03/07/2018

ARTIFICIAL INTELLIGENCE.

Intelligence revolves around the skill of Reasoning. Reasoning refers to the process of finding the appropriate path towards arriving at a viable solution for an available problem.

Pattern - A set of events that get repeated over a period of time.

Agent - Given a set of conditions, it performs a desired action.

An Intelligent Agent - Tries to inference the request and tries to solve it by itself.

To stimulate intelligence we need Rules. Rules can be defined for a system by means of a set of if-then rules.

If-then rules showcase the set of steps to be executed based on a given set of conditions.

Inference - Understanding the conditions and deducing a affirmation

Reasoning - Understanding the conditions and deducing a path to a solution.

Artificial Intelligence is the process of replicating an intelligence pattern into a non-living entity. The inspiration for AI is a natural and inherent intelligence.

Hexagon serves as a better space utilization polygon compared to other tetrahedrons.

Eg :- Honey combs and base stations.

Swarm Behaviour :- Any quality we inbibe from living animals.

/Swarm Intelligence

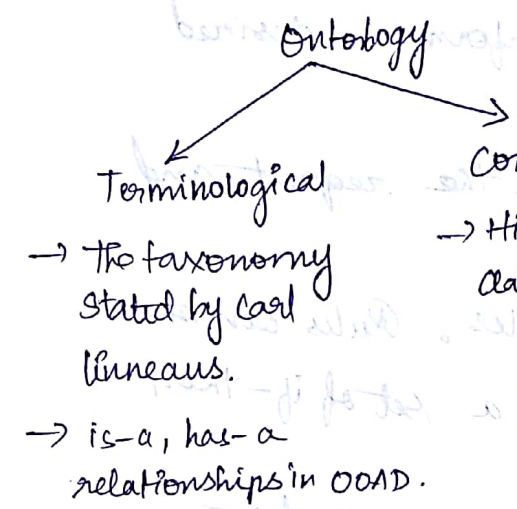
Eg :- Honey bees and their interaction with the swarm.

Pheromone – A chemical that helps ants to identify unclaimed food.

Inspiration for Network Routing.

Bio Inspired Computing – The field of computing that deals with Natural Intelligence.

Ontology – A form of knowledge Representation.



An intelligent System:-
Does not believe in its logic alone. Capable of reversing

An Expert System:- beliefs
An answer for every question based on the logic/ belief it has been program with.

Making a computer forget is the most difficult and currently the unaccomplished task in the field of AI.

Neuro Linguistic Programming (NLP):-

→ A field that talks about Neuro life balance and the phenomenon of remembrance.

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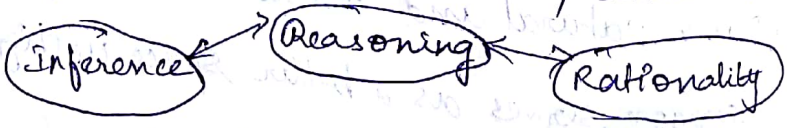
Decision-Making:- The power to pivot based on a condition/ circumstance

Who discovered the method to communicate with plants? (H.W.)



Rational:- The capacity to Reason and balance the scales.

Constrained Programming:- Deriving a solution using a given set of conditions. / Propagation.

Three levels of Reasoning

→ Syntax (Rules).
→ Semantics (components).
→ Pragmatics (expectations).

An inherent "Context" level for comprehending the meaning.
Eg:- Sarcasm under pragmatics.

Eg:- Soppanasundari ah yaar Vechurka.
↓ pragmatics ↓ context.

