

17.1 AI & 17.2 ML-Reading

Notebook: How Computers Work [CM1030]

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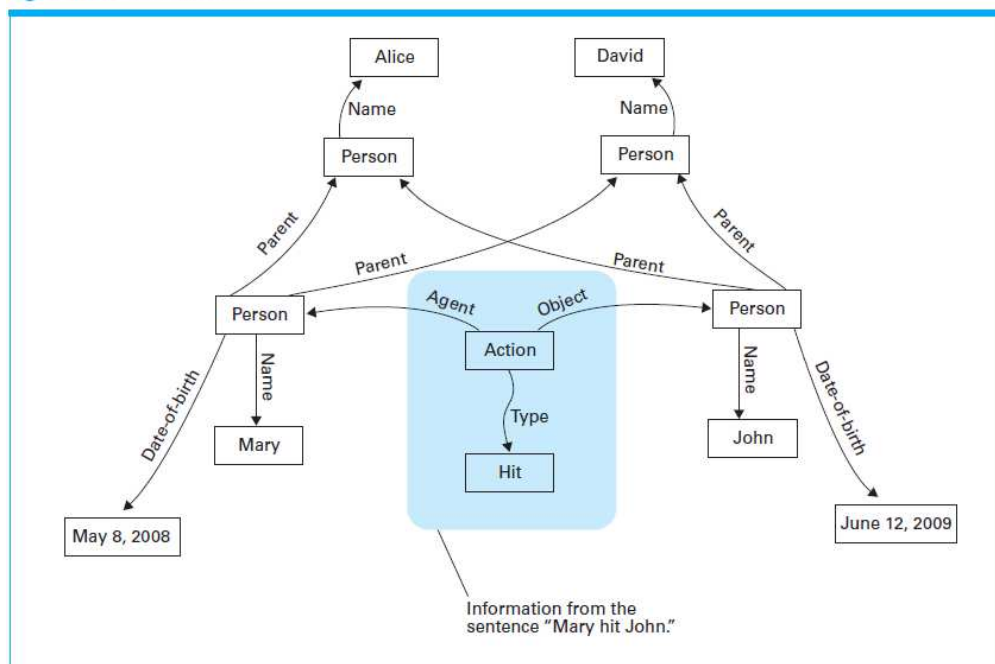
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Cornell Notes	Topic: 17.1 Artificial Intelligence 17.2 Machine Learning -Reading	Course: BSc Computer Science
		Class: How Computer Work [CM1030]-Reading
		Date: February 03, 2020
Essential Question:		
What is AI?		
Questions/Cues:		
<ul style="list-style-type: none">• What is an agent?• What is procedural knowledge?• What is declarative knowledge?• What is the Turing Test?• What is image processing?• What is image analysis?• What is edge enhancement?• What is region finding?• What is Information Retrieval?• What is Information Extraction• What is a Semantic Net?• What is a production system?• What is a collection of States?• What is a collection of Productions?• What is a Control System?• What is a Problem Space?• What is a State Graph?• What is a Search Tree?• What is the Breadth-first manner of tree construction?• What is the Depth-first manner of tree construction?• What is meta-reasoning?• What is the closed-world assumption?• What is the frame problem?• What is learning by Imitation?• What is supervised training?• What is the training set?• What is Reinforcement Learning?• What is a genetic algorithm?• What is Evolutionary Programming?		
Notes		

- Agent = "device" that responds to stimuli from its environment. Most agents have sensors by which they receive data from their environment (microphones, cameras, range sensors) & actuators by which they affect their environment (wheels, legs, wings)
- Procedural Knowledge (learning "how") = involves a trial-&-error process by which agent learns appropriate actions, being punished for poor actions & rewarded for good ones.
- Declarative knowledge (learning "what") = form of expanding or altering the "facts" in an agent's store of knowledge from which rational responses to future events are determined
- Turing test = a test proposed by Alan Turing in 1950, allows a human (interrogator) to comm with test subject via a typewriter system without being told whether test subject was human or machine. In this environment, machine would be declared to behave intelligently if human was unable to distinguish it from human
- Image Processing = refers to identifying characteristics of image
- Image Analysis = refers to process of understanding what image characteristics mean
- Edge Enhancement = process of applying mathematical techniques to clarify boundaries between regions in image
- Region Finding = process of identifying those areas in image that have common properties such brightness, color, or texture
- Information retrieval = identifying docs that relate to topic at hand
- Information extraction = task of extracting info from docs so it takes a form useful in other apps
- Semantic Net = large linked data structure in which pointers are used to indicate associations among data items

