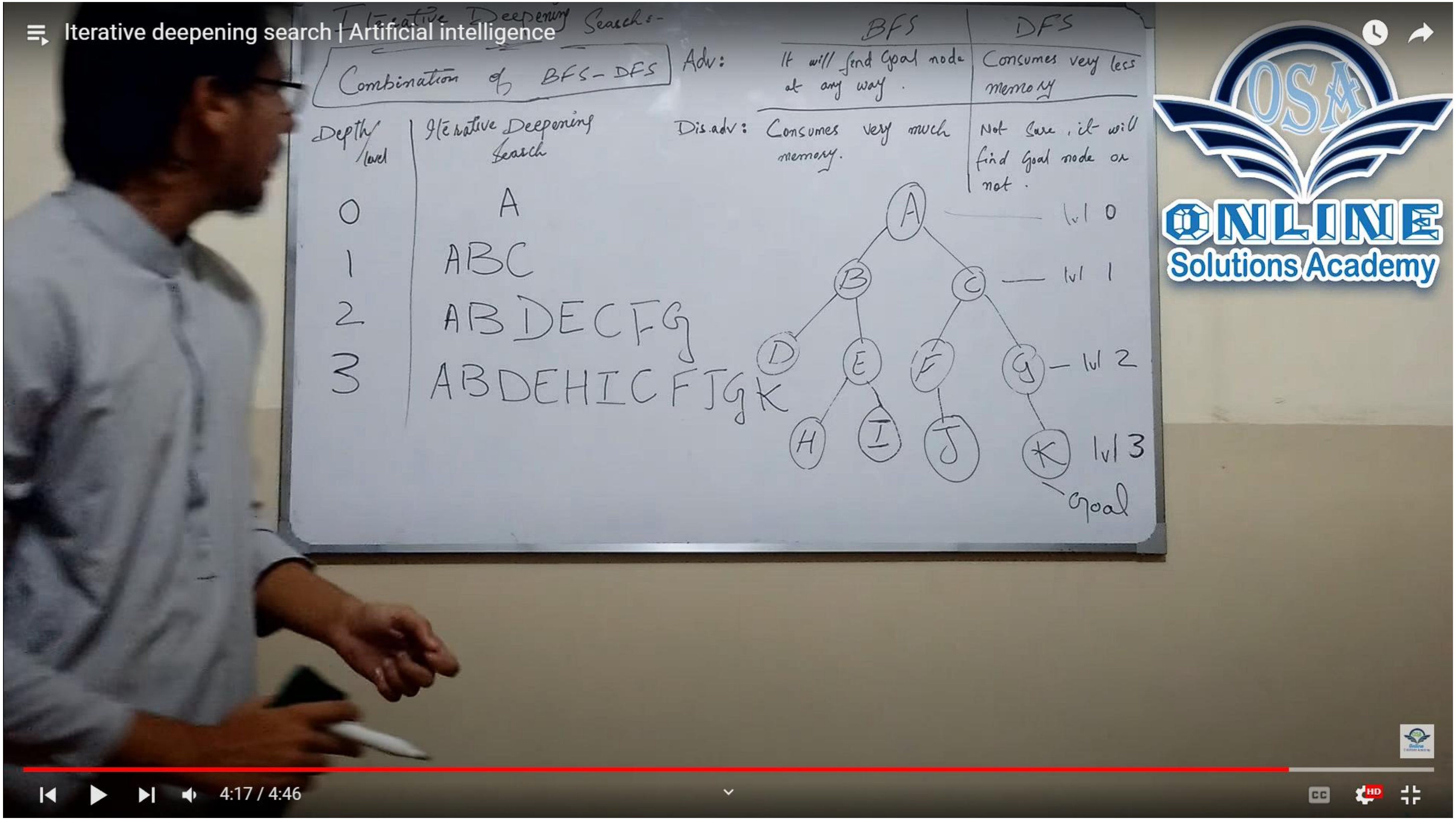


Iterative deepening search | Artificial intelligence
Iterative Deepening Search:-
Combination of BFS - DFS
BFS
DFS
Adv:
It will find Goal node at any way.
Consumes very less memory
Dis.adv:
Consumes very much memory.
Not sure, it will find Goal node or not.
Depth/level
Iterative Deepening Search
0
A
1
ABC
2
ABDECFG
3
ABDEHICFJGK
A
B
C
D
E
F
G
H
I
J
K
lvl 0
lvl 1
lvl 2
lvl 3
Goal
ONLINE
Solutions Academy
4:17 / 4:46

