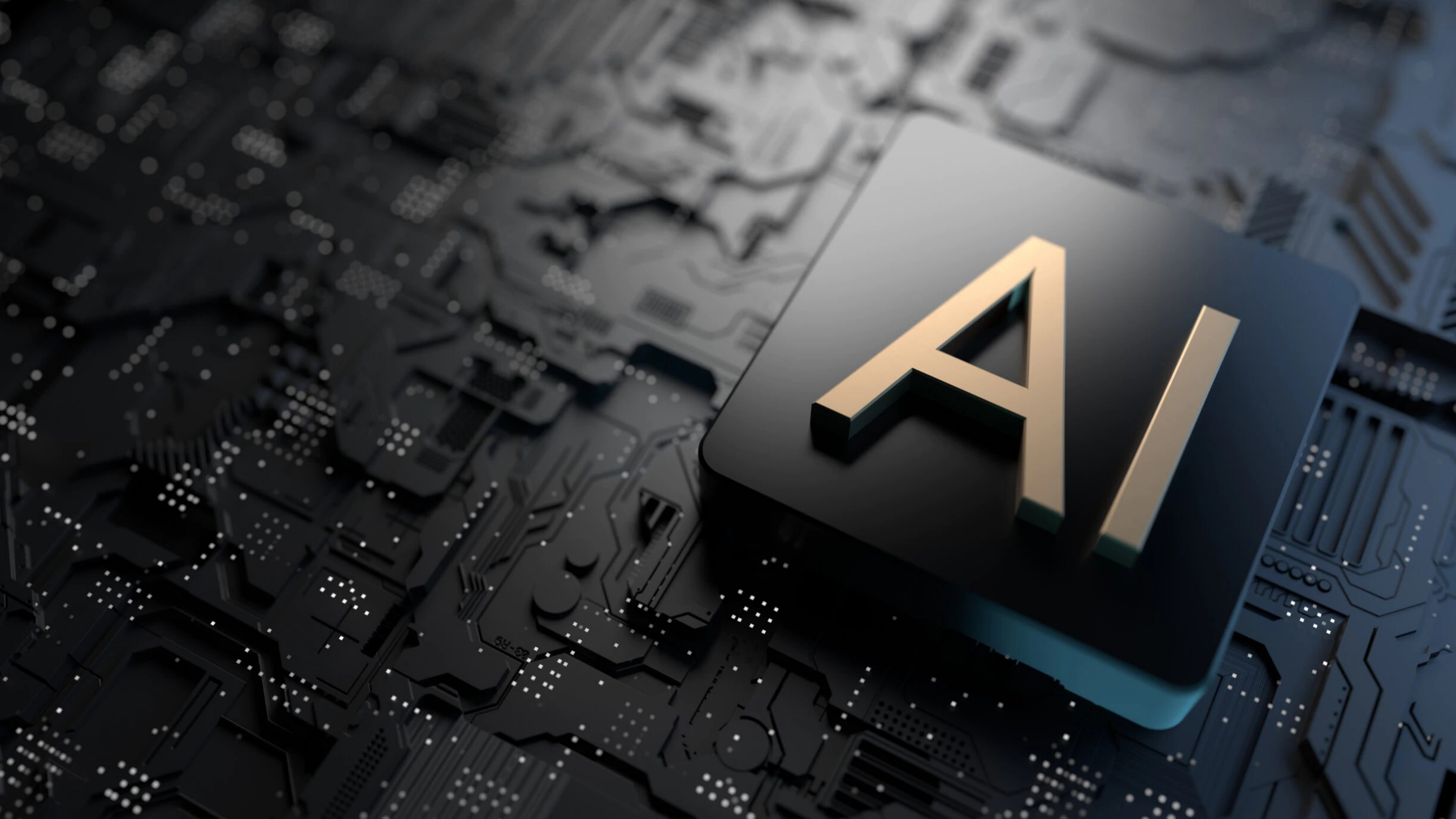
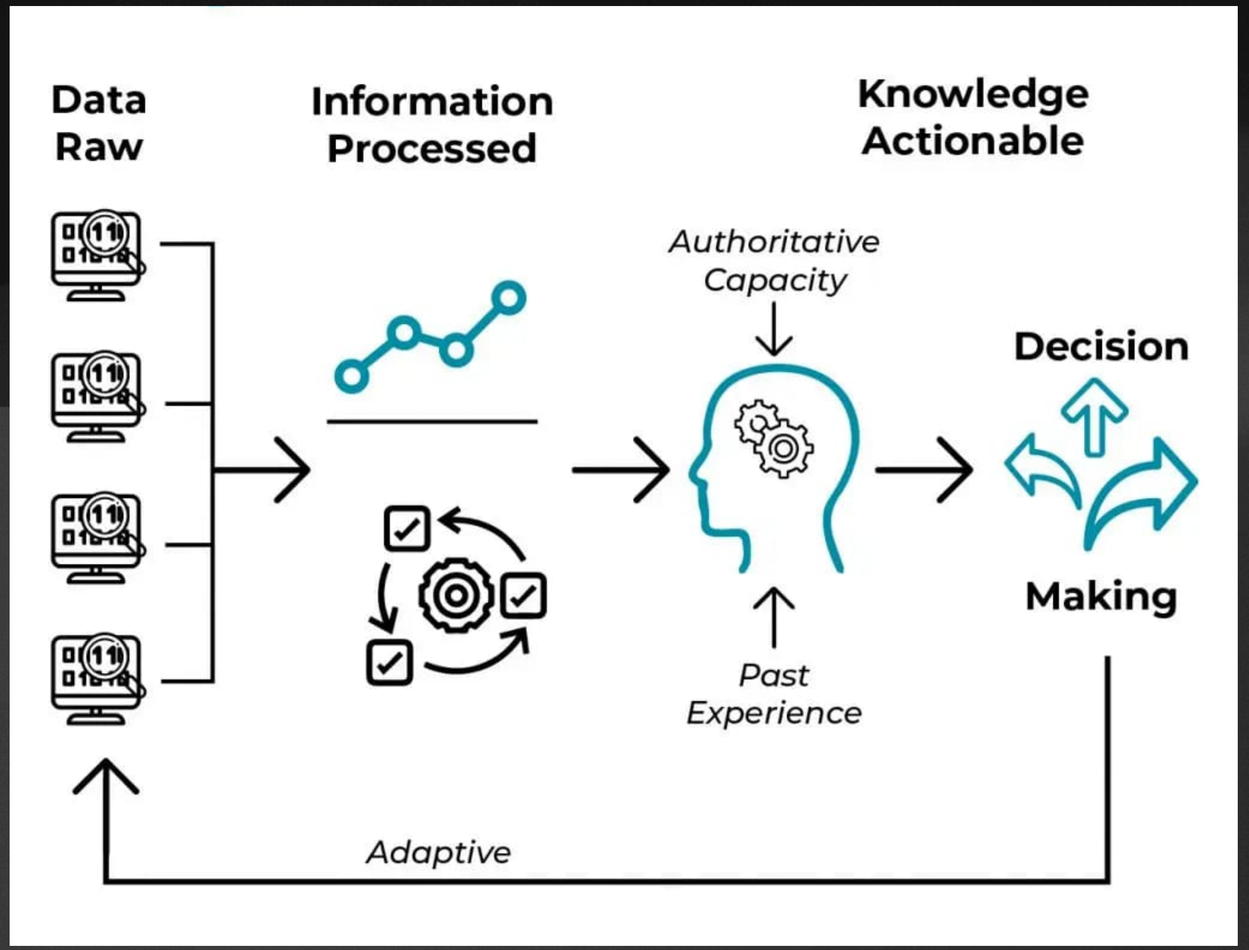

AI

KNOWLEDGE REPRESENTATION IN AI

What is knowledge representation?



Knowledge Representation in Artificial Intelligence refers to that concept where ways are identified to provide machines with the knowledge that humans possess so that AI systems can become better

Basic presentations to feed knowledge

- ***OBJECT:-***Numerous objects constantly surround humans. The information regarding these objects is something that we can consider as a type of knowledge. For example, cars have wheels, and the piano has keys, the train is a locomotive, etc.

