
Assignment-03

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1 What is AI ??

Since the very start researchers have tried different ways to study and model AI. Finally, they come at two ways - human vs rational and thought vs behaviour. Turing Test was done in 1950 to check whether AI could mimic human intelligence. This needed several key abilities like NLP, Automated reasoning, Machine Learning etc. Success came in flight not by mimicking birds but by understanding principles of flight. The same goes with AI. To build a model which thinks like human we need to learn about introspection, psychological exp, brain imaging. For example, Allen Newell and Herbert Simon developed a program called GPS that solved problems but also acted the way humans think while solving problems. Rationality in AI arises from using logical structures to give correct conclusions just like Aristotle with his syllogisms. In situations like war or politics where we don't have exact rules probability fills the gap.

Acting rationally in AI is creating agents that take best possible to reach goal even under the uncertainty of the real world. This is possible when we use probability theory along with the existing logic program. AI programmed with achieving an objective works in cases like chess, but becomes hard in real world problems. In self driving cars if reaching destination is the only goal then the chance of accidents increase. We need AI systems which ask for clarification, learn from us and then take judgement.

2 Foundations of AI

Just like every subject has its background, AI also has many foundational structures. Philosophy has contributed to AI by addressing how knowledge is acquired and also exploring questions about mind, knowledge and action. Many philosophers like Aristotle and Descartes explored logic and debated the nature of thought and free will. Ideas like empiricism and utilitarianism influenced decision-making in uncertain situations. Mathematics provided the tools to shape a better understanding on reasoning, compute algorithms and manage uncertainty which are very important for AI. Gödel's incompleteness theorem and Church-Turing thesis defined limits of computation. Boolean Logic and probability theory make the AI model better for real-world applications. NP-completeness helped in solving large scale problems more effectively. Economics was an important tool for decision-making by preferences and interactions. Utility theory helped in shifting focus from money to preferences. Markov's decision processes and Herbert Simon's concept of satisficing which made decisions that are "good enough". Decision theory gives you individual decisions and game theory gives strategies for multi-agent interactions. Neuroscience studies how the brain controls all information through neurons. Paul Broca found areas of the brain responsible for speech. Optogenetics help in control and study neurons with light. Even with a computer of unlimited capacity, we still require further breakthroughs in our understanding of intelligence. Cognitive psychology, which views the brain as an information-processing device. Doug Engelbart, pioneers of HCL emphasised that computers should augment human abilities than automate. Modern Digital computers developed during World War II changed the field of AI. Performance doubled every 18 months (Moore's Law). Hardware were tuned to AI like GPU, TPU and WSE. Quantum computing promises future breakthroughs in AI. Control theory is used to develop systems that can regulate themselves. Starting from the water clock, steam engine, and thermostat this field today involves feedback control in machines which Wiener coined as "cybernetics". These systems minimize the cost function to achieve optimal control. Modern linguistics and AI were born about the same time which merged to form computational linguistics.

The form we should present the language that computers can reason with led to the development of knowledge representation.