knowledge based agent |Artificial intelligence | Lec-23 | Bhanu Priya

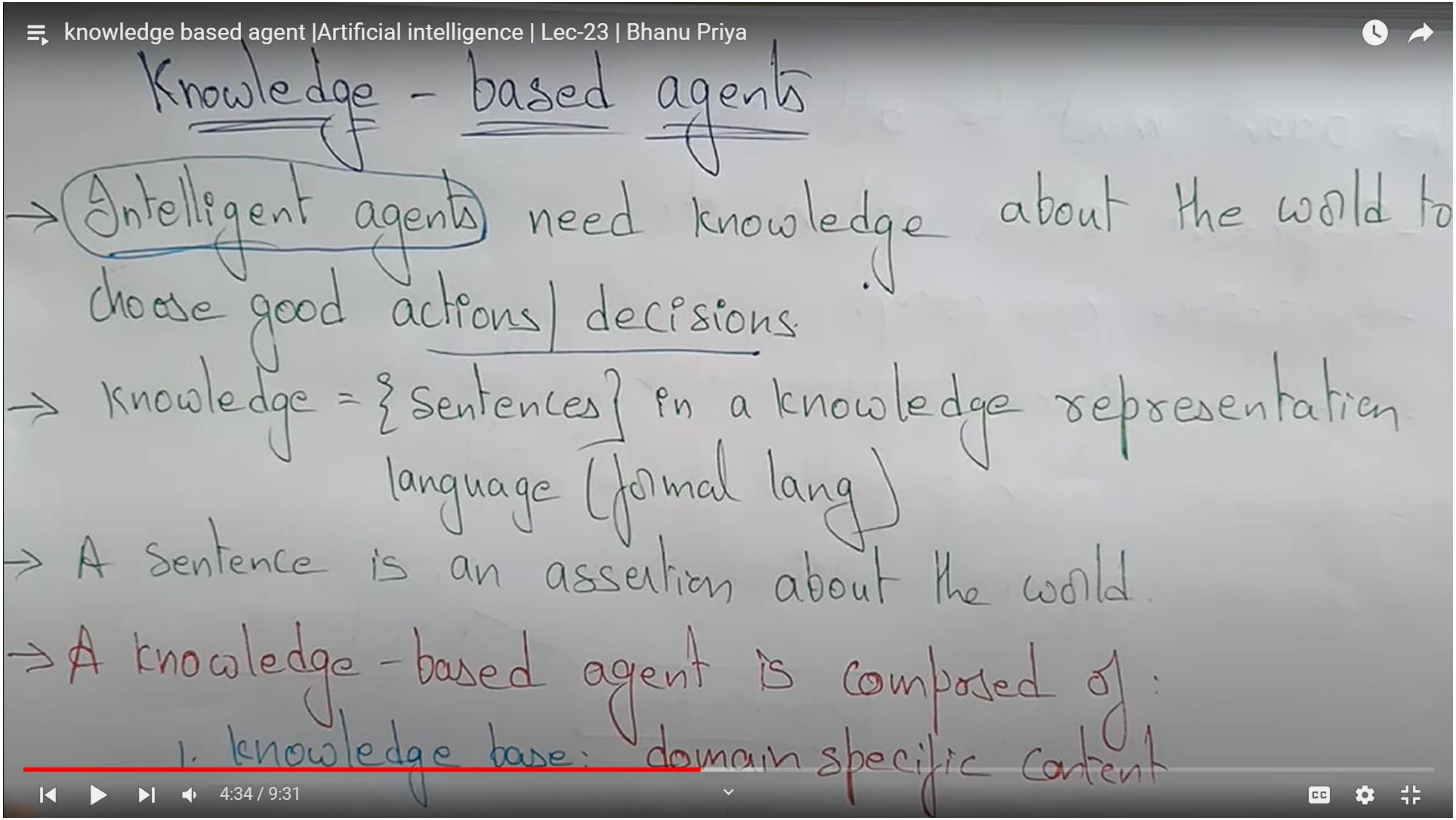
Press Esc to exit full screen

logical agents

Agents with some representation of complex knowledge about the world / its environment & uses inference to ~~delive~~ derive new information from the knowledge combined with new i/ps.

knowledge base :- set of sentences in a formal lang representing facts about the world

3:49 / 9:31


knowledge based agent |Artificial intelligence | Lec-23 | Bhanu Priya
Knowledge - based agents
→ Intelligent agents need knowledge about the world to choose good actions / decisions
→ knowledge = {sentences} in a knowledge representation language (formal lang)
→ A sentence is an assertion about the world.
→ A knowledge-based agent is composed of:
1. knowledge base: domain specific content
4:34 / 9:31

knowledge based agent |Artificial intelligence | Lec-23 | Bhanu Priya

→ Intelligent agents need knowledge about the world to choose good actions/ decisions

→ knowledge = {sentences} in a knowledge representation language (formal lang)