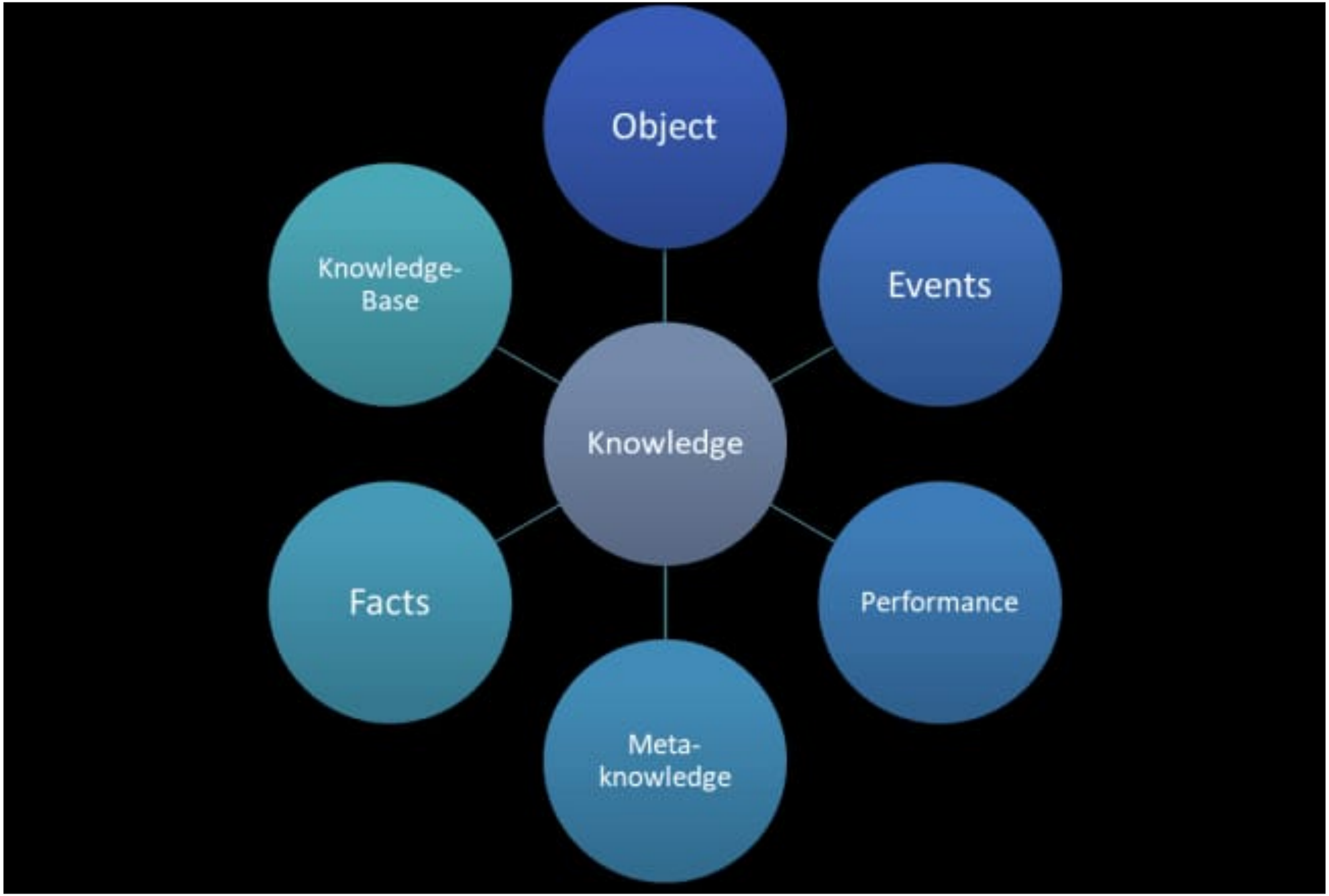
- ***EVENT:-*** Our perception of the world is based on what we know regarding the various events that have taken place in our world. This knowledge is regarding all those events. The wars, famines, achievements, advancement of societies, etc., are an example of this knowledge.

- ***PERFORAMANCE:-***It deals with how humans and other beings and things perform certain actions in different situations. Thus, it helps in understanding the behavior side of the knowledge.It deals with how humans and other beings and things perform certain actions in different situations. Thus, it helps in understanding the behavior side of the knowledge.

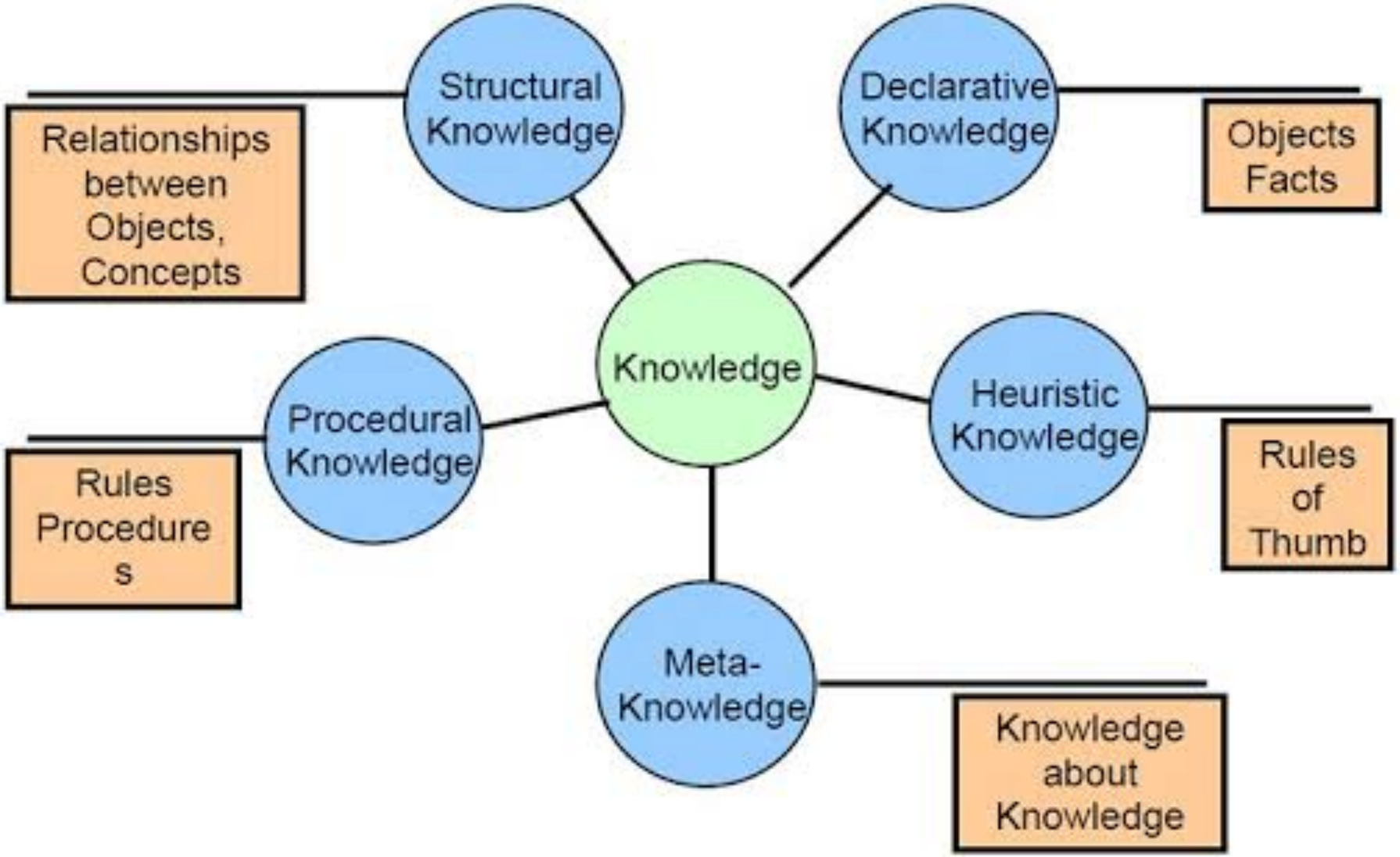
- ***META KNOWLEDGE: -***In a way, if we look at the world around us and take the sum of all the knowledge that is out there, then this can be divided into 3 categories: What we know, What we know that we don't know, and knowledge that we even are unaware of and Meta knowledge deals with the first concept. Thus, meta-knowledge is the knowledge of what we know.

- ***FACTS:-*** As the name suggests, this is the knowledge of the factual description of the world.

- ***KNOWLEDGE BASE:-***It is the main component of any human, i.e., having a knowledge base. This refers to a group of information regarding any discipline, field, etc. For example, a knowledge-base regarding constructing roads.


