI~~ ~~Can~~ ~~is~~ machine are working just like a human being in the concept of AI. so we can easily say AI is replicate to the human intelligent

* Building a machine that can do human intelligent task*

eg: playing chess, Autonomous car driving ...

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* Solving problem that required knowledge
* Providing advice to the users

Advantages

⇒ Reduction in human error

Human can make mistake from time to time, Computers doesn't make this mistake, if they are programmed properly with AI decisions are taken from the previously gathered information appling certain set of algorithms. So errors are reduced.

Takes risk instead of human

This is the biggest advantages of AI. we can overcome many risky limitation of humans by developing an AI robotic which can do risky things for ours

eg: mining of Gold and oil
Natural or man made disasters
Explore the ocean part
Diffuse the bomb.

* Available 24x7

Every human will work for limited time, the humans are not trained without any break, they can't they wanted to some time for refreshing, and they wanted to spent some time to their family. but using AI there no any emotional like family. and they are trained 24/7 without any breaks, they don't like bone like human beings.

* Faster decision

Using AI taking decision faster than human and carried out actions quicker.

Disadvantages.

* High Cost of Creation
* making human lazy
* unemployment
* No emotion
* Losing out of born thinking (Relationship not)

Applications / characteristic

AI in astronomy

⇒ AI can be very useful to solve the complex universe problems.

⇒ AI technology is very helpful to understanding universe such as how it works, origin etc...

AI in Gaming:

AI in health care:

AI in Data Security:

AI in Social media:

AI in Entertainment

Expert System

⇒ Computer based AI

⇒ Expert System doing everything just like a human

⇒ The System which exhibit intelligent behaviour, learns, demonstrate, explain advance ~~the~~ it has

Intelligent Robot

Speech Recognition

propositional ~~logic~~ Calculus

⇒ Proposition Calculus is a branch of logic

⇒ propositional Calculus is also called propositional logic

⇒ propositional logic is the simplest form of logic where all the statement are made by propositions.

⇒ A proposition is a declarative statement which is either true or false.

⇒ propositional Calculus is more generalized representation

Propositional Calculus Symbols

The Symbols of propositional Calculus are-

Propositional Symbol

P, Q, R, S: ... :

truth Symbol

true, false

and Connectives

$\wedge, \vee, \neg, \rightarrow, \equiv$

Propositional Calculus Sentences

Every propositional Symbol and truth Symbol is Sentence

eg: true, P, Q, R are Sentence

The negation of a Sentence is a Sentence

eg: ¬P and ¬false are Sentence

The Conjuction, or and, of two Sentences is Sentence

eg: P∧¬P is a Sentence

The disjuction, or or, of two Sentences is Sentence

eg: P∨¬P is a Sentence

The Implication of one Sentence from another is a Sentence

eg: P⟶Q is a Sentence

The equivalence of two Sentences is a Sentence

eg: P∨Q=R is a Sentence:

Legal Sentence are called well-formed formulas or WFFs

⇒ An expression P∧Q C P and Q

∧ Conjuction

∨ disjunction

⟶ Implication

The Semantics of the propositional Calculus

The Semantic means the meaning. The meaning of Sentence are stated here.

⇒ propositional Symbol Corresponds to a statement about the world.

eg: P may denote the Statement "It is raining" and Q may denote the Statement "I live in a known house"

The proposition may be either T or F

⇒ The truth value assigned to propositional Sentences is called an interpretation.

⇒ An Interpretation I of a set of proposition is the assignment of a truth value, either T or F,

⇒ The Symbol True is always assigned T

⇒ The Symbol False is always assigned F

⇒ The Interpretation of Truth value for sentence is determined

* The truth assignment of negation, ¬P,
where p is any propositional Symbol
F is assigned to p is T
T is assigned to p is F

* The truth assignment of Conjunction ∧, is T only when both Conjuncts have truth value T, otherwise F

* The truth assignment of disjunction ∨, is F only both disjuncts have truth value F, otherwise it T.

