CS2012 – Artificial Intelligence

Project Report – 1

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Problem topic : Solving Sudoku puzzles using constraint satisfaction and local search algorithms.

Introduction to AI :

- Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to behave like humans.
- It involves the development of computer systems capable of performing tasks that typically require human intelligence.
- AI systems use algorithms and data to analyze patterns, make predictions, and adapt to new information.
- By mimicking human cognitive abilities, AI has the potential to revolutionize various industries, including healthcare, finance, transportation, and entertainment.

AI and Simulated Annealing for Sudoku Solving :

- Sudoku is a popular logic-based puzzle that involves filling a 9x9 grid with digits so that each column, each row, and each of the nine 3x3 sub-grids contains all of the digits from 1 to 9.
- Solving Sudoku puzzles can be challenging, especially when they are designed to be difficult. Artificial Intelligence (AI) techniques, such as Simulated Annealing, can be useful in solving Sudoku puzzles efficiently.

Simulated Annealing :

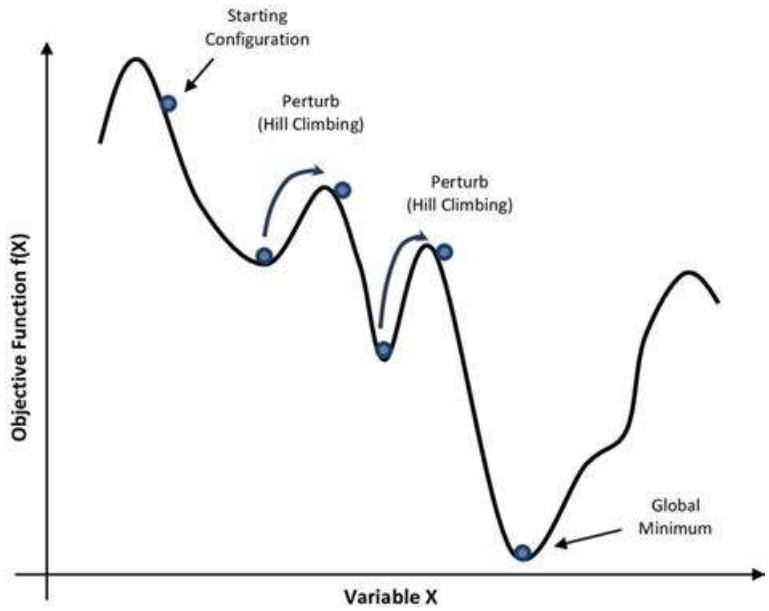
- Simulated Annealing is a Local search algorithm inspired by the annealing process in metallurgy.
- It is particularly effective for solving combinatorial optimization problems, such as Sudoku.
- Simulated Annealing starts with an initial solution and iteratively explores the solution space by making moves and accepting moves that improve the solution or satisfy certain criteria. It also allows for occasional moves to avoid getting stuck in local optima.

Simulated Annealing for Sudoku Solving :

Simulated Annealing can be applied to solve Sudoku puzzles by treating the puzzle as an optimization problem and constraint satisfaction problem.

Benefits of Simulated Annealing for Sudoku Solving :

1. **Efficiency**: Simulated Annealing can efficiently explore the solution space and find good solutions for Sudoku puzzles. It ***avoids getting stuck in local optima*** by occasionally accepting non-optimal moves, allowing it to explore different regions of the solution space.



2. **Adaptability**: Simulated Annealing can be easily adapted to different variations of Sudoku puzzles, such as Sudoku-X or irregular Sudoku. The algorithm ***can be modified by adding the specific constraints of these variations.***

3. **Less Storage**: By focusing on the current state, previous state, and generating candidate moves based on the temperature, Simulated Annealing avoids the need to store all the states of the Sudoku puzzle. This reduces the storage requirements as it is ***not necessary to store the entire state space*** of the Sudoku and allows the algorithm to efficiently search for a solution .

Conclusion :

- Simulated Annealing is a powerful AI technique that can be applied to efficiently solve Sudoku puzzles.
- By treating Sudoku as a constraint satisfaction problem and utilizing an energy function to evaluate moves, Simulated Annealing explores the solution space and converges towards a solution that satisfies the Sudoku constraints.
- This approach allows us to avoid searching the entire state space, as we focus solely on local states to determine the next move.
- As a result, we do not need to store and search the entire state space, which enhances the time and storage complexities of the algorithm.