Object
Knowledge-
Base
Events
Knowledge
Facts
Performance
Meta-
knowledge

TYPES OF KNOWLEDGE REPRESENTAION



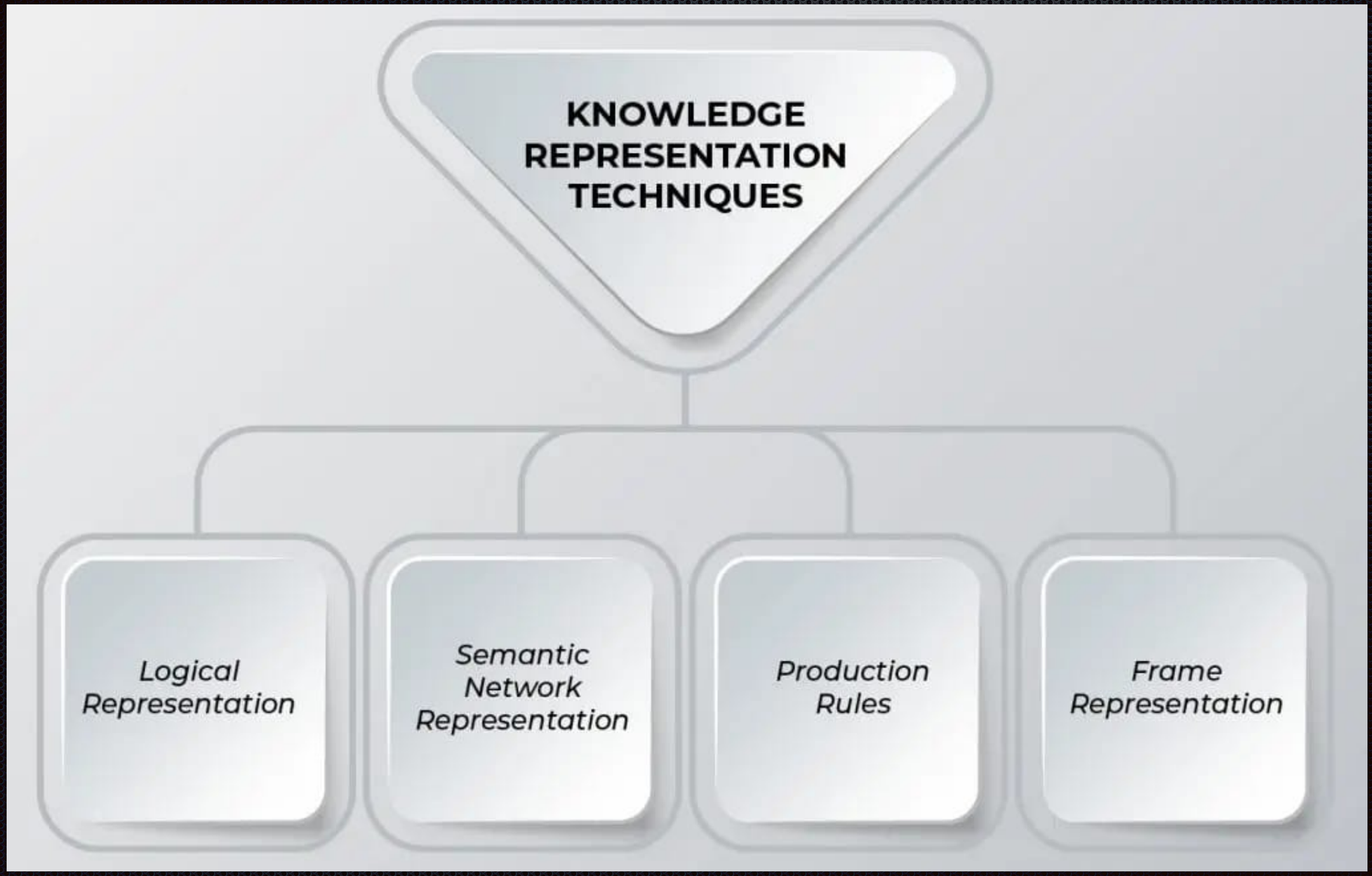
Relational knowledge concept

- Represent set of attributes and associate values.
- Used in database system.
- Weak inferential capacity.
- Simplest way of storing facts.
- Columns represents attribute names row represent corresponding values.

Relational knowledge concept

Name	Age(in years)	Sex	Qualification	Salary(in Rupees)
John	38	Male	Graduate	200000
Mike	25	Male	Undergraduate	150000
Mary	30	Female	Ph D	250000
James	29	Male	Graduate	180000

Knowledge Representation Techniques



Logical representation

Logical representation using two methods:-

1. *Prepositional logic:-* This type of logic representation is also known as statement logic. Which works in boolean i.e. true or false method

2. First-order- logic:-This type of logic representation is also known as first -order predicate calculus logic which is advanced version of prepositional logic where quantifiers and predicates are used.

Ex:- all humans are mortal cannot be represented using a relational approach it can be easily represented in predicate logic as

(∀x)human (x) ← mortal(x)

Let us consider John as X :

we have a fact John is human then we can easily infer that John is mortal.

SEMANTIC NETWORK REPRESENTATION

- In this form, a graphical representation conveys how the objects are connected and are often used with a data network.
- The Semantic networks consist of node/block (the objects) and arcs/ edges (the connections) that explain how the objects are connected.
- The relationships found in the Semantic Networks can be of two types

1. IS-A: relation connects to classes.
   - Man is a human i.e. man is a sub-class of human class
2. instance: relation relates specific member of class.
   - John is a instance of man

- This form of representation is more natural than logical. It is simple to understand however suffers from being computationally expensive and do not have the equivalent of quantifiers found in the logical representation.