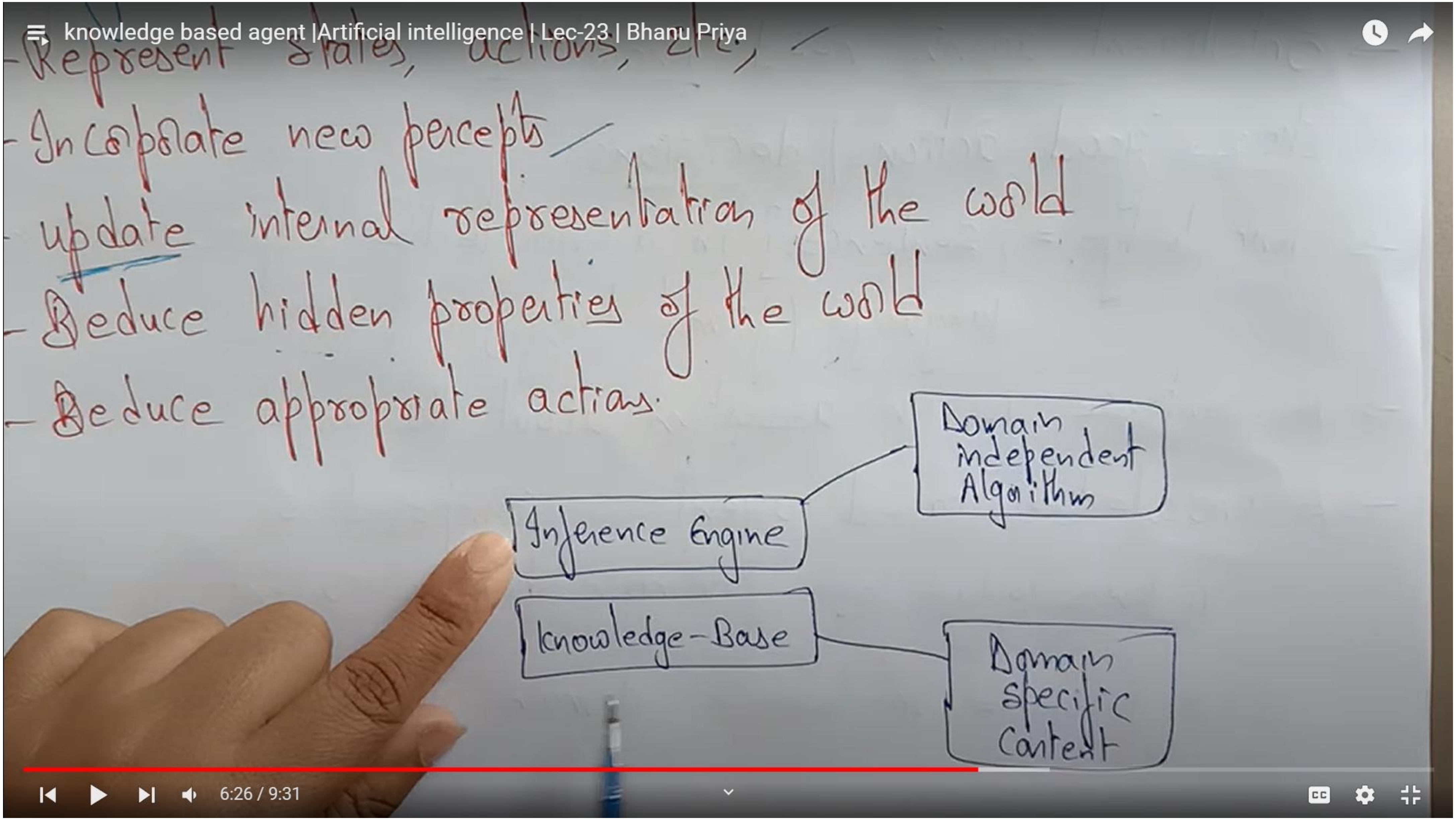
→ A sentence is an assertion about the world.

