Problem Solving through AI

Dr. Partha Pakray

About

- To develop universal intelligence system to match the intelligence capabilities of human beings.
- Developed many AI systems - problem specific domain.
- Application of AI is to develop intelligent systems to solve real world problems.

AI Problem Solution Methodology

- Problem
- Search Space
- Search
- Well defined problem
- Solution of the problem

AI Problem Solution Methodology

- **Problem**: question which is to be solved.
- **Search Space**: Complete set of states including start and goal states where answer of the problem is to be searched.
- **Search**: process of finding the solution in search space.
- **Well defined problem**: three major components - initial state, final state and space including transition function or path function.
- **Solution of the problem**: A solution of the problem is a path from initial to goal state. The movement from start to goal states guided by transition rules - try to find optimal solution.

To build AI computational system

- **Define the problem precisely** - initial and goal
- **Analyze the problem**
- **Isolate and represent the task knowledge** that is necessary to solve problem
- Choose the **best problem solving techniques** and apply it to the particular problem.

Representation of AI Problem

- **Lexical Part**
- **Structural Part**
- **Procedural Part**
- **Semantic Part**

Representation of AI Problem - “Playing Chess”

- **Lexical Part**: Board Position - 8 X 8 array - each position contains a symbol i.e. official opening position.
- **Structural Part**: Legal Moves - initial state to goal state
- **Procedural Part**: Applying rule for winning game - “set of winning moves”
- **Semantic Part**: it is not required in chess - because there is no hidden meaning associated with any piece and all the move meaning are explicit.

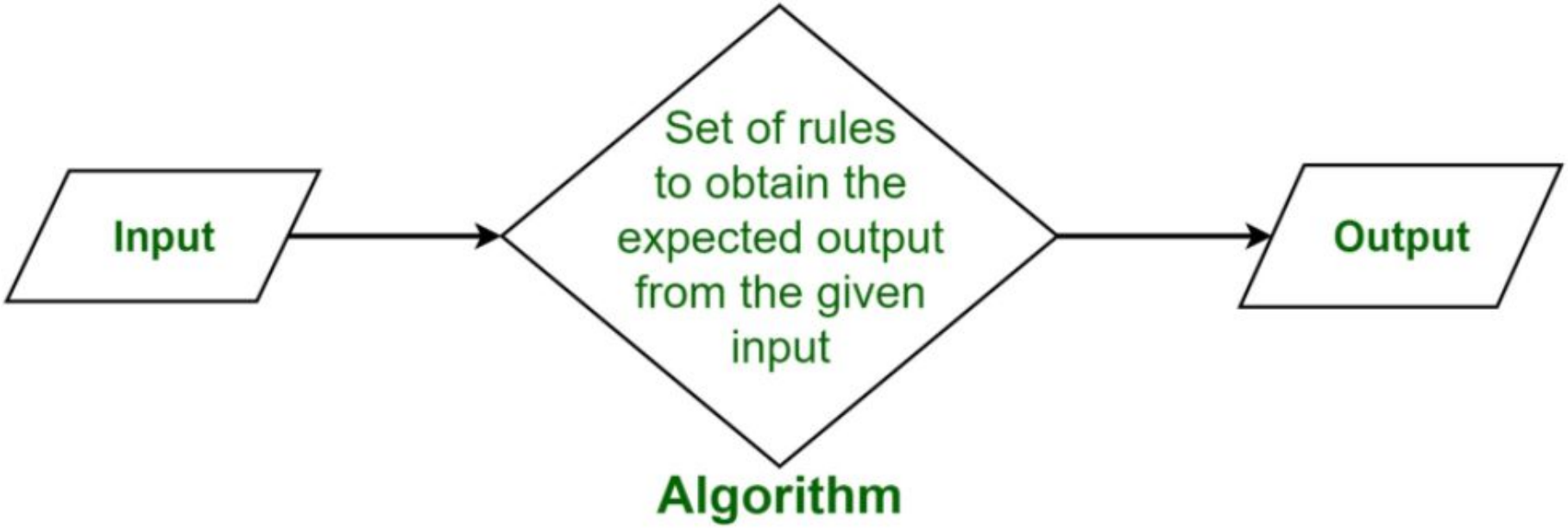
Production System

1. **Set of production rules**: P→Q: each rule consists of a left hand side constituent that represents the current problem state and right hand side represents a result or generated output state.
2. **One or more knowledge/ databases**.
3. **A control strategy** - specifies order in which the rule will be compared to the database.
4. **A rule applier**: check the applicability of rule by matching the current state with the left hand side of the rule and finds the appropriate rule from the database.

Characteristics of Production System

- Data Structure: suitable data structures - graphs and trees - Nodes in the graph corresponds to problem state and arcs between nodes corresponds to valid transitions.
- Control Strategies: applying rules and searching the problem solution in search space.

Algorithm of Problem solving



Various examples of AI Problems

- Tic-Tac-Toe
- Water-Jug Problem
- 8-puzzle problem
- 8-queens problem
- Chess problem
- Missionaries and cannibals problem
- Tower of Hanoi problem
- Traveling Salesperson problem
- Magic square
- Language understanding problem
- Monkey and Banana Problem
- Cryptarithmetic Puzzle
- Block World Problem

Nature of AI Problems

- Path Finding Problems
- Decomposable Problems
- Recoverable Problems
- Predictable Problems
- Problems Affecting the quality of solution
- State finding problem
- Problem requiring Interaction
- Knowledge intensive problems

Thank You! Any Questions...

It's difficult to be rigorous about whether a machine really 'knows', 'thinks', etc., because we're hard put to define these things. We understand human mental processes only slightly better than a fish understands swimming.

(John McCarthy)

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