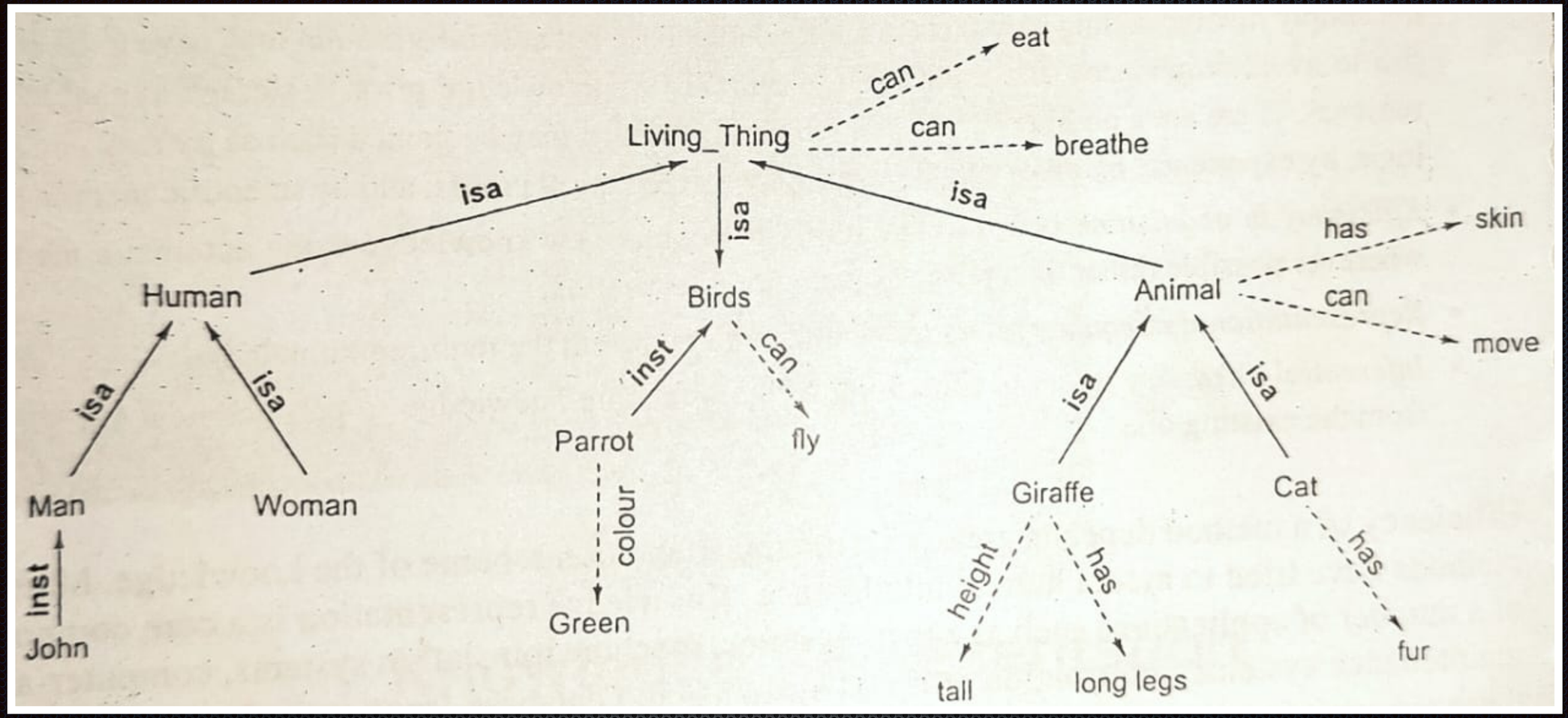
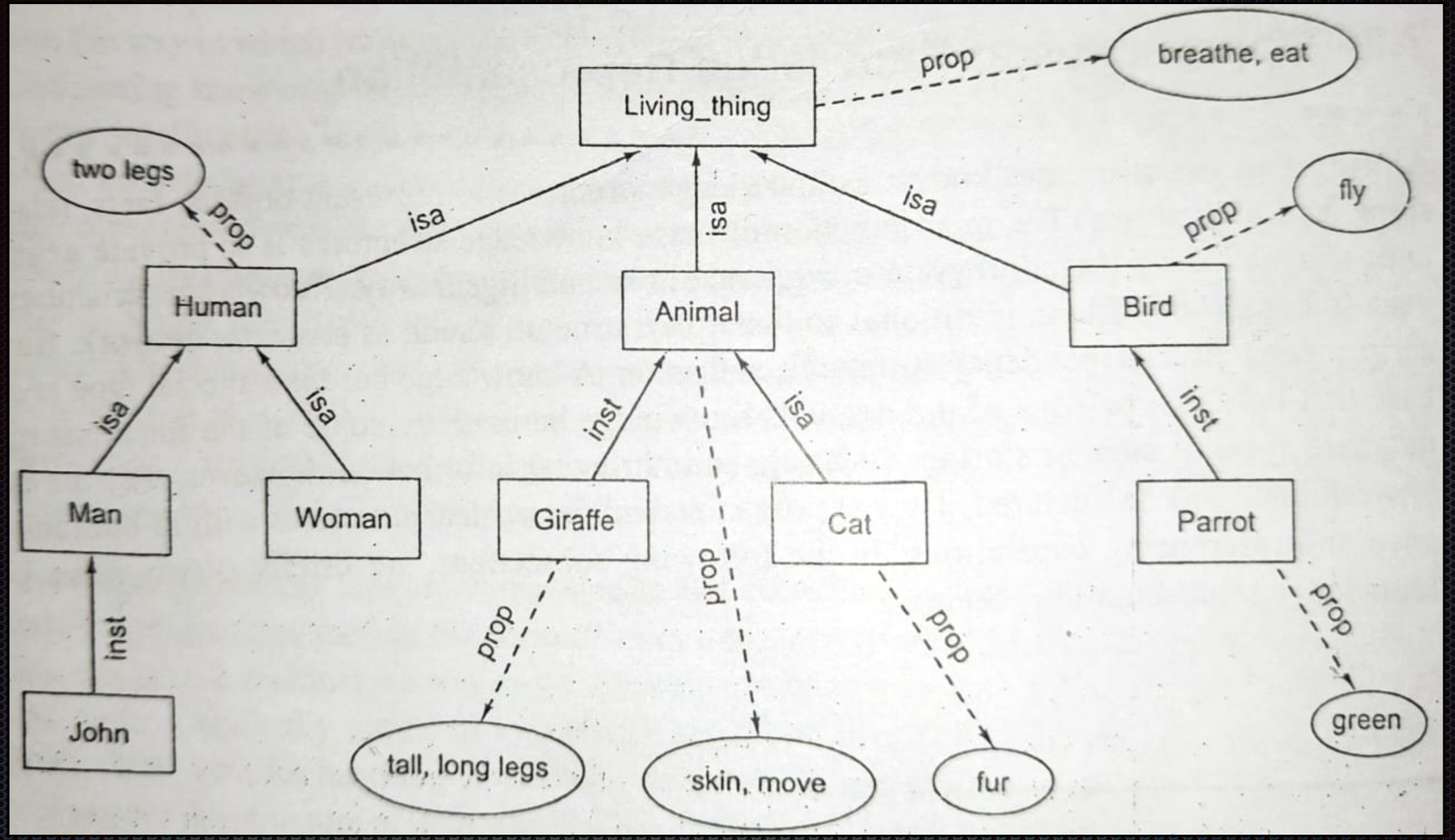


Fig knowledge representation using semantic network

We can also represent other relations such as {can, has, colour, height} are known as property relations Represented with dotted lines.



Concepts connected with proper links

- Square node represent objects, connected with is a or inst links
- Oval nodes represent property attributes attached to square nodes
- Property links are shown as dotted line

Property inheritance algorithm:

Input: object and property to be found from semantic net
Output: Return yes if object has desired property else return False
Procedure:

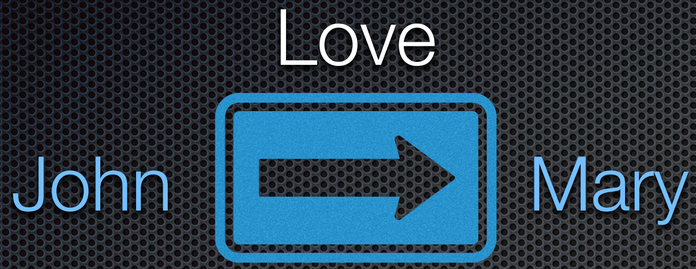
- Find an object in semantic net
- Found = False
- While [(object != root) OR found] do
  {
- If there is an attribute attached with an object then found = True;
- Else {
- Object = isa (object ,class) OR object = inst (object, class)
  }
  }

If found = then report ‘yes’ else report ‘no’

Extended semantic networks for KR

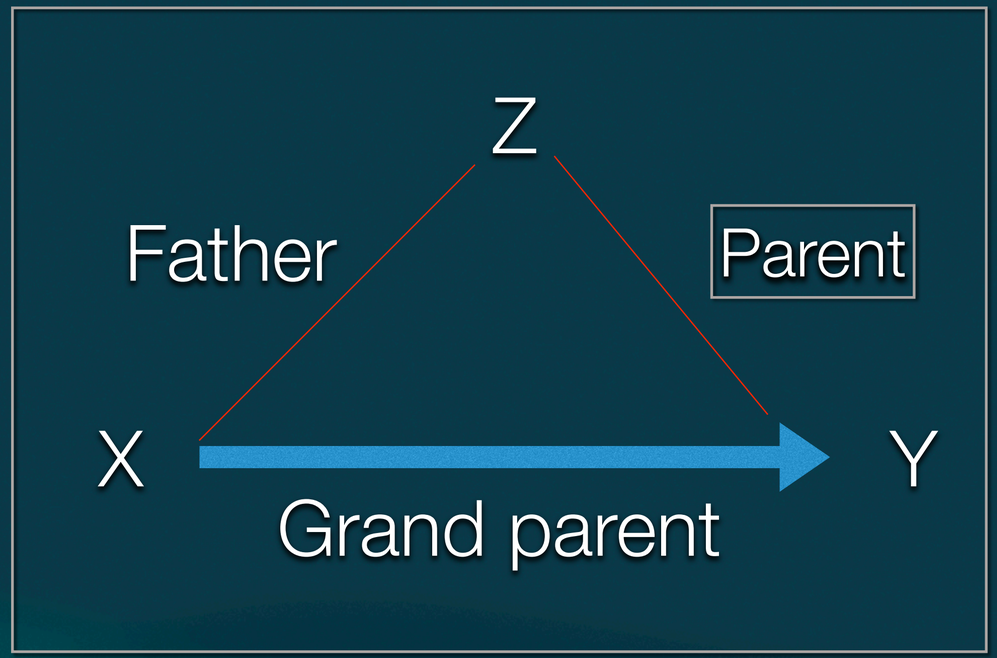
In 1979, are kowalski and his colleagues proposed extended semantic network which combines the advantages of both logical and semantic network where terms are represented by nodes similar to as done in conventional semantic network (where constant, variable, and functional terms are represented by constant variable and functional nodes respectively.