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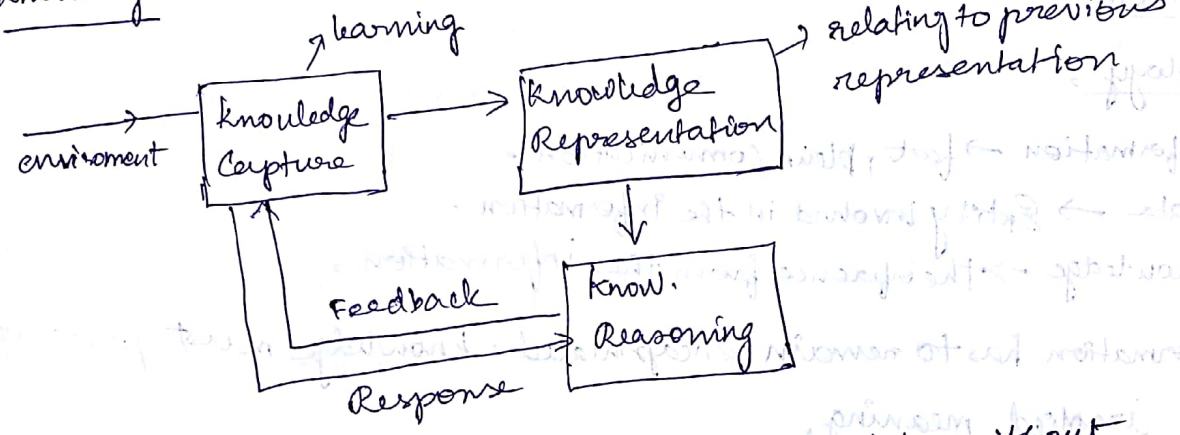
Knowledge



Knowledge Capture:- The process of observing something without no effort to understand/find what that is.

Knowledge Reasoning:- Understanding the environment to deduce the motive of the events.

Understanding:- Capture + Representation + Reasoning.

Capture:- get/take info from surroundings via sensory organs.

Environment:- The components our sensory organs have access to constitutes our relative environment.

Reasoning:- Accepting & Neglecting imbibed facts based on evaluation conditions.

Description logics.

→ A method/language of knowledge representation
→ Only dealing with I order logic.

→ Knowledge is represented in the form of ontology. It is a collection of nodes with connections based on required logic.

Nodes are termed as concepts and the links are called relations.

If the concept has description via attributes → Ontology.

Only concept is present → Terminological Ontology.

A concept is defined by its properties/attributes.

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Ontology :-

Information → fact, plain communication.

Data → Entity involved in the information.

Knowledge → the inference from the information.

Information has to remain encapsulated. knowledge must perceive the implied meaning.

There is no structure for information. It can be unconstrained.

Data establishes relationships between entities.

Ontology deals with the semantic layer of knowledge.

Eg :- Penguin is a bird.

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S0 : All birds fly. → Statement (combinations of facts and truth).

S1 : Penguin is a bird → Premise (A logical derivation that may/may not hold)

S2 : Penguin fly. → Assumption.

predicate logic has no need to stay true. Every representation is a an entity with no place for grammatical connections.

Universally accepted facts can't be given a second thought.

A fact is bounded by constraints of the entity.

Eg :- Sunrises in the east.

Sun - fact/entity.

East - Indicative word & can't be considered as a fact.

From an entity bird we derive an assumption that it has wings. Only on personal perception we analyse the premise's truth.

Causal
~~Cause and~~ Reasoning :- Causal is the primary evidence to backup a truth and reasoning is the method by which we equate the truth and evidence logically.

Eg:- Wrt penguins, we realise feathers aren't necessary for birds to fly.

Yet feathers exist for all birds. So we refine the fact to include Binary cases. The fact fails for particular subset of all possible entity.

Exception - Universally present, personally absent.
Exclusive - Universally absent personally present.

Types of Reasoning :-

→ Deduction (Cause and effect : If A and B let C happen).
→ Induction (Same as M.I.).

Eg :- Bharathi is tall.
(Po) So : Bharathi is tall.
(Pi) S1 : Bharathi is fair
S2 : Bharathi female.

The assumption was useless as both premises didn't contribute to a fruitful inference.

→ Retroduction
→ Abduction.

+ deduction can go wrong if the machine hasn't had sufficient training.

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FIRST ORDER LOGIC

Sentence → Atomic Sentence
| (Sentence Corrective Sentence)
| (Quantifier Variable, Sentence)
| ¬ Sentence.

Atomic Sentence → Predicate (Term,) Term-Term

Term → Function (Term, . . .)
| Constant
| Variable.

Corrective → ⇒ | ∧ | ∨ | ⇔

Quantifier → ∀ | ∃

Constant → A | X₁ | John |

Variable → a | x | s

Predicate → Before | Has colour | Raining.

Function → Mother | Leftleg.

① Statement 1 :- King John.

⇒ King (John)
F() C

② Every John is a King. | The goal is to represent every x as king
∀John → ∀x ⇒ John king(x)

③ Every king is a John.
→ Naive approach not allowed as John is a constant.
∀x King (x) ⇒ (x ⇐ John).