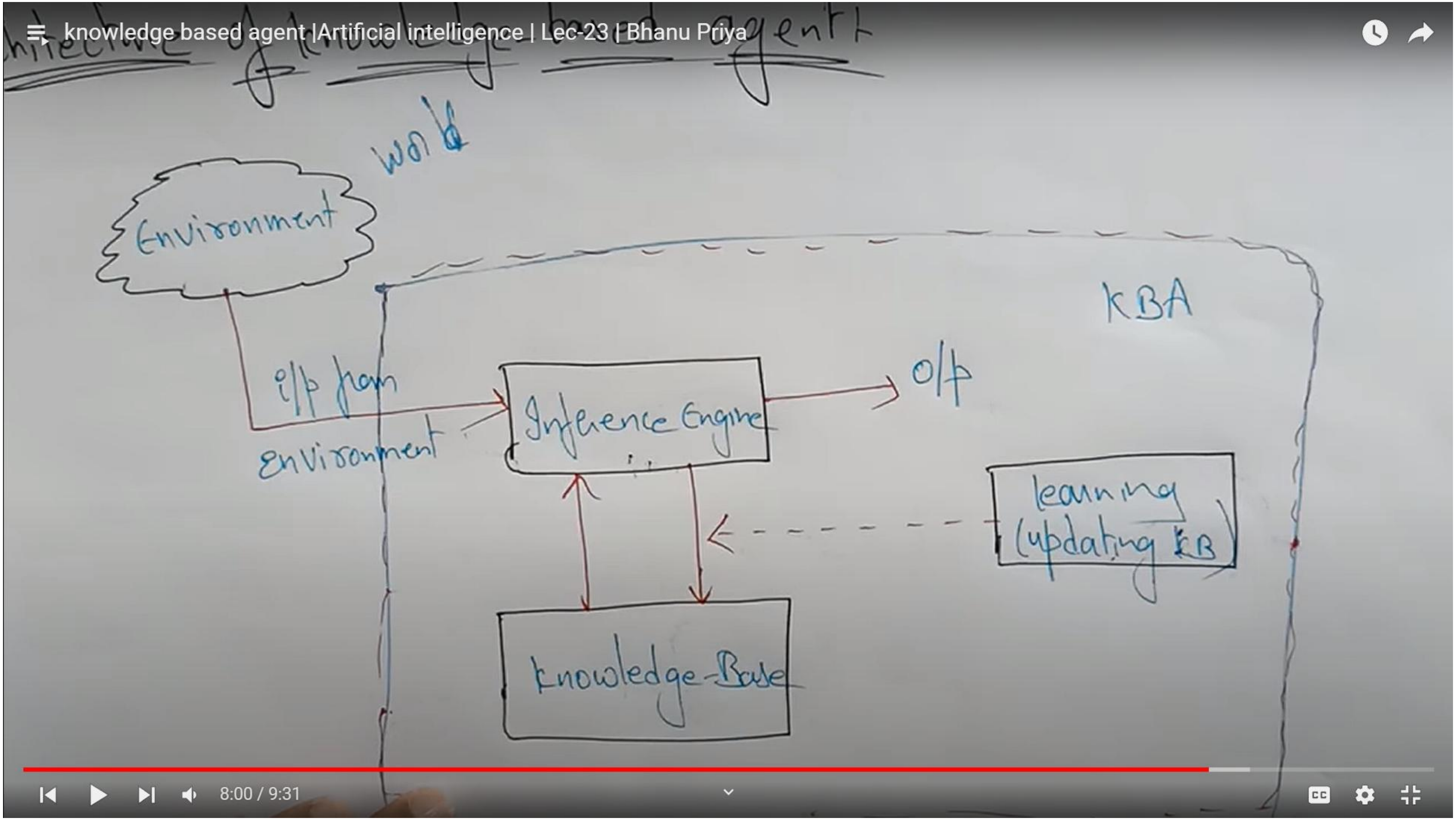
→ A knowledge-based agent is composed of:

1. knowledge base: domain specific content

2. Inference mechanism: domain-independent algorithm

5:19 / 9:31


knowledge based agent |Artificial intelligence | Lec-23 | Bhanu Priya
- Represent states, actions, etc,
- Incorporate new percepts
- update internal representation of the world
- Deduce hidden properties of the world
- Deduce appropriate actions.
Inference Engine
Knowledge-Base
Domain independent Algorithm
Domain specific Content
6:26 / 9:31