.Binary Predicate symbol



An atom of form love(John, Mary) is an arc labeled as love with its two end nodes representing John and Mary. The direction of arc indicates the order of arrangements of predicate symbol.

Conclusions and conditions of clausal forms



The arc denoting conditions are drawn with red line these are called denial
While the acs denoting conclusions are denoted with blue arrow known
As assertion links

Grand father(x, y) ← father(x, z), parent (z, y)

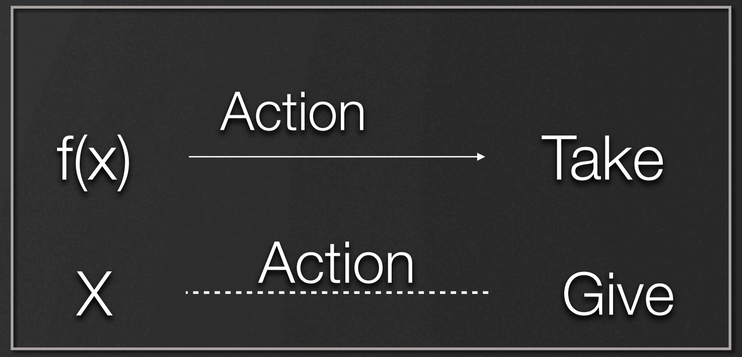
Inference rules:

Inference rules are embedded in the representation itself some of inference rules are being discussed as follows:

- The representation of the inference for every action of giving, there is an action of taking in casual logic is action

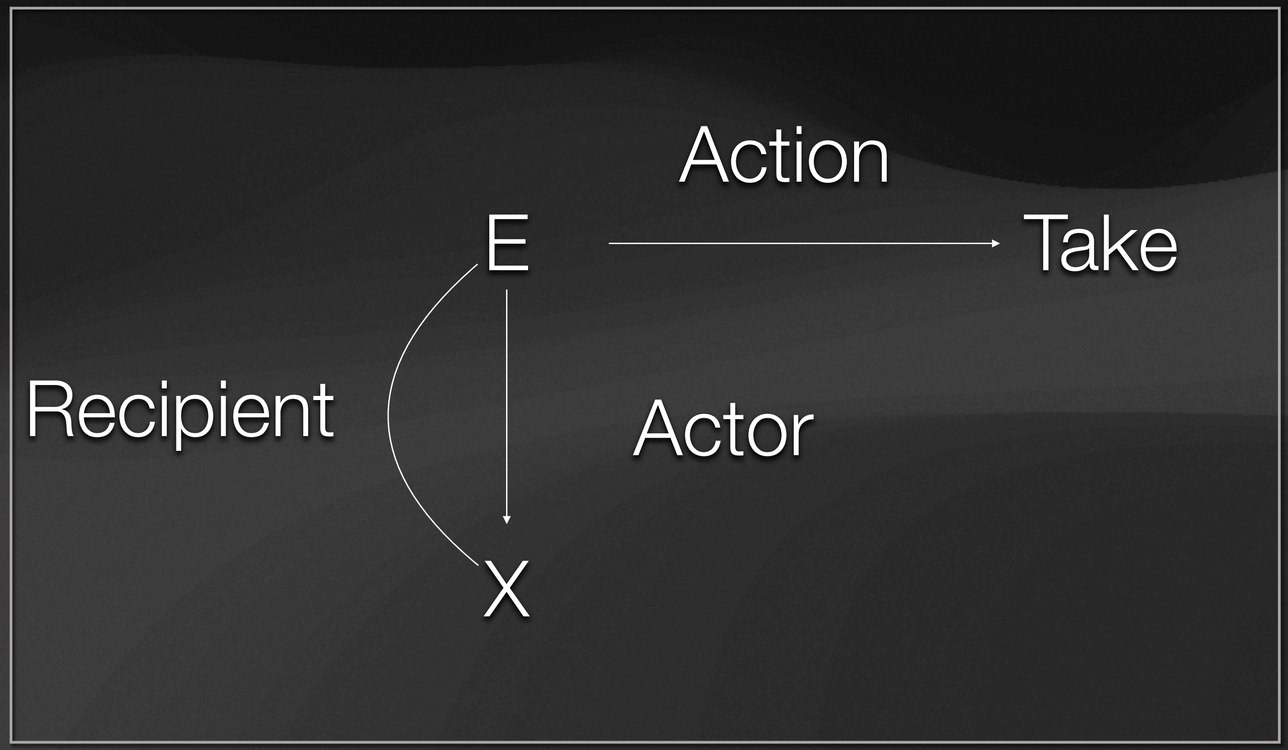
(f(x),take) ← action(x, give)

The interpretation of this rule is that event of taking action is a function of event of giving action.



- The inference rule that an actor who performs a taking action is recipient of this action and can be easily represented in clausal logic

recipient(E,X) ← action(E,take), actor(E,X)



Ex: Represent the following clauses in ESNet:

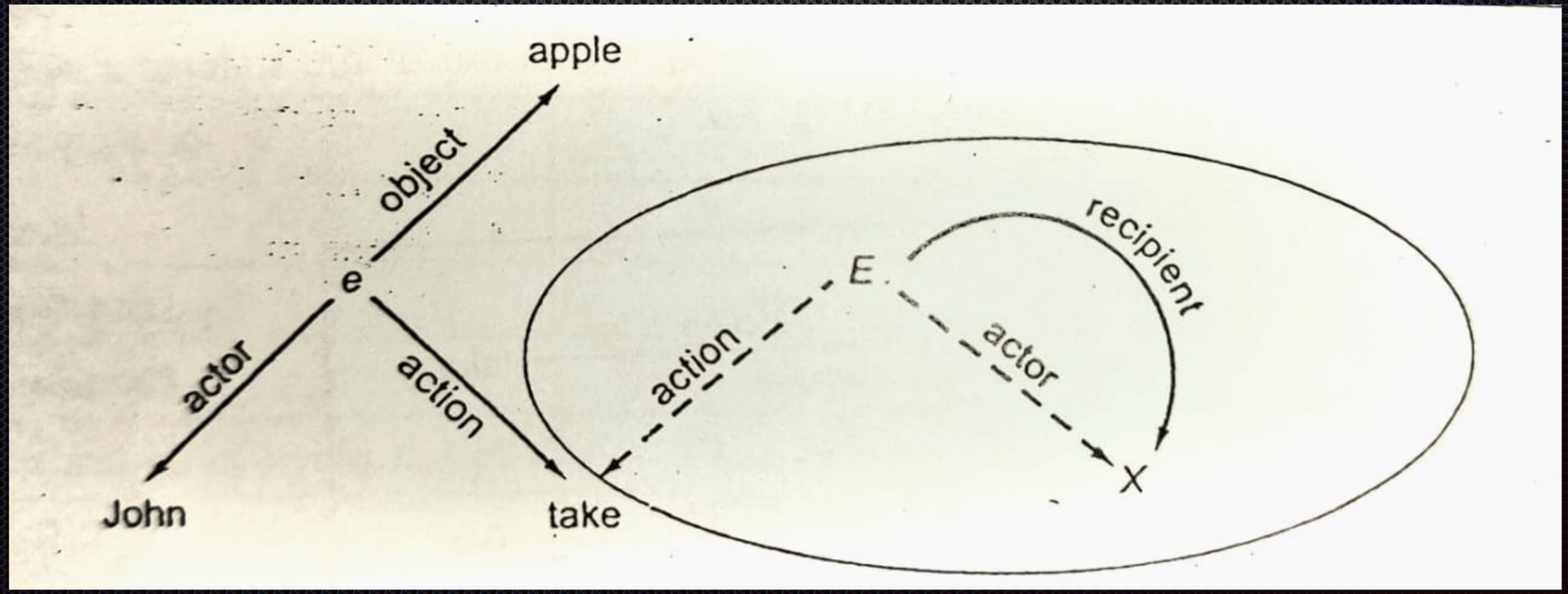
recipient(E,X). ← action(E, take), actor(E,X)

Object (e, apple)

action(e, take)

actor(e, John)

Sol: Here, E is a variable for some event and ‘e’ is an actual event.



Deduction in extended semantic networks:

In logic there are two types of inference mechanism :

- Forward reasoning inference mechanism:

  Also known as bottom-up approach where we start with the given assertion and derive new assertion using clausal role.

- Backward reasoning inference mechanism:

  Also known as top-down approach where we prove query from the set of clauses.