④ John is an evil king.
EvilKing (John).
Adjectives can't be expressed in Order I.

⑤ Richard is the Brother of John.
Brother (John) ⇒ Richard.
↳ Brother (Richard) ⇒ John.
While expressing bigender relation the relationship tends to point in the opposite.

⑥ Seeta is the wife of Rama.
Wife (Seeta) ⇐ Rama.
⇒ λ → R sequence
wife (seeta, Rama).

⑦ wife of
Rama is Sita.
wife (Rama, Sita).

1st Order logic has no provisions to accomodate gender.

=) L→R is the sequence to be followed and the sentence has to be considered as provided.

⑧ John is the Brother of Richard.

Brother(John, Richard).

⑨ I love you. (Not possible in 1st order).

Love(I, you) — No provision to handle pronouns ✗.

x⇒I ∧ y=you] Love(x,y).

⑩ ⇒ Rama loves Sita.

loves(Rama, Sita).

⑪ Every daughter loves her father.

Loves (daughter, father) → Quantifier can't be applied.

$\forall x$ - daughter(x) ∧ y = father(y).

Every function can take a maximum of 2 arguments.

⑫ Everyone loves someone.

⑬ Everybody likes Teachers except a few.

⑭ Brothers.

$\forall x,y$ Brother (x, y)

Brother

$\forall_{x,y}$ Brother(x) ⇐ Person(x) ∧ Male(x) ∧ hasSibling(x) → y

⑮ Brothers are siblings.

$\forall x,y$ Brother (x,y) ⟹ Sibling (x,y)

⑯ Mothers and Daughters are friends. ⑰ Daughters are friend.

$\forall x,y$ Daughters

⇒ Brothers

$\forall x$ (Person(x) ∩ Male(x)) ∩ ($\forall y$ Person(y) ∩ Male(y)) ∩ has-Sibling(x,y)

↳ Brothers(x,y)

⇒ Daughters :-

$\forall x$ (Person(x) ∩ Female(x)) ∩ ($\forall y$ person(y) ∩ Female(y)) ∩ has-Sibling(x,y)

Needed for sisters.

∩ has someparent(x,y) ↳ Daughters(x,y)

(17) Everybody loves somebody.

$\forall_x \exists_y$ loves(x,y) $\Rightarrow$ $\exists_y \forall_x$ (person(x) $\wedge$ person(y)) $\Rightarrow$ loves(x,y).

person(x) person(y)

$\Rightarrow \forall_x \exists_y$ (person(x) $\wedge$ person(y))

(18) There is someone who is loved by everyone.

$\exists_y \forall_x$ (person(x) $\wedge$ person(y)) $\Rightarrow$ loves(x,y).

$\Rightarrow \exists_y \forall_x$ loves(x,y).

(19) Everyone likes icecream.

$\forall_x$ likes$(x,$ icecream$)$ $:= A(x)$

(20) There is no one who does not like icecream.

$\Rightarrow \sim(\forall_x$ likes$(x,$ icecream$))$.

(21) Everyone does not like icecream.

$\forall_x \sim$(likes$(x,$ icecream$)$).

(22) Someone does not like icecream.

$\forall_x \exists_y \sim$(likes$(x,$ icecream$)$)

(23) Henry is the father of John.

Father(Henry, John).

(24) Richard has atleast 2 brothers.

$\forall_{x,y}$ (person(x) $\wedge$ male(x) $\wedge$ person(y) $\wedge$ male(y) $\wedge (x \neq y)$)

$\Rightarrow P$

(25) Grandparent is a parent of someone's daughter.

$\exists_{x,y,z}$ (Parent(x,y) $\wedge$ Parent(y,z)).

$\wedge \exists_{a,b}$ (Female(b) $\wedge$ Parent(b,a)) $\wedge$ Parent(b,x).

(26) Aniruddh has only one lover.

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(1) Everyone who loves all animals is loved by someone.

(2) Anyone who kills an animal is loved by no one.

(3) Jack loves all animals. $\Rightarrow \forall x \; Animals(x) \Rightarrow loves(Jack, x)$.

(4) Either Jack or Curiosity killed the cat, who is named Tuna.