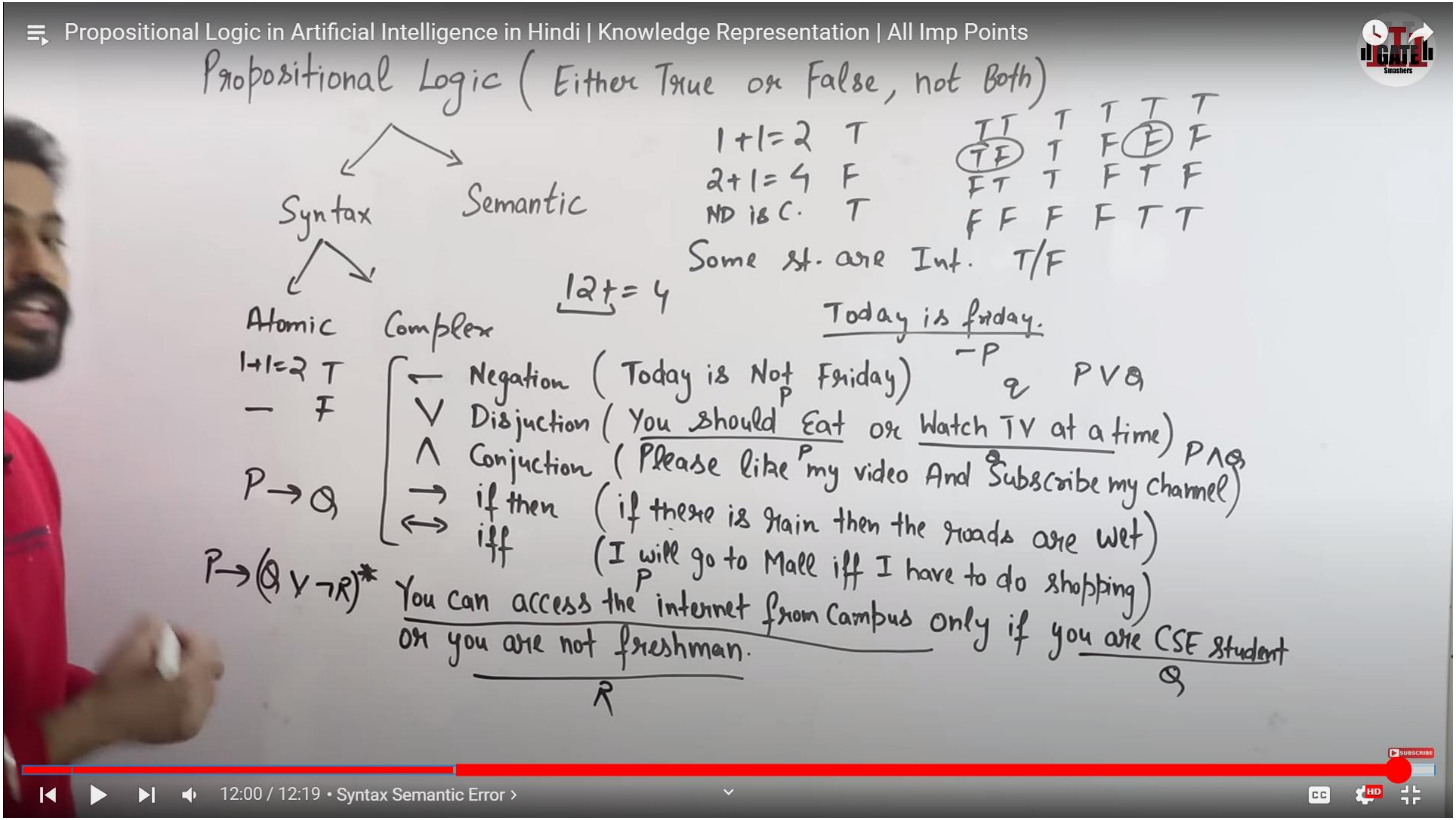

knowledge based agent |Artificial intelligence | Lec-23 | Bhanu Priya
world
Environment
KBA
i/p from
Environment
Inference Engine
O/p
learning
(updating KB)
Knowledge-Base
8:00 / 9:31

Declarative:

You can build a knowledge-based agent simply by "TELLing" it what it needs to know

Procedural:

- Encode desired behaviors directly as program code
  - Minimizing the role of explicit representation & reasoning can result in a much more efficient system.



Propositional Logic in Artificial Intelligence in Hindi | Knowledge Representation | All Imp Points
Propositional Logic (Either True or False, not Both)
Syntax
Semantic
Atomic
Complex
1+1=2 T
— F
P → Q
P → (Q ∨ ¬R)*
1+1=2 T
2+1=4 F
ND is C. T
Some st. are Int. T/F
12+=4
Today is friday.
¬P
Q
P ∨ Q
¬ Negation (Today is Not Friday)
∨ Disjuction (You should Eat or Watch TV at a time)
∧ Conjuction (Please like my video And Subscribe my channel)
P ∧ Q
→ if then (if there is rain then the roads are wet)
↔ iff (I will go to Mall iff I have to do shopping)
You can access the internet from Campus only if you are CSE student
or you are not freshman.
P
Q
R
12:00 / 12:19 • Syntax Semantic Error ›

Propositional Calculus:-

↳ It is a system that deals with the method used for manipulation of the symbols according to some rules.

ALPHABET SET:

↳ i) Set of Variables or Propositional Symbols P, Q, R

ii) Logical Constants → True (T), → false (F)

iii) Two Parentheses "(" and ")"

iv) Set of logical operators

IMP:- ↳

	word	symbol.	example
i)	not	$\neg$	$\neg X$
ii)	and	$\wedge$	$X \wedge Y$
iii)	or	$\vee$	$X \vee Y$
iv)	implies	$\rightarrow$	$(X \rightarrow Y)$ if X then Y
v)	if and only if	$\leftrightarrow$	$(X \leftrightarrow Y)$

X: It is Hot

Y: It is Humid

Z: It is raining

{All, Some ↳ (PL) ✗}

(X, Y)

① if it is $\underbrace{\text{humid}}_{\text{'Y'}}$ then it is $\underbrace{\text{hot}}_{(X)}$.

↳ $(Y \rightarrow X)$

② if it is $\underbrace{\text{hot}}_{X}$ and $\underbrace{\text{humid}}_{Y}$ then it is not $\underbrace{\text{raining}}_{Z}$.

$$\boxed{(X \wedge Y) \rightarrow \neg Z}$$

L53: Propositional Logic | Set of Equivalence Relation | Rules of Inference(MODUS PONENS, TOLLENS)

vi) Set of equivalence relations or laws: (P, Q, R) are Variables.

- Commutative Laws: $P \wedge Q \cong Q \wedge P$, $P \vee Q \cong Q \vee P$
- Associative Laws: $(P \wedge Q) \wedge R \cong P \wedge (Q \wedge R)$, $(P \vee Q) \vee R \cong P \vee (Q \vee R)$
- Double Negation: $\sim(\sim P) \cong P$
- Imp De-Morgan's Law: $\neg(P \vee Q) = \neg P \wedge \neg Q$, $\neg(P \wedge Q) \cong \neg P \vee \neg Q$
- Absorption Law: $P \wedge (P \vee Q) \cong P$, $P \vee (P \wedge Q) \cong P$
- Law of Contradiction: $P \wedge \neg P \equiv$ False $\left.\begin{matrix} P=1 \\ \neg P=0 \end{matrix}\right] 0$ $\left.\begin{matrix} P=0 \\ \neg P=1 \end{matrix}\right] 0$
- Law of excluded middle: $P \vee \neg P =$ True $\left.\begin{matrix} P=1 \\ \neg P=0 \end{matrix}\right] 1$ $\left.\begin{matrix} P=0 \\ \neg P=1 \end{matrix}\right] 1$
- Law of impotency: $P \wedge P \cong P$ $\begin{bmatrix} P=1 \rightarrow 1 \\ P=0 \rightarrow 0 \end{bmatrix}$

4:12 / 7:32

RULES OF INFERENCE:

↳ ① **MODUS PONENS**: If 'P' and '$P \to Q$' is given to be true, then we can infer that 'Q' is true.