Example for illustrating inferencing methods

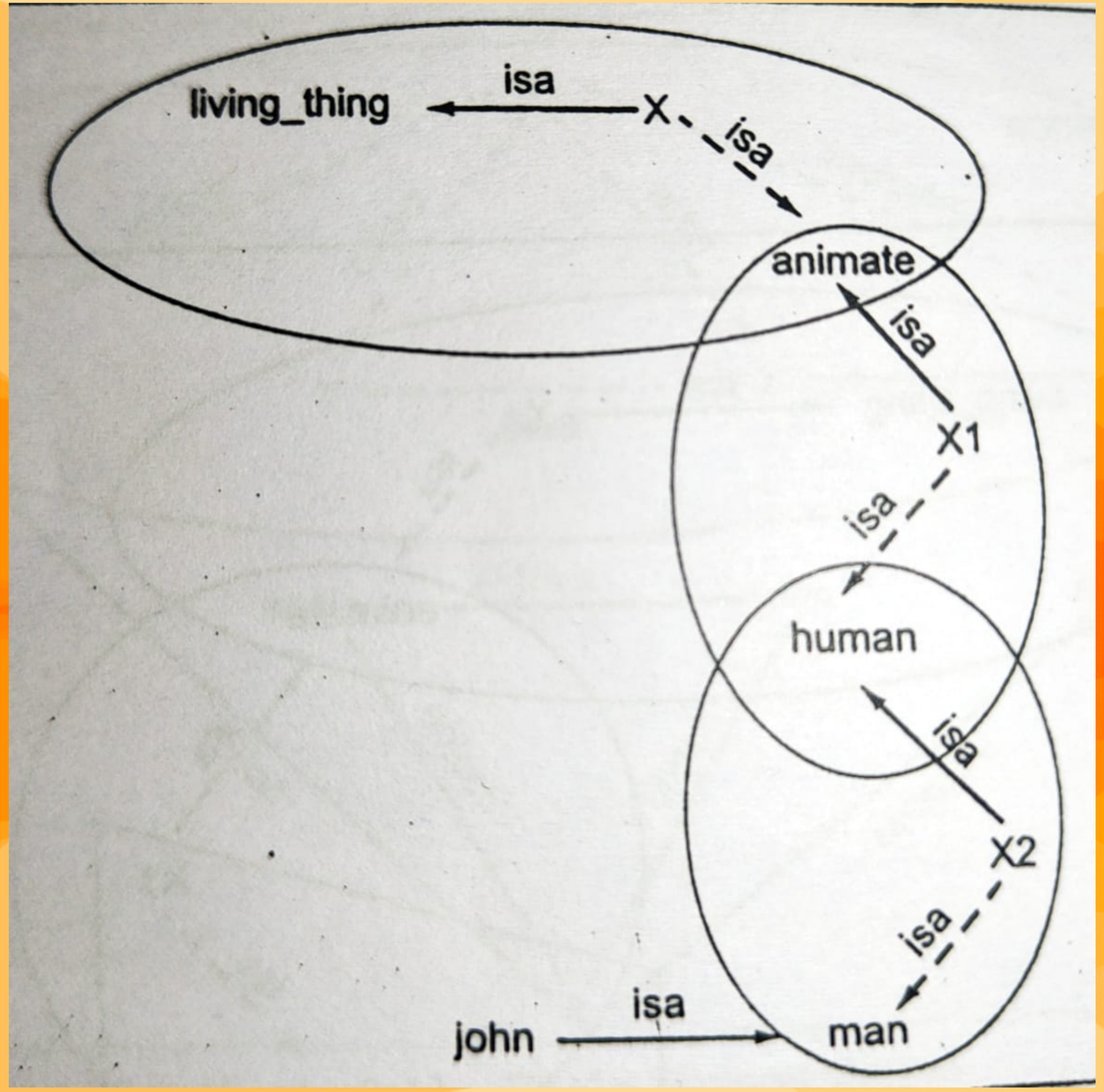
Consider the following example, represented in clausal form:

isa(X, living_thing) ← isa(X, animate)

isa(X, animate) ← isa(X, human)

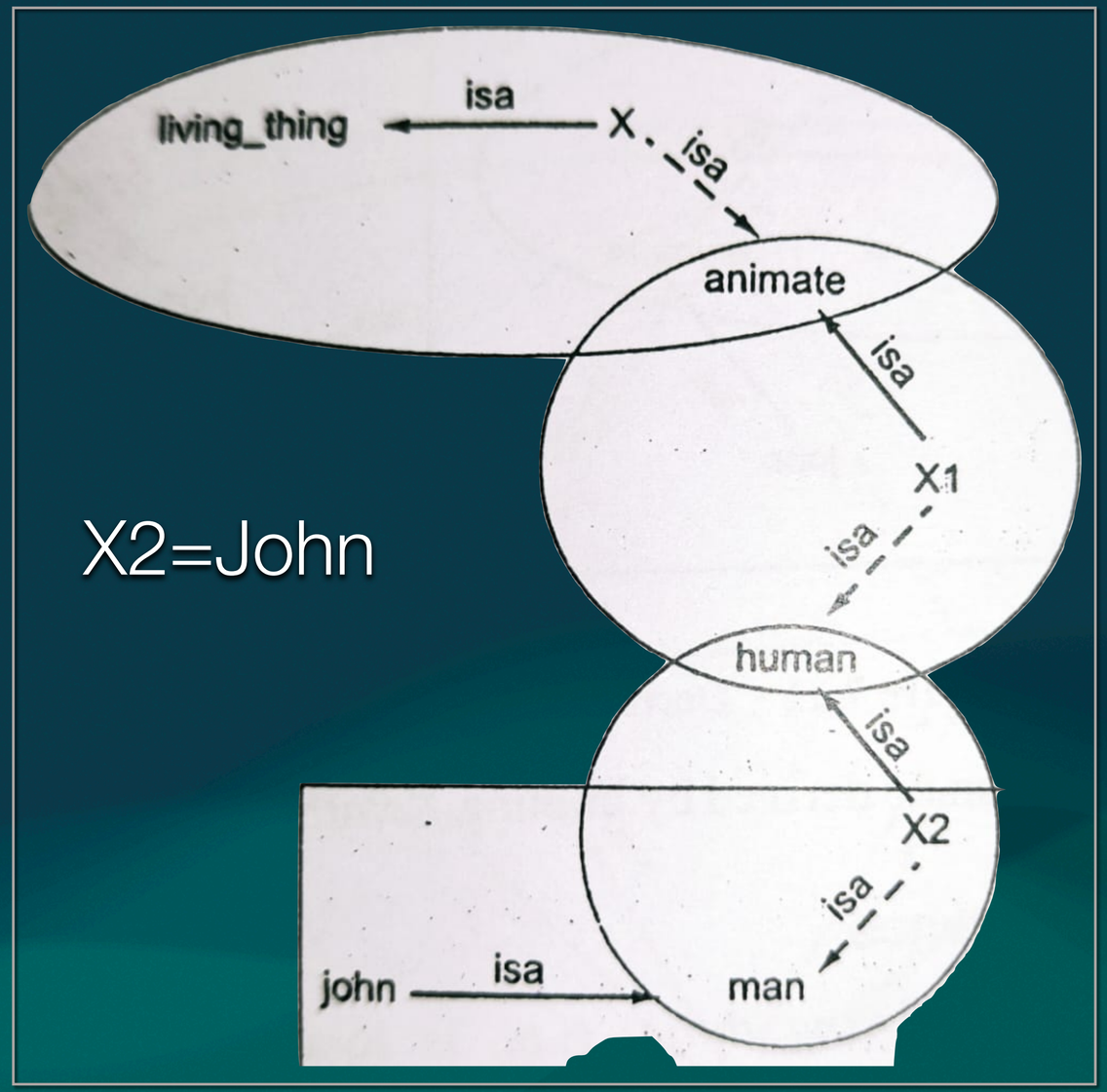
isa(X, human) ← isa(X, man)

isa(John, man)



