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Notes unit 6

* Expert System
  + Class of computer programs
    - made of a set of rules that analyze information
    - limited to a specific class of problems
    - provide analysis of those problems
    - depending on design, may recommend a course of user action
  + Developed during the 1970's, applied commercially in the 1980's
  + When to use?
    - Need justifies cost
    - humans not always available
    - problem can be solved with symbolic reasoning
    - domain is well structured
    - traditional computing methods fail
    - cooperative articulate experts available
      * experts needed that are able to explain the problem
    - proper size and scope of problem (limited)
  + to learn from an expert
    - ask about specific situations to learn the expert's general knowledge
    - ask about situation pairs that look identical but are handled differently
  + capturing rules
    - connection between expertise and an implemented system
    - need defined rules
    - inference engine produces a result
  + knowledge engineering
    - knowledge representation
      * independent of problem domain
      * example: rules
    - inference technique
      * dependent on knowledge structure
      * example: forward, backwards chaining
    - see: block diagram
  + Expert system
    - Knowledge base(facts)
    - rules(if...then)
    - inference engine (how the rules are applied to facts)
  + Forward vs backward
    - forward
      * fact driven
      * finds new ideas
    - backwards
      * hypothesis driven
      * usually used for diagnosis
  + Zookeeper expert system example
    - Uses rules to define animals
  + Forward chaining
    - until no new assertions are identified
      * for each rule
        + try to find antecedents in knowledge base

if all supported, add consequent to knowledge base

* + Inductive reasoning
    - reasoning from observation to generalization
    - premises support the conclusion but do not ensure it
    - example: europeans thought all swans where white until they got to Australia
    - conclusions derived from system may not be correct, even though it is correct for the information it has.
  + Deductive reasoning
    - conclusion is of less or equal generality
    - example: all men are mortal, socrates is a man, therefore, socrates is mortal.
  + Backwards chaining
    - until all hypotheses have been tried or animal is identifies
      * for each hypothesis
        + for each rule with matching consequent

try to support its antecedents by matching assertions in knowledge base or creating a new hypothesis

if all antecedents supported, announce hypothesis is true

* + - Swifty example
  + How rules and facts relate
    - all facts already known?
      * Forward chaining
    - hypothesis leads to many questions?
      * High degree of input
      * forwards chaining
      * lots of things that need to be satisfied
    - no facts gathered?
      * Backwards chaining
    - set of facts lead to many conclusions
      * high degree of potentials out
      * backwards chaining
  + Mycin
    - expert system to diagnose blood diseases
    - written in Lisp by Edward Shortliffe
    - about 500 rules, 100 diseases
    - backwards chaining
    - outperformed real doctors
    - never actually used in practice
  + expert systems as idiot davants
    - rule based systems solve many problems
    - they answer questions about how and why
    - they do not reason on multiple levels
    - they do not use different perspectives
    - they do not use constraint-exposing models
    - they do not know reasoning behind the rules
    - they do not know when to break their rules