P: It is a holiday ✓ T

Q: The School is closed] → we can infer that it is true.

$P \to Q$: If it is a holiday, then School is closed ✓ T

② **MODUS TOLLENS**: If '$\sim Q$' and '$\sim P \to \sim Q$' are given to be true, then we can infer that $\sim P$ is true.

$\sim Q$ = School is not closed.

($\sim P \to \sim Q$) → if it is not a holiday, then School is not closed.

↳ $\sim P$] it is not a holid

First Order Logic (FOL) | Artificial intelligence | Lec-28 | Bhanu Priya

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First-Order Logic in Artificial Intelligence

- FOL is another way of knowledge representation in A.I.
- It is an extension to PL. (Propositional Logic)
- FOL is also know as Predicate logic. It is a powerful language that develops information about the objects in a more easy way and can also express the relationship between those objects.
- FOL does not only assume that the world contains facts like PL but also assumes

0:01 / 5:22

· FOL is another way of knowledge representation in A.I.

It is an extension to PL. (Propositional Logic)

· FOL is also know nas Predicate logic. It is a powerful language that develops information about the objects in a more easy way and can also express the relationship between those objects.

· FOL does not only assume that the world contains facts like PL but also assumes

1) objects: A, B, people, no:, colors, wars, pits, Wumpus, ...

② Relations: It can be unary relation such as:
n-any relation such as: the sister of, brother of, has color.

- function: father of, best friend, end of, ...

⇒ As a natural lang, FOL has two main parts.

a. Syntax

b. Semantics

Syntax of FOL: Basic Elements

Constant	:	1, 2, A, Bhanu, Hyderabad, ...
variables	:	$x, y, z, a, b, \ldots$
Predicates	:	Brother, father, $>$, ...
Functions	:	sqrt, ...
connectives	:	$\neg, \Rightarrow, \land, \lor, \Leftrightarrow$
Equality	:	$=$
Quantifiers	:	$\forall, \exists$

Inference in FOL | Artificial intelligence | Lec-32 | Bhanu Priya

Inference in First order logic:

→ Inference in FOL is used to ~~red~~ deduce new fact
Sentences from existing sentences.

Before understanding FOL inference rule, let's unders
some basic terminologies used in FOL.

① Substitution

It is a fundamental operation performed on terms and formulas. It occurs in all inference sys in FOL.

0:11 / 4:09

Inference in FOL | Artificial intelligence | Lec-32 | Bhanu Priya

→ Inference in FOL is used to ~~get~~ deduce new facts

Sentences from existing sentences.

Before understanding FOL inference rule let's underst

Some basic terminologies used in FOL.

① Substitution

It is a fundamental operation performed on terms and formulas. It occurs in all inference sys in FOL.

F[a/x]

Substitute a constant "a" in place of variable "x".

1:15 / 4:09

Inference in FOL | Artificial intelligence | Lec-32 | Bhanu Priya

Equality:-

FOL logic does not only use predicate & terms for making atomic sentences but also uses another way, which is equality in FOL.

predicate(term1, term2, ...

