SNS COLLEGE OF TECHNOLOGY

Coimbatore-35

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF AI&ML

FOUNDATIONS OF ARTIFICIAL INTELLIGENCE

II YEAR - III SEM

UNIT 5 – **Explanation based learning**

Explanation Based Learning - EBL

- Definition

- Explanation-Based Learning (EBL) is a method for using available domain knowledge to improve supervised learning.

- EBL - can be in speed of learning, confidence of learning, accuracy of the learned concept, or a combination of these.

- EBL Computers uses the domain theory to inherit the properties of examples (part of Domain)
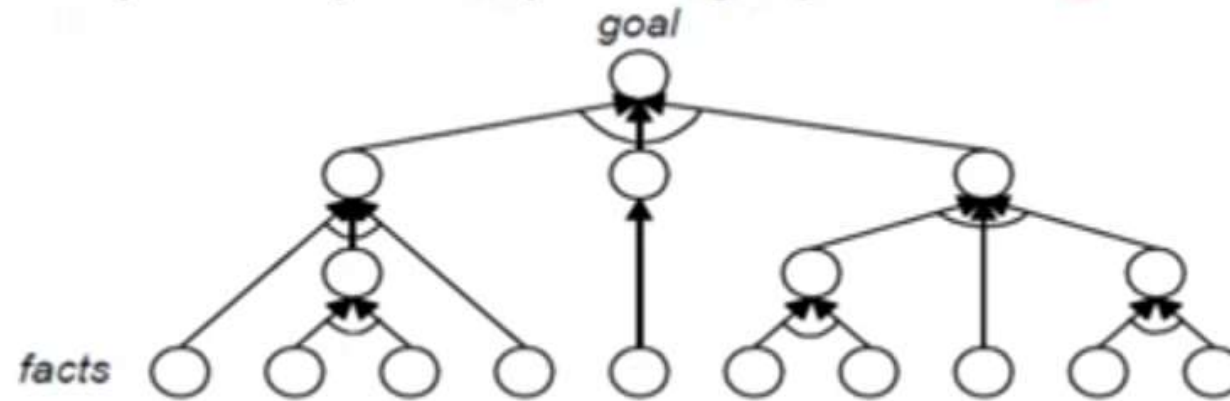
Explanation Based Learning - EBL

- EBL is a method for extracting general rules from Individual Observations.

- A part of domain is called an example, is a member of concept

- Learn the essential properties of the concept

- Trade-off - the need to collect many examples *for* the ability to "explain" single examples (a "domain" theory)
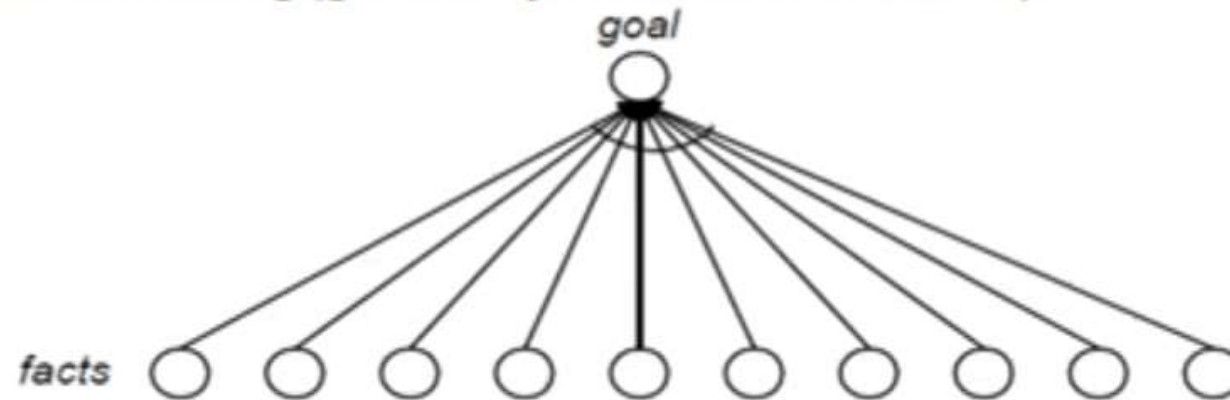
Explanation Based Learning – EBL ...

- An EBL accepts 4 kinds of input:
- A goal concept
  - a high level description of what the program is supposed to learn.
- A training example
  - what the learning sees in the world.
- A operational criterion (facts)
  - a description of which concepts are usable.
- A domain theory
- a set of rules that describe relationships between objects and actions in a domain.

- **Use problem solver to justify, using the *rules*, the *goal* in terms of the *facts*.**

- **Generalization - Generalize** the justification as much as possible.

Standard Approach to EBL

An Explanation (detailed proof of goal)

goal

facts

After Learning (go directly from facts to solution):

goal

facts

Explanation Based Learning – EBL ...

- EBL computes a **generalization** of the training example, to describe the goal concept.
- It also satisfies the operational criterion.
- EBL has two steps:
- Explanation
- -- the domain theory is used to remove all unimportant aspects of the training example with respect to the goal concept.
- Generalization
- -- the explanation is generalized as far possible while describing the goal concept.

Explanation Based Learning – EBL - Example

- Explanation-Based Learning is a method for extracting general rules from Individual Observations.

- As an example,

- Consider the problem of differentiating and simplifying algebraic expressions.

- If we differentiate an expression such as X^2 with respect to X, we obtain 2X.

- In a logical reasoning system, the goal might be expressed as

$$\text{ASK}(Derivative(X^2, X) = d, \text{KB}).$$

- With solution d = 2X.

Explanation Based Learning – EBL - Example ...

- Application of the standard rules of differentiation yields the expression $1 \times (2 \cdot x \cdot (x^{(2-1)}))$ and this simplifies to 2X.

EBL – Memorization

- Once the rule is identified then that should be memorized

- Whenever it finds an example, immediately it will apply the same rule (taken from cache memory) on the example.

EBL – Memorization

- In the case of differentiation, memorization would remember that the derivative of x^2 with respect to X is 2X,

- Now, the agent to calculate the derivative of Z^2 with respect to Z

- Extract the general rule, for any arithmetic unknown u, the derivative of u^2 with respect to u is 2u.

- In logical terms, this is expressed by the rule

- Arithmetic *Unknown(u)* $\Rightarrow$ Derivative(u^2,u) = 2u .

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Explanation Based Learning - EBL

- Extracting general rules from examples
- Improving efficiency