(5) Did curiosity kill the cat? $\rightarrow kills(curiosity, cat)$.

(6) Who killed Pana? $\rightarrow kills(x, Diana)$

(9) ~~Who~~ employed whom?

A:- employs(x, y).

(21) What is your age?

Not possible (1st order restriction).

(8) Democracy is by the people, of the people, for the people.

(10) Every mammal has a parent.

(11) Horses, cows, pigs are mammals

(12) Brothers and sisters have I none. But that man's father is my father's son.

(13) Dogs are Dogs $\Rightarrow \forall x \; Dog(x) \Rightarrow Dog(x)$.

(14) Spare the rod and spoil the child.

(15) Shankar was flying. $\Rightarrow flies(shankar, yesterday)$.

(16) Reign of Elizabeth II followed that of George VII.

1st order accepts only present tense as predicate but yesterday was included to indicate past tense.

~~After(Reign(George VI))~~ $\Rightarrow After(follows(Reign(EII))) \Rightarrow Reign(G6)$.

(17) Gods love. $\Rightarrow$ love of God).

(18) The fruit is too good $\Rightarrow$

(19) Keep learning

31/01/2018

① All Birds fly.

$\forall_x$ Bird(x) $\Rightarrow$ fly(x) (universal fact).

② Penguin is a bird.

Bird(Penguin). (statement).

$\Rightarrow \forall_{penguin}$ Bird(Penguin) $\Rightarrow$ Fly(Penguin).

$\therefore$ Fly(Penguin).

By observation it is wrong. A penguin naturally does not fly. The statement is to be reanalysed.

Conclusion:- ~~Bird~~ Fly(Penguin) is false.

Inference:- Bird(Penguin) is also false.

Bird(Penguin) is a statement that always holds true. So it can be negated. A certain coupling is needed to establish the statement.

Fly is an attribute of Class Bird.

Support 1:- Penguin has wings. Penguin flies.

~~Has~~ has_Wings(Penguin) is T $\therefore$ Fly(Penguin) is T But as per expert it is false.

Support 2:- wings-have-bones

F $\leftarrow$ has-bones(wings) T $\Rightarrow$ Fly(Penguin) T ⊗

has-wings(Penguin) T

Specify any condition with appropriate logical Notations.

$\rightarrow$ has_wings(P) T.

$\wedge$ (has-bones(wings)) F.

$\vee$ Fly(Penguin).

Induction:-

$\rightarrow$ Hen flies $\rightarrow$ Bird(hen).

$\rightarrow$ All Birds $\rightarrow \forall_x$ Bird(x) $\Rightarrow$ fly(x).

$\forall x+1$ Bird $(x+1) \Rightarrow$ fly $(x+1)$.
$\Rightarrow$ Bat flies $\Rightarrow$ fly (Bat)

$\therefore$ Bat is a Bird.

H.W:- Owl, Ostrich, Peacock.

1. Artificial Intelligence is a tough subject.
2. Wear jeans unless either they are dirty or you have a job interview today.
3. Wear a sweater if it is cold.
4. It is usually warm in summer.
5. everyone in our university is intelligent.
   ↳ Everyone in the university is intelligent.
6. Some students took internship in last semester.
7. Every student is also a genius.
8. All that glitters is not gold.
9. Only one student took greek in spring 2001.
10. The Best scoring greek is always higher than the best score in french.
11. This is the standard structure of a good CV.

Convert to 1° order

02/08/2017

Inference in first order logic:-

$\forall x$

→ Inference:-

Will Penguin fly? (B.C.).

Wings have no bones.

Penguins have wings ⇒ Penguins are Birds.

has wings (Penguin) ⇒ is Bird (Penguin).

Penguins are birds ⇒ Penguins fly. ✗

Penguins do not fly ⇐ Wings have no bones. (A)

Penguins have wings ⇒ Penguins are birds (B).

A & B ⇒ Penguins are birds that do not fly

Forward Chaining:-
Fact to Conclusion.

Backward chaining:-
Conclusion to fact

Eg:- Penguins have wings.
↳ Start from has wings (bones).
proceed to the All birds fly fact.

$\forall x \neg Bird(x) \Rightarrow \neg Flies(x)$.

UNIFICATION :-

① ~~If All birds fly~~.
$\forall x \neg(Bird(x) \Rightarrow Flies(x))$. $\Rightarrow$ No Birds fly.