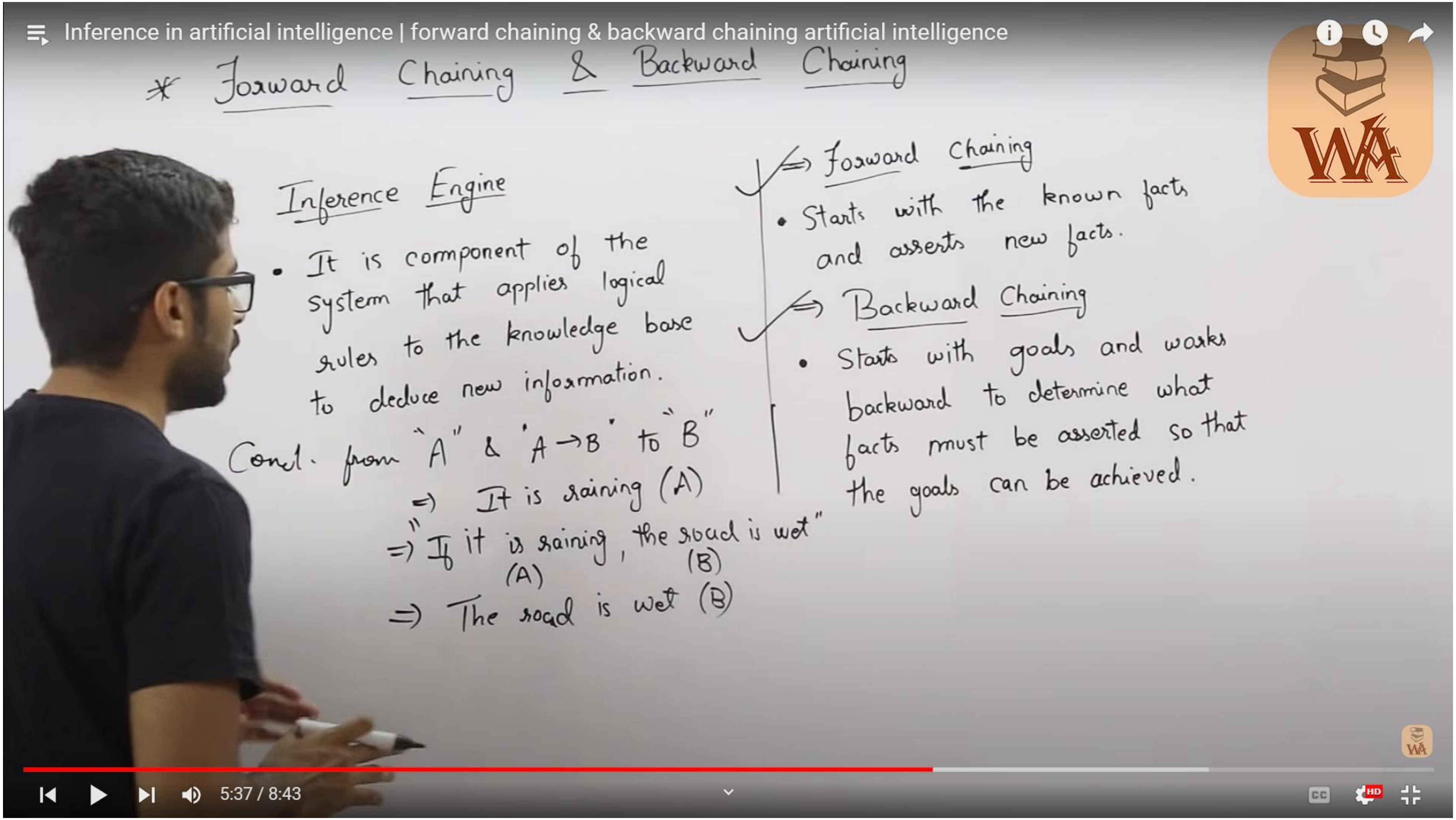
=

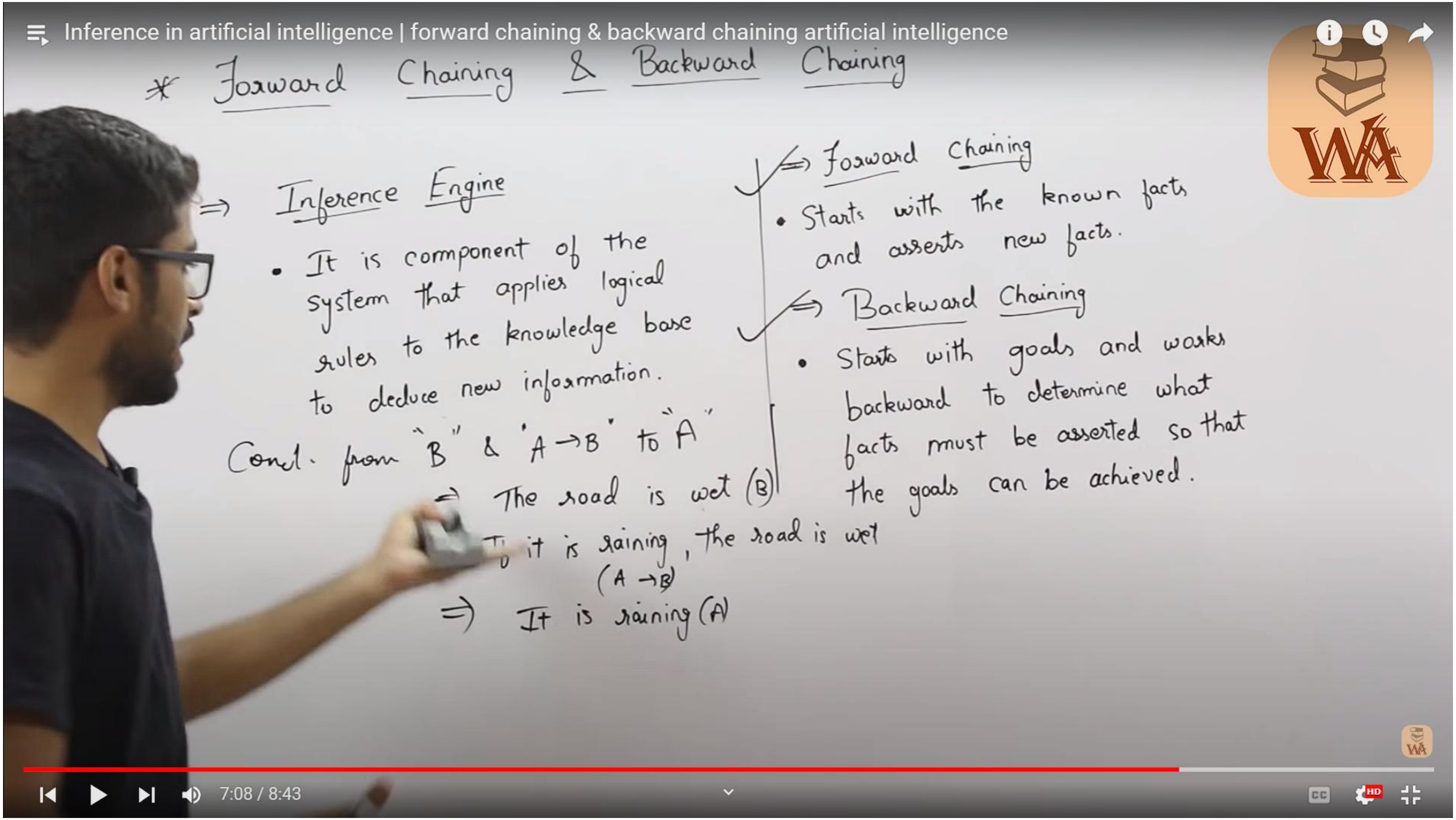
Eg:- $\boxed{\text{Brother(John)} = \text{Smith}}$