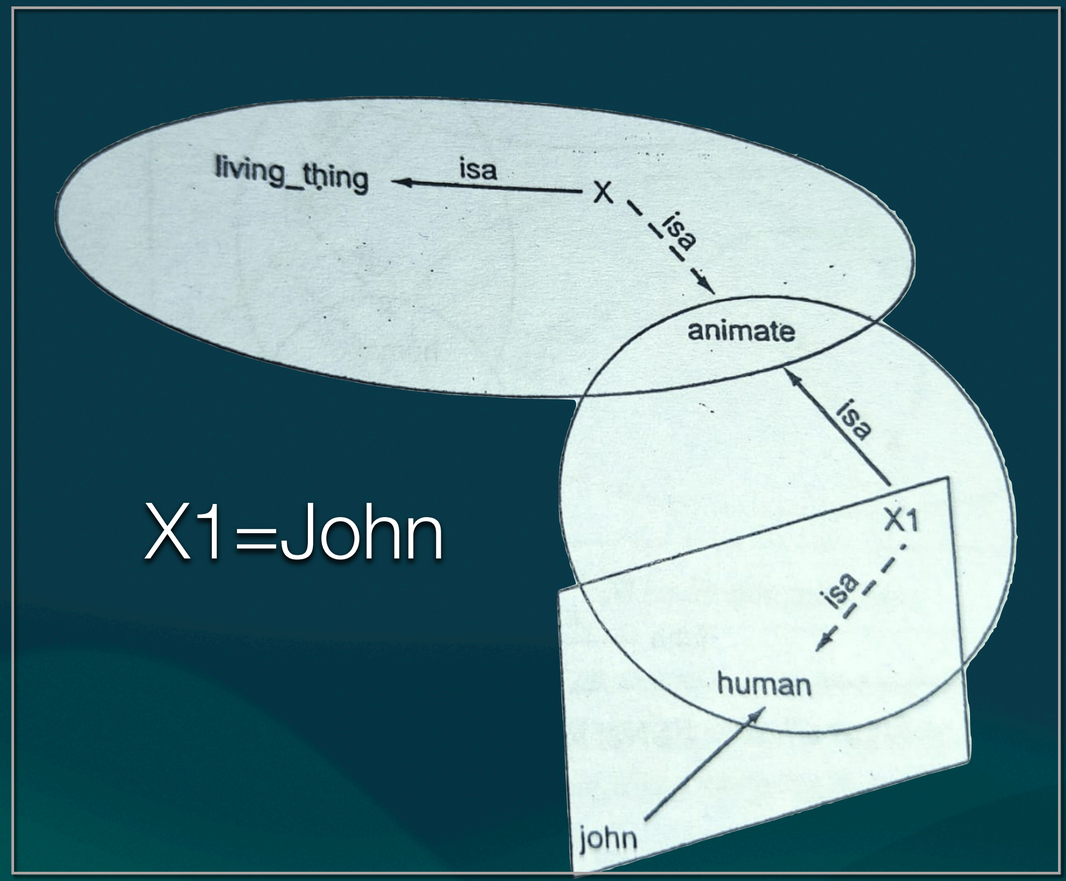
E.S net representation

Forward reasoning interface



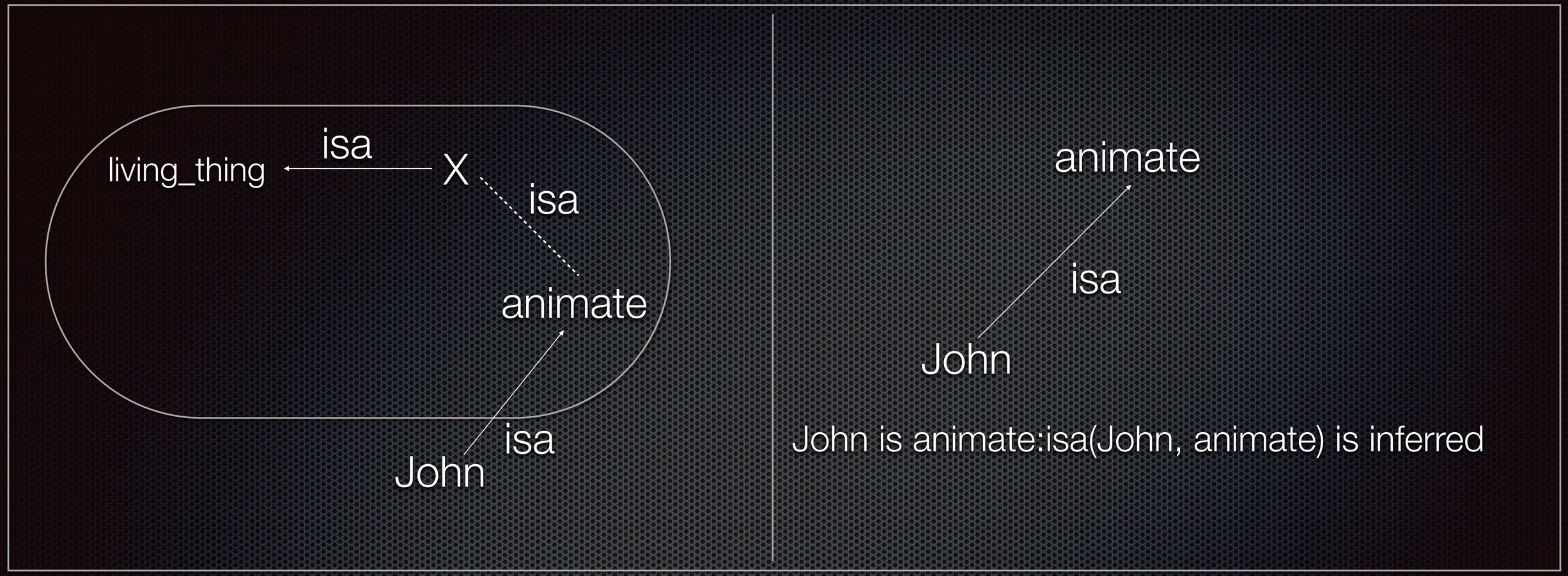
X2=John

1



X1=John

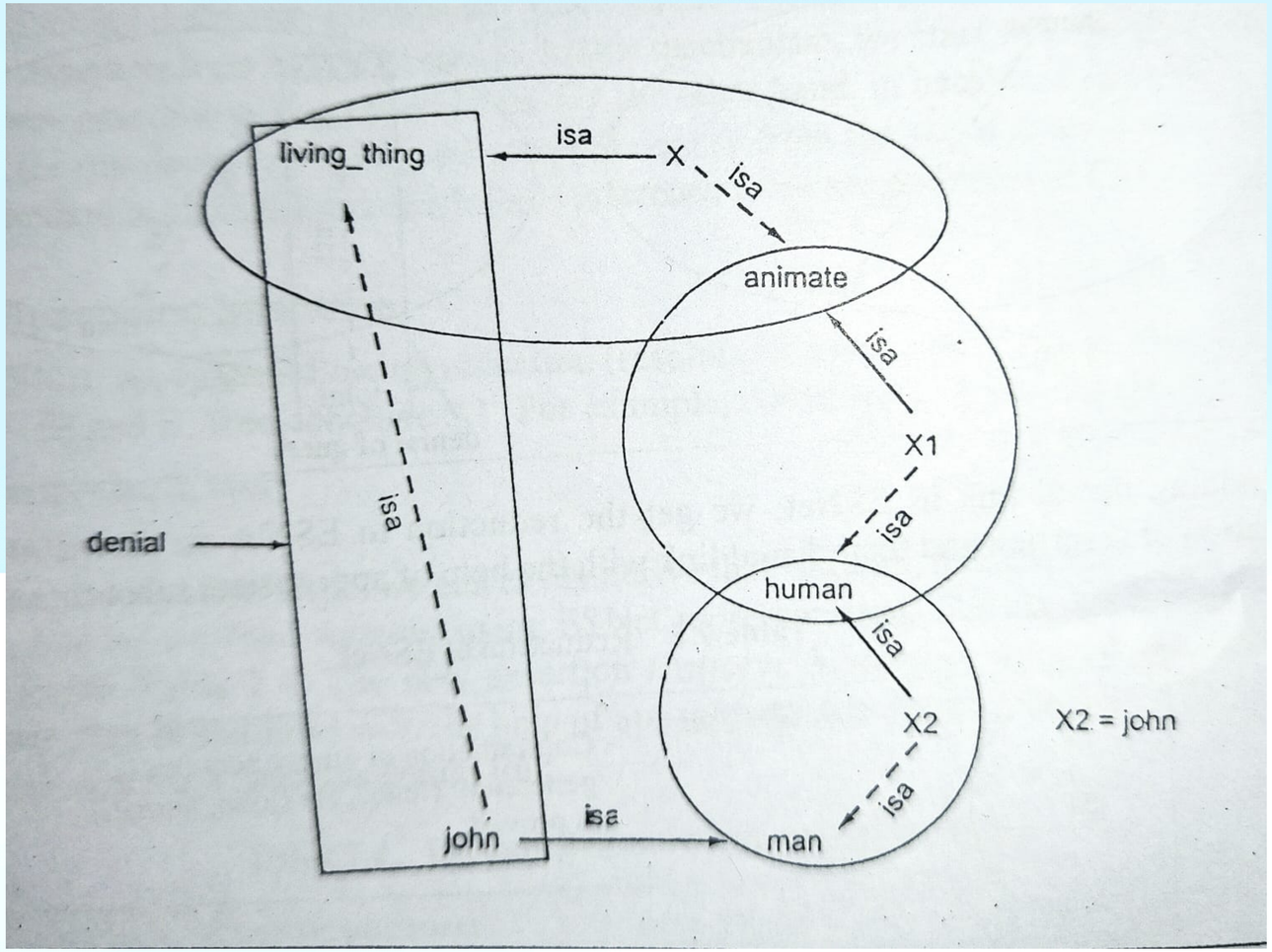
2



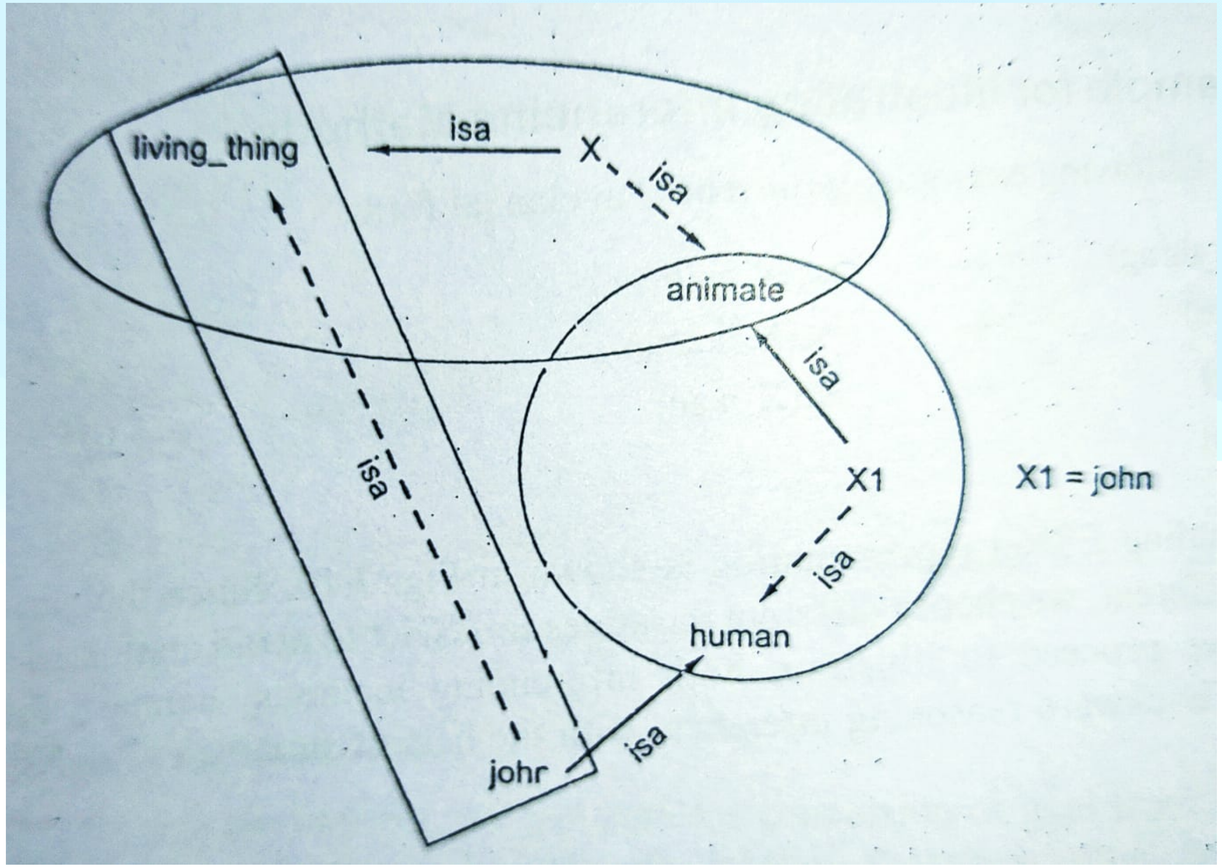
Derivation of John is animate