~~$\forall x$~~ $\Rightarrow \forall x \neg Bird(x) \Rightarrow \neg Flies(x)$ $\Rightarrow$ No birds cannot fly.

② $\forall x (King(x)) \wedge Greedy(x) \Rightarrow Evil(x)$.
All kings who are greedy are evil.

③ King John. → John is Greedy.
What is the Inference → Conclusion :- John is evil.

Inferences are Based on Operators $\Rightarrow$ the use of $\forall x$ and $\wedge$ greedy stands implicity true.

If I was present inference wasn't stand true

② $\forall x \exists x (King(x) \wedge Greedy(x)) \Rightarrow Evil(x)$.
Here the logic applies to a subset only
Out of so many Johns, only a few adhere to the 2nd stmt.

③ $\forall x \forall y Brother(x,y) \Rightarrow Sibling(x,y)$
Reduce it.
$\Rightarrow \forall x, y$ Brother $(x,y) \Rightarrow$ Sibling (x,y).

b) ~~Can you~~ is $\forall x, y$ Siblings $(x,y) \Rightarrow Sibling(y,x)$.
A) yes the relation is symmetric.

c) ~~$\forall x$~~ $\forall x \exists y$ Loves (x,y)
Everyone loves someone.

d) $\exists y \forall x$ Loves (x,y)
Someone is loved by everyone.

Rules :-

① $\forall x \neg P \equiv \sim \exists x P$.

② ~~$\sim$~~ $\sim \forall x P \equiv \exists x \sim P$.

③ $\forall x P \equiv \sim \exists x \sim P$

④ $\exists x P \equiv \sim \forall x \sim P$

⑤ $\sim P \wedge \sim R \equiv \sim (P \vee R)$.

⑥ $\sim (P \wedge Q) \equiv \sim P \wedge \sim Q$.

⑦ ~~$\sim (P \wedge Q)$~~ $P \wedge Q \equiv \sim(\sim P \vee \sim R)$.

⑧ $P \vee R \equiv \sim$

07/08/2018

Agent

Rational lee

→ Balanced

rational <

Rationality

① Can a n

A) Yes, If

Measuring

→ Performa

Types of En

② Student

P-

E-

A-

S-

Environ

→ full

→ Det

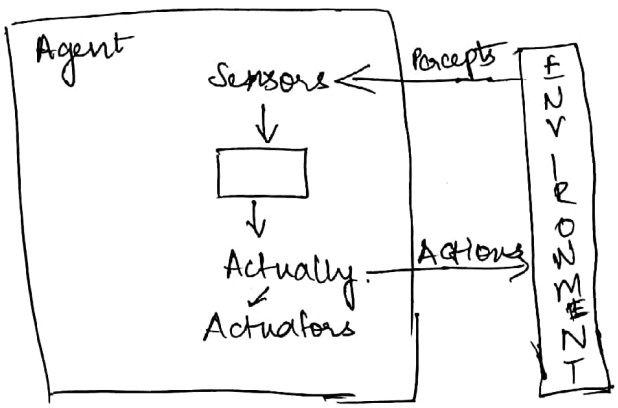
→ Episo

→ Stati

→ Disc

⑤ PVR ≡ N(TPAEO)

07/08/2018



→ Sense perceives what is happening around the environment.

Rational behaviour :-

→ Balanced decision making.

Rational ← Cognitive Neuroscience (Humanitarian Behaviour).
Cognitive Modelling (Rational Behaviour).

Rationality and Intelligence go hand in hand.

① Can a machine behave rationally.?

A) Yes, If we provide Decision-making ability.

Measuring Rationality

→ Performance Measures.

Types of Environment :-

Eg:- Taxi Driver.
P - Driving.
E - Road, taxi, city.
A - Horn, indicator, gears.
S - Mirror, Police, speedbreaker

② Student.
P - Read, write, memory.
E - School, College, Class.
A - Teacher, Peer, Book, Classroom.
S - Bell, deadline, exam.

Environment

→ fully observable vs. partially observable.
→ Deterministic vs. Stochastic.
→ Episodic (comm.) vs. Sequential (No comm.)
→ Static vs. Dynamic.
→ Discrete vs. Continuous.

→ Single Agent vs. Multi Agent.
(one person drives (train).
in car)