Here, the obj refered by Brother (John) is similar to obj refered by smith. The equality symbol can also be used with negation to represent that two terms are not the same objects.

Eg:- $\neg(x = y)$ which is Equivalent to $x \neq y$.

3:12 / 4:09


Inference in artificial intelligence | forward chaining & backward chaining artificial intelligence
* Forward Chaining & Backward Chaining
Inference Engine
• It is component of the system that applies logical rules to the knowledge base to deduce new information.
Concl. from "A" & 'A → B' to "B"
⇒ It is raining (A)
⇒ "If it is raining, the road is wet"
(A) (B)
⇒ The road is wet (B)
⇒ Forward Chaining
• Starts with the known facts and asserts new facts.
⇒ Backward Chaining
• Starts with goals and works backward to determine what facts must be asserted so that the goals can be achieved.
WA
5:37 / 8:43


Inference in artificial intelligence | forward chaining & backward chaining artificial intelligence
* Forward Chaining & Backward Chaining
⇒ Inference Engine
• It is component of the system that applies logical rules to the knowledge base to deduce new information.
Concl. from "B" & "A → B" to "A"
⇒ The road is wet (B)
If it is raining, the road is wet (A → B)
⇒ It is raining (A)
⇒ Forward Chaining
• Starts with the known facts and asserts new facts.
⇒ Backward Chaining
• Starts with goals and works backward to determine what facts must be asserted so that the goals can be achieved.
WA
7:08 / 8:43

L58: Unification Algorithm in Artificial Intelligence with example | AI Lectures in Hindi

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Ques:- Describe Unification Algorithm with an example.

Unifications means making expressions looks identical.

↳ can be done with the process of Substitution.

Simple Eg:- $p(x, F(y))$ — ① $p(a, F(g(z)))$ — ②

↳ ① and ② are identical if x is replace with a and y is replace with $g(z)$

$p(a, F(g(z)))$

$\underbrace{[a/x, g(z)/y]}_{\text{Substitution Set}}$

Unification Condⁿ:-

① Predicate Symbol must be Same.

② No. of arguments in both expressions must be identical. → Same

③ If two Similar Variables present in Same expression, then Unification fails.

p(_ _)
p(_ _ _)] ⊗

ALGORITHM:-

Unify (A1, A2)

① if A1 or A2 is Variable / Constant
  ↳ if A1 and A2 are identical return NIL
  ↳ Else if A1 occurs in A2 return fail
   ↳ Else return {A2/A1}
  ↳ Check for A2 in A1
   ↳ fail if A2 occurs in A1
   ↳ Else return (A1/A2)

② if Predicate not Same

③ if diff. arguments

④ Else SUBST to NIL

⑤ Loop

⑥ Return SUBST.

5:03 / 10:10

L58: Unification Algorithm in Artificial Intelligence with example | AI Lectures in Hindi

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Ques:- $\underbrace{Q(a, g(x,a), f(y))}_{A_1}, \underbrace{Q(a, g(f(b),a), x\}}_{A_2}$

Substitute x with $f(b)$ $[f(b)/x]$

$Q(a, g(f(b),a), f(y)), Q(a, g(f(b),a), f(b)\}$

Substitute (b/y) [y is substituted with b].

$[Q(a, g(f(b),a), f(b)), Q(a, g(f(b),a), f(b)]$

Unified Successfully.

8:59 / 10:10

L58: Unification Algorithm in Artificial Intelligence with example | AI Lectures in Hindi

Prime (11), Prime(y)

Substitute y with 11 [(11/y)]

$$\underbrace{\text{Prime}(11),\ \text{Prime}(11)}_{\text{Successfully unified}}$$