⇒ The truth assignment of Implication, →

⇒ The truth assignment of equivalence

Truth table

Negation (¬)

p	¬p
T	F
F	T

Conjunction (AND)

p	q	p∧q
T	T	T
T	F	F
F	T	F
F	F	F

Disjunction (OR)

p	q	p∨q
T	T	T
T	F	T
F	T	T
F	F	F

Implication

p	q	p→q
T	T	T
T	F	F
F	T	T
F	F	T

eg: A — it is hot
B — it is humid
C — it is raining

Question:
⇒ If is humid, then it is hot : B → A
⇒ If it is hot and humid then it is not raining
: A ∧ B → ¬C

Predicate Calculus

⇒ Predicate Calculus is an extension of propositional calculus.

⇒ In propositional logic we have seen how to represent statements using propositional logic. But unfortunately, in propositional logic we can only represent the facts, which are either true or false. propositional Logic is not sufficient to represent the complex sentences or natural language statements.

eg: "Some human are intelligent", or
"Sachin likes Cricket"

To represent the above statements PL logic is not sufficient, So we need some more powerful logic, which is called as first-order logic.

⇒ The first-order logic is also known as Predicate logic or predicate Calculus

⇒ First order logic is a powerful language that develops information about the objects in a more easy way and can

also express the relationship b/w those objects.

⇒ Consider the following statement

Ram is a student

Now Consider the above statement in terms of predicate Calculus.

⇒ Here "is a student" is a predicate and Ram is subject.

⇒ Let denote "Ram" as x and "is a student" as a predicate p then we can write the above statement as p(x)

⇒ Generally a statement expressed by predicate must have at least one object associate with predicate.

In our case Ram is the required object with associated with predicate p.

⇒ First order logic also has two parts

* Syntax
* Semantic

Basic elements

Constant : 1, 2, A, Bhanu, Hyderabad..

Variable : x, y, z, a, b ...

Predicate : Brothers, fathers, >, <

Function : Sqrt, ...

Connectives : ¬, ⇒, ∧, ∨, ⇔

Equality : =

Quantifiers : ∀, ∃

Atomic Sentences

Atomic Sentense are the most-basic Sentences of first-orders logic.

* We can represent atomic sentences as predicate(term1, term2 ... termn)

eg: Ravi and Vijay are brothers => Brothers(Ravi, Vijay)

Quantifier in predicate logic

~~We need Quantifiers to express ... words to instruct all and some.~~

The variable of predicate is quantified by quantifiers.

There are two type quantifier in predicate Calculus:

* Universal Quantifier
* Existential Quantifier

> universal quantifier - states that the statement within it is accurate for every value of specific variable.

Universal Quantifier

=> It represented by Symbol is ∀

=> universal Quantifier [for all, everyone, everything.

=> universal quantifier is a Symbol of logical representation, which specifies that statement within its range is true for everything

eg: "Man is Mortal"

=> Can be represented into propositional form ∀x P(x)

where P(x) is predicate

x = mortal

∀x = all men

Existential Quantifier

⇒ It means that the statement withers scope are true for some value of the specific variable. It denoted by symbol ∃

Eg: Some people are "dishonest"

⇒ Can be transformed into propositional form ∃x P(x)

⇒ P(x) is predicate

⇒ x dishonest

⇒ ∃x Some dishonest men

Semantics

⇒ In the Semantic of propositional logic, we assign truth value to atom, the predicate logic we can assign a truth value is a predicate P(t1,t2...tn) applied to terms.

⇒ If we can define semantics in predicate Calculs first we define interpretation over a domain D.

Let domain D be non-empty set.

1) Each Constant is assigned an element D
2) Each variable is assigned to a non-empty Subset of D.
3) Each function f of arity m is defined on m arguments of D and returns mapping from D^m into D
4) Each predicate P of arity n is defined on n argument of D and returns mapping from D^n into {T if ∃}

Inference Rule

⇒ In artificial Intelligence, we need Intelligent Computers which can create a new logic from old logic or by evidence, so generating the Conclusion from evidence and facts is termed as Inference.

⇒ Inference rules are applied to derive proofs in AI. and the proof is a sequence of Conclusion that leads to desired goal.