Further, John is living_thing can be derived by binding X with John.

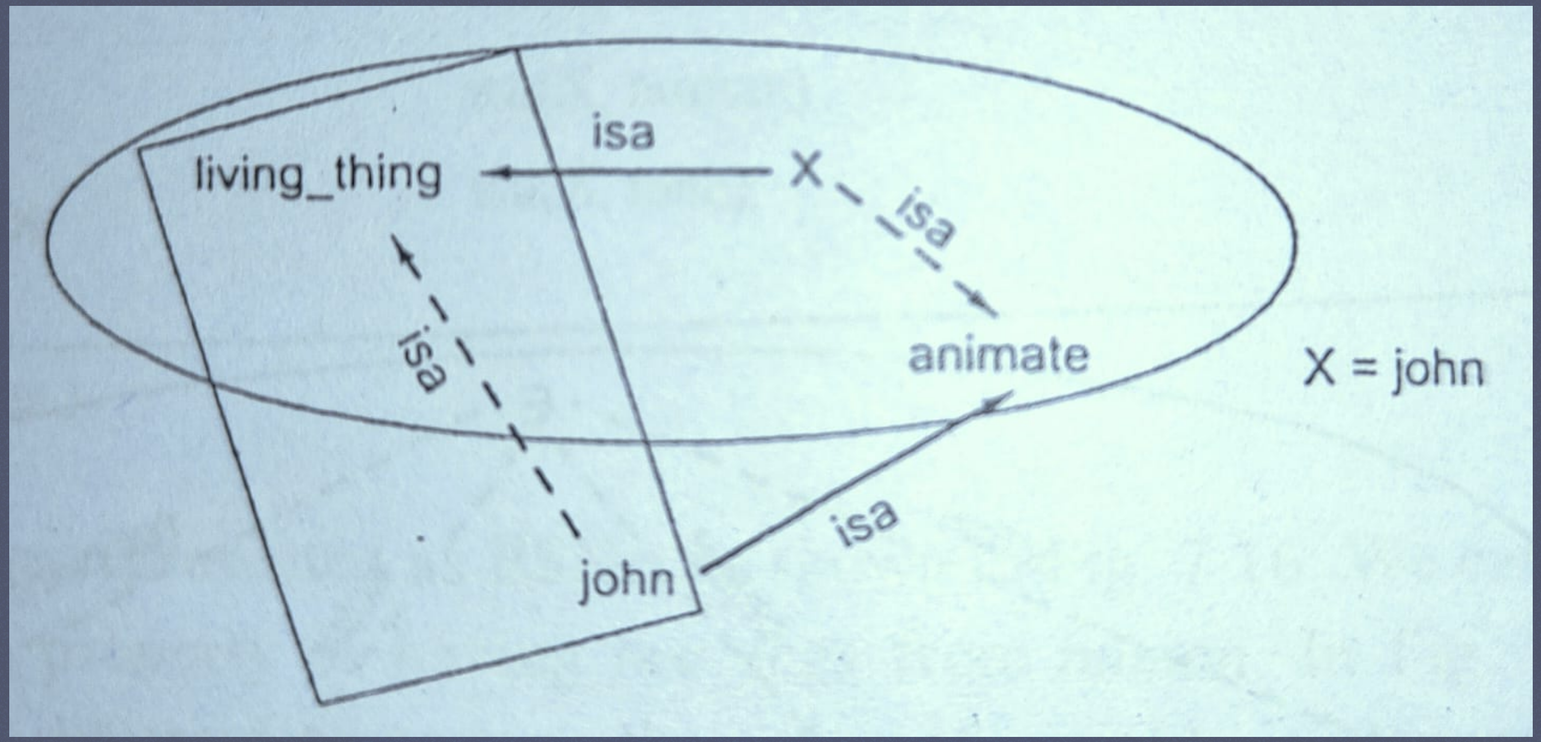
Backward reasoning inference:



1



2


living_thing
isa
X
isa
isa
animate
X = john
isa
john


isa
living_thing
John
isa

"It seems

undone till

it's done...!"

By Abhishek & Revan