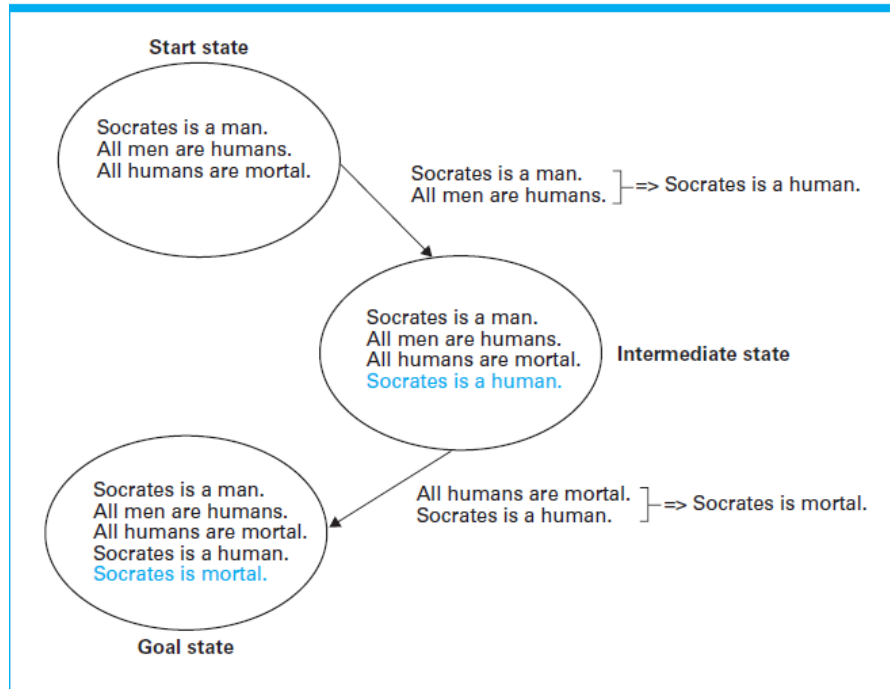
Figure 11.3 A semantic net



- Production System = large class of reasoning problems with common characteristics
 - Collection of States = Each state is situation that might occur in app environment. Beginning state is called start (initial) state; desired state (or states) called goal state
 - Collection of productions(rules or moves)= Production is operation that can be performed in app environment to move from one state to another. Each production might be associated with preconditions; conditions might exist that must be present in environment before production can be applied.
 - Control System = Control system consists of logic that solves problem of moving from start state to goal state. At each step in process control system

must decide which of those productions whose preconditions are satisfied should be applied next

Figure 11.5 Deductive reasoning in the context of a production system



- Problem Space = collection of all states, productions, & preconditions in production system
- State Graph = the conceptualized form of a problem space. Often a directed graph, a collection of locations called nodes connected by arrows. State graph consists of collection of nodes rep'ing the states in the system connected by arrows rep'ing the productions that shift system from one state to another. Two nodes connected by arrow in state graph if and only if there is production that transforms system from the state at the origin of the arrow to state at destination of arrow
- Search tree = consists of the part of the state graph that has been investigated by control system. Root node of search tree is start state & children of each node are those states reachable from parent by applying one production. Each arc between nodes in search tree reps the application of single production, & each path from the root to a leaf reps a path between the corresponding states in state graph
- Breadth-first manner = meaning tree is constructed layer by layer
- Depth first manner = tree is constructed by building vertical paths rather than horizontal layers
 - This approach is often referred to as best-first construction in recognition of the fact that the vertical path chosen for pursuit is the one that appears to offer best potential
- Meta-reasoning = reasoning about reasoning
- Closed-world assumption = assumption that a statement is false unless it can be explicitly derived from info available
- Frame problem = problem of keeping stored knowledge up-to-date in a changing environment
- Imitation-learning = in which a person directly demonstrates steps in task, perhaps by carrying out a sequence of comp operations or by physically moving a robot through a sequence of motions & comp simply records the step
- Supervised training = person identifies correct response for series of examples & then agent generalizes from those examples to develop an algorithm that applies to new cases
- Training set = series of examples
- Reinforcement learning = agent is given a general rule to judge for itself when it has succeeded for failed at a task during trial & error

- Agent acts autonomously as it learns to improve its behavior over time
- Genetic Algorithm = will discover a solution by random behavior combined with a simulation of reproductive theory & evolutionary process of natural selection
 - GA begins by generating a random pool of trial solutions (each solution is just a guess)
 - Each trial solution called a chromosome & each component of chromosome called a gene
 - GA proceeds to generate a new pool of chromosomes whereby each chromosome is offspring(child) of two chromosomes(parents) of previous pool
 - Parents are randomly selected from pool giving a probabilistic preference to those chromosomes that appear to provide best chance of leading to solution; emulating evolutionary principle of survival of the fittest
 - Each child is random combination of genes from parents. Resulting child may occasionally be mutated in some random way.
 - Hopefully by repeating this processing over & over, better & better trial solutions will evolve until a very good one, if not the best, is discovered. But is no assurance that GA will find a solution
- Evolutionary programming = When GA applied to prog development it's called Evolutionary programming. Goal is to develop progs by allowing them to evolve rather by explicitly writing them.
 - In functional prog langs, you begin with a collection of progs that contain a rich variety of functions. The functions in starting collection form "gene pool" from which future gens of progs will be constructed. This allows evolutionary process to run for many gens, hoping that by producing each gen from best performers in previous gen, a solution to target problem will evolve.

Summary

In this week, we learned about what AI is & how "intelligence" is produced in machines.