Rules

Following are some terminologies related to the Inference rule

1) Implication: one of the logical connectivity is represented by $p \rightarrow q$. It is known as

2) Converse: It is like to the implication it is represented by $q \rightarrow p$

3) Contrapositive: The negation of converse is termed as contrapositive

$\neg q \rightarrow \neg p$

Inverse: The negation of implication called inverse

$\neg p \rightarrow \neg q$

Types of Inference rule

1) Modus ponens:

=> It is one of the most important rule of inference

=> It state that if p and $p \rightarrow q$ is true, then we can infer that q

$$\frac{p,\ p \rightarrow q}{q}$$

eg: 1) If I am sleepy then I go to bed $\Rightarrow p \rightarrow q$

2) I am sleepy $\Rightarrow p$

3) I go to bed $\Rightarrow q$

Now we can say that $p \rightarrow q$ is true the p is also true then q will be true

p	q	$p \rightarrow q$
0	0	0
0	1	1
1	0	0
1	1	1

2) Modus Tollens

⇒ It states that, $p \to q$ is true and $\neg q$ is true, then $\neg p$ will also be true.

$$\frac{p \to q, \neg q}{\neg p}$$

eg: 1) "If I am sleepy then I go to bed" $\Rightarrow p \to q$

2) "I do not go to the bed" $\Rightarrow \neg q$

3) "I am no sleepy" $\Rightarrow \neg p$

AND elemination

The and elemination states that. Conjuctive Sentesse are true.

If $p \wedge q$ then we can conclude that p and q are true.

AND Introduction

If p and q are true, then $p \wedge q$ are true.

Universal Instantiation

Universal Instantiation is also called as universal elimination

⇒ If a is from the domain of x,

$\forall x\, P(a)$

let us says $P(a)$

Logic based Financial Advaices

⇒ The logic-based financial advaices used to help the Investment to make decision regarding the Investment in a Saving account or stock maret.

⇒ It is good example of application of use predicate Calculus.

⇒ In this application decision making is depend on the following Cretera

* Individual with inadequate saving account should always make increasing the amount saved their first priority, regardless of their income

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⇒ Individual with adequate income should consider Saving account and adequate income should consider a risk but potentially more profitable investment in stock market.

⇒ Individual with less income who already have an adequate Saving account wanted to consider Splitting this surplus income between Saving and stocks to increase the income.

The Saving account and income can be represent using binary predicate.

1) Saving_account (adequate)
2) Saving_account (inadequate)
3) Income (adequate)
4) Income (inadequate)

The above predicates can be used to represent the criteria of decision making as follows

1) Saving_account (inadequate) → Investment (Saving)
2) Savings_account (adequate) ∧ Income (adequate) → Investment (Stocks)
3) Savings_account (adequate) ∧ Income (inadequate) → Investment (Combination)

Characteristic of AI problem

1) Is the problem decomposable ?

Here we will have a problem and we will devide the problem into subproblems and we will solve each subproblem and at the last we will combine answer of all of them to get the final result

eg: Sorting, Integration, satisfying problem

satisfying (non-decomposable)

2) Can solution steps ignore or undone ?

To find out solution in a problem then we can solve the problem step by step manner. Suppose if some steps should be ignored, then without that step the problem

is Completed or not

The mainly the problems are classes 3 classes

1) Ignorable problems: In which Solution steps can be ignored
eg: Theorem proving

2) Recoverable: In which Solution step can be undone
eg: 8 puzzle problem.

3) Irrecoverable: In which Solution step cannot be undone
eg: Chess.

3) Is the problems universe predictable

=) The outcome of problem can be predictable
eg: In 8 puzzle problem when you're moving a move we know exactly what the solution will be ie, what might be the next step we can be allowing. In which all the next next step are predictable.

4) Is the good solution is absolute or relative

here we will have two types of problem
1) Absolute
2) Relative

For absolute problem we are focusing on geting the solution and for the relative problem we are focusing on getting the optimum solution

eg: Absolute: percentage Season
Relative: Traveling Salesman problem

5) Is the Solution on state or path

we have Solution on state form or path form
Watching

6) What is the role of knowledge

There are two things
⇒ Fixed knowledge: In which knowledge is fixed we can't change it

Eg: Chem

Expert knowledge: to have knowledge have to be updated.

Eg: election C

1) Does the task require interaction with a person?

We are having problems like Solitary task and another is Conversation.

In Solitary there is no interaction between machine and a user or human here we will give basic rules and laws to the Computer and machine will work according to that

Eg: Theorem proving

In Conversational task there is intermediate Communication among machine and user: not AI required

Eg: Medical diagnosis