



Sudoku Puzzle Solver

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Problem and Statement Analysis

- The problem we addressed was the automated solving of Sudoku puzzles
- Sudoku is a puzzle where you fill out a $n \times n$ square such that in each row, column and square each number is unique
- Each puzzle has prefilled out squares

3			8		1		2
2		1		3		6	4
			2		4		
8		9				1	6
	6						5
7		2				4	9
			5		9		
9		4		8		7	5
6			1		7		3

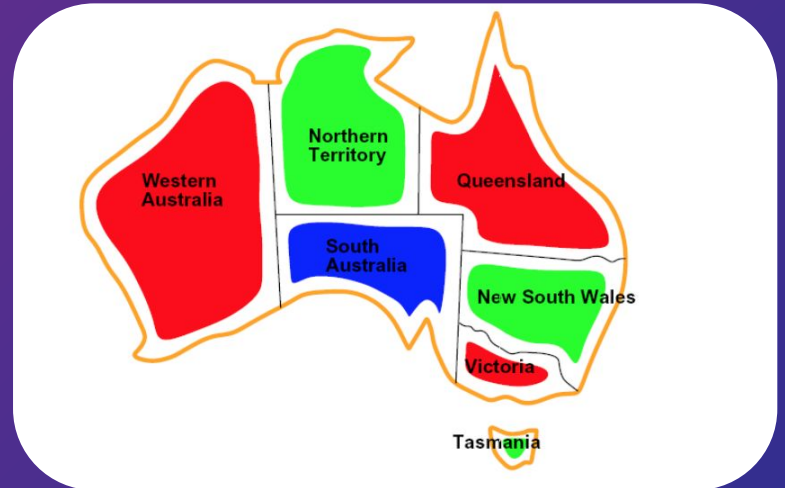
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Defining the Problem

Variables: {The cells}

Domain: {1, 2, ..., n}

Constraints: Alldiff (each row), Alldiff (each column), Alldiff (each minisquare)



Use-Case Scenarios

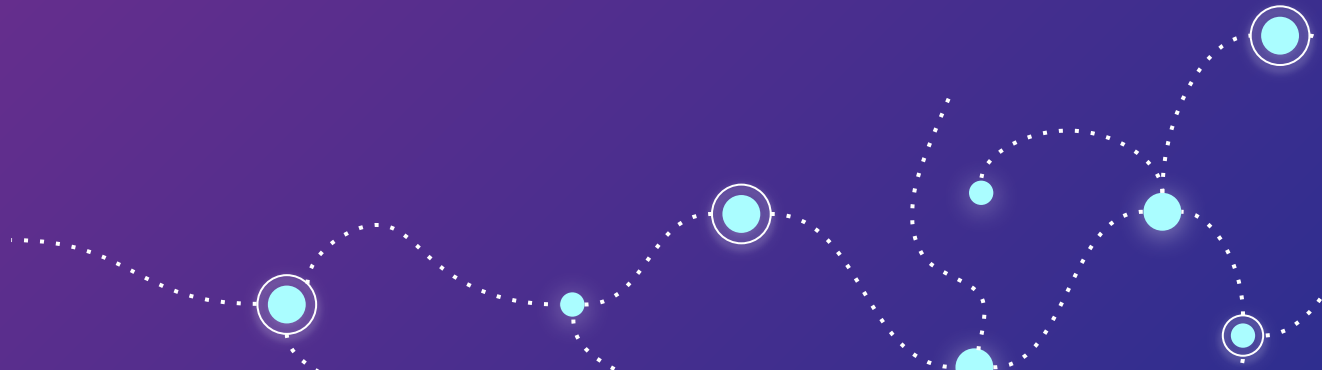
- Solving Sudoku Puzzles
 - Validating data
- Educational purposes
 - Cognitive enhancement



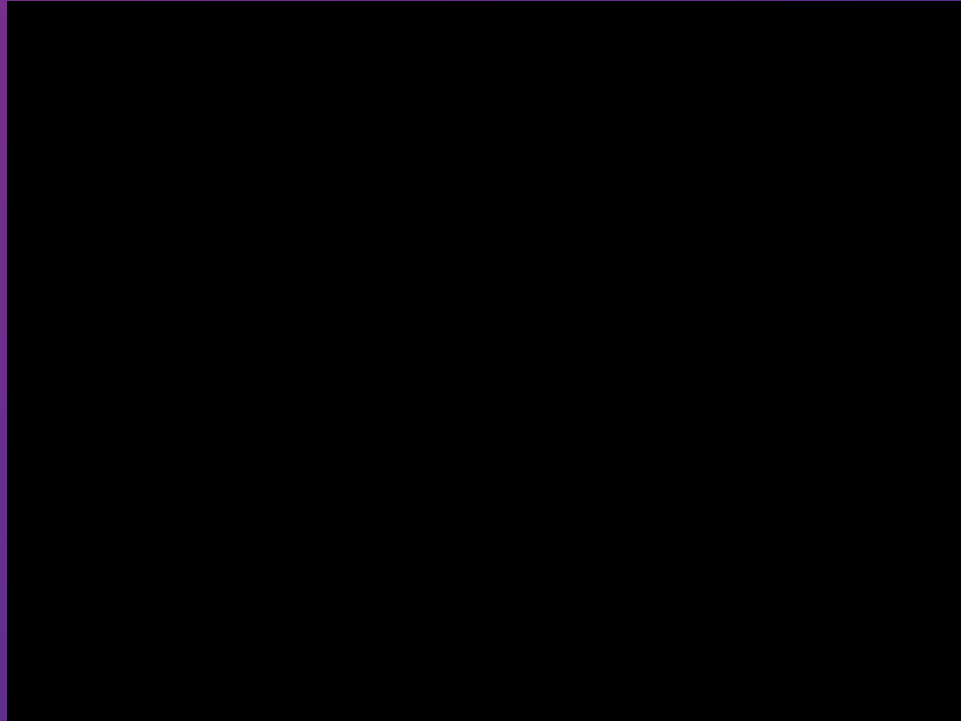
AI Algorithm and Model

- Backtracking
- Forward-Looking
- Constraint Propagation
- Heuristic Selection of Variables

Results and Demonstration



Demo



Results

- Solves 130 standard Sudoku puzzles with difficulties ranging from low to extremely high, in ~1 second.
- Solves 30 extremely hard standard Sudoku puzzles in ~2 seconds
- Solves 140 extremely hard standard Sudoku puzzles in ~2 seconds
- Solves 10 large 16x16 Sudoku puzzles in <1 second
- Solves 44 extremely hard 16x16 Sudoku puzzles in ~2 minutes

.	4	.	|	.	5	.	|	.	6	7
.	.	.	|	1	.	.	|	.	4	.
.	.	.	|	2	.	.	|	.	.	.
-	-	-	-	-	-	-	-	-	-	-
1	.	.	|	8	.	.	|	3	.	.
.	.	.	|	.	.	.	|	2	.	.
.	6	.	|	.	.	.	|	.	.	.
-	-	-	-	-	-	-	-	-	-	-
.	.	.	|	.	4	.	|	.	5	.
3	.	.	|	.	.	.	|	8	.	.
2	.	.	|	.	.	.	|	.	.	.

.	E	B	.	.	.	A	.	.	F	1	8	.	5
.	.	A	9	|	7	.	.	.	.	.	.	3	C
.	5	G	.	|	.	4	3	|	.	B	.	.	E
C	.	1	.	|	.	.	F	|	A	3	8	.	.
-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	6	.	.	|	.	.	1	|	.	.	4	|	F
5	.	.	.	|	2	.	.	|	.	9	|	.	G
.	3	8	|	G	.	6	|	C	.	F	|	.	.
.	E	.	.	|	D	.	.	|	.	5	|	B	A
-	-	-	-	-	-	-	-	-	-	-	-	-	-
E	.	.	|	B	8	.	.	|	7	C	|	4	.
.	D	.	|	.	.	4	|	.	.	.	|	3	5
B	.	5	F	|	6	.	.	|	.	.	|	C	7
4	9	.	|	A	7	.	5	|	D	.	2	|	G
-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	.	7	.	|	.	E	.	|	6	G	.	|	A
.	G	2	B	|	5	.	.	|	.	.	.	|	4
.	.	.	.	|	6	.	.	|	.	8	1	|	7
.	.	.	.	|	C	.	.	|	2	B	A	|	G

Lesson Learned

- Continue to develop the AI
 - Started with only backtracking
- Constraint propagation



Questions?