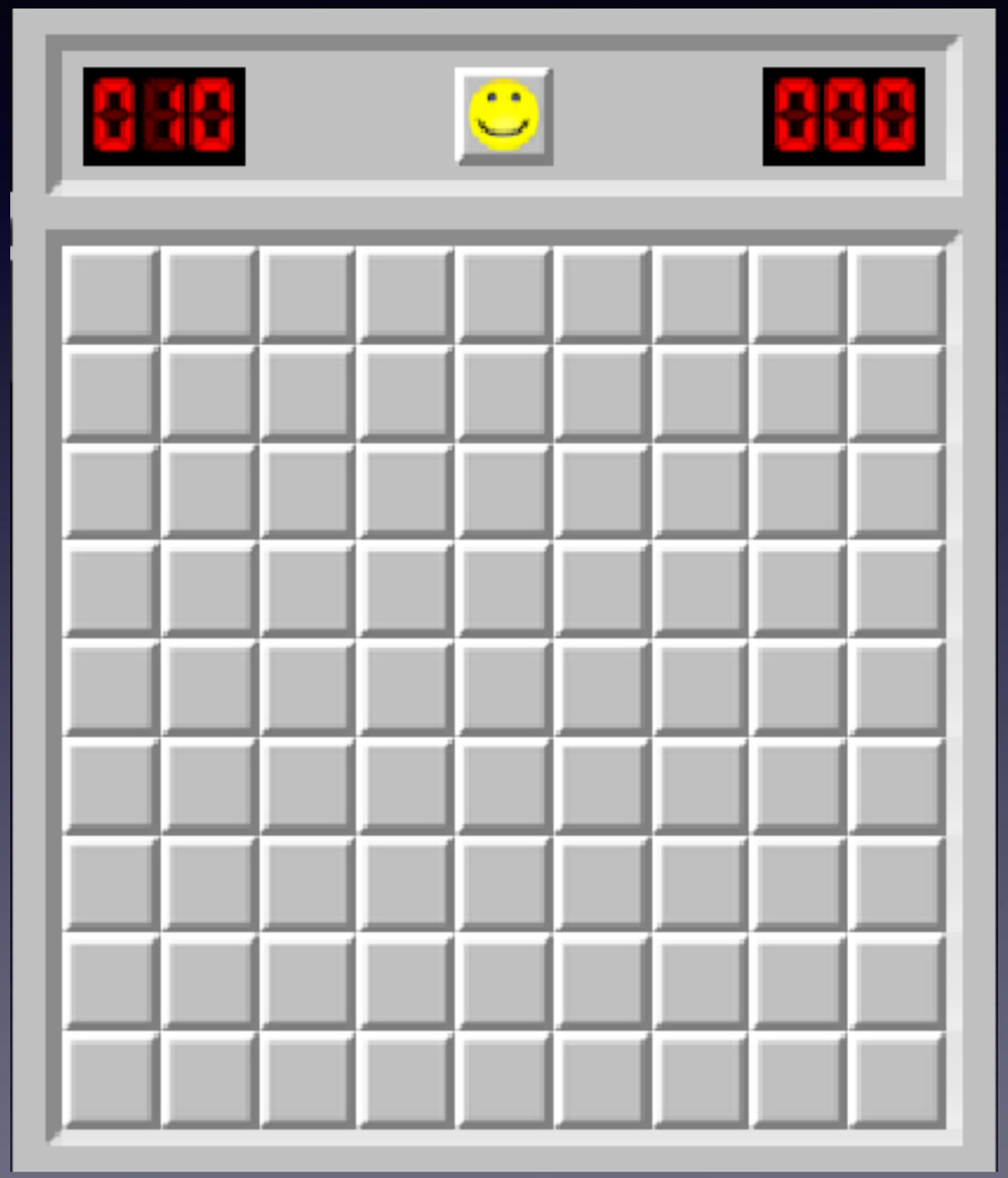
MinesweeperMind

MinesweeperMind

- Created a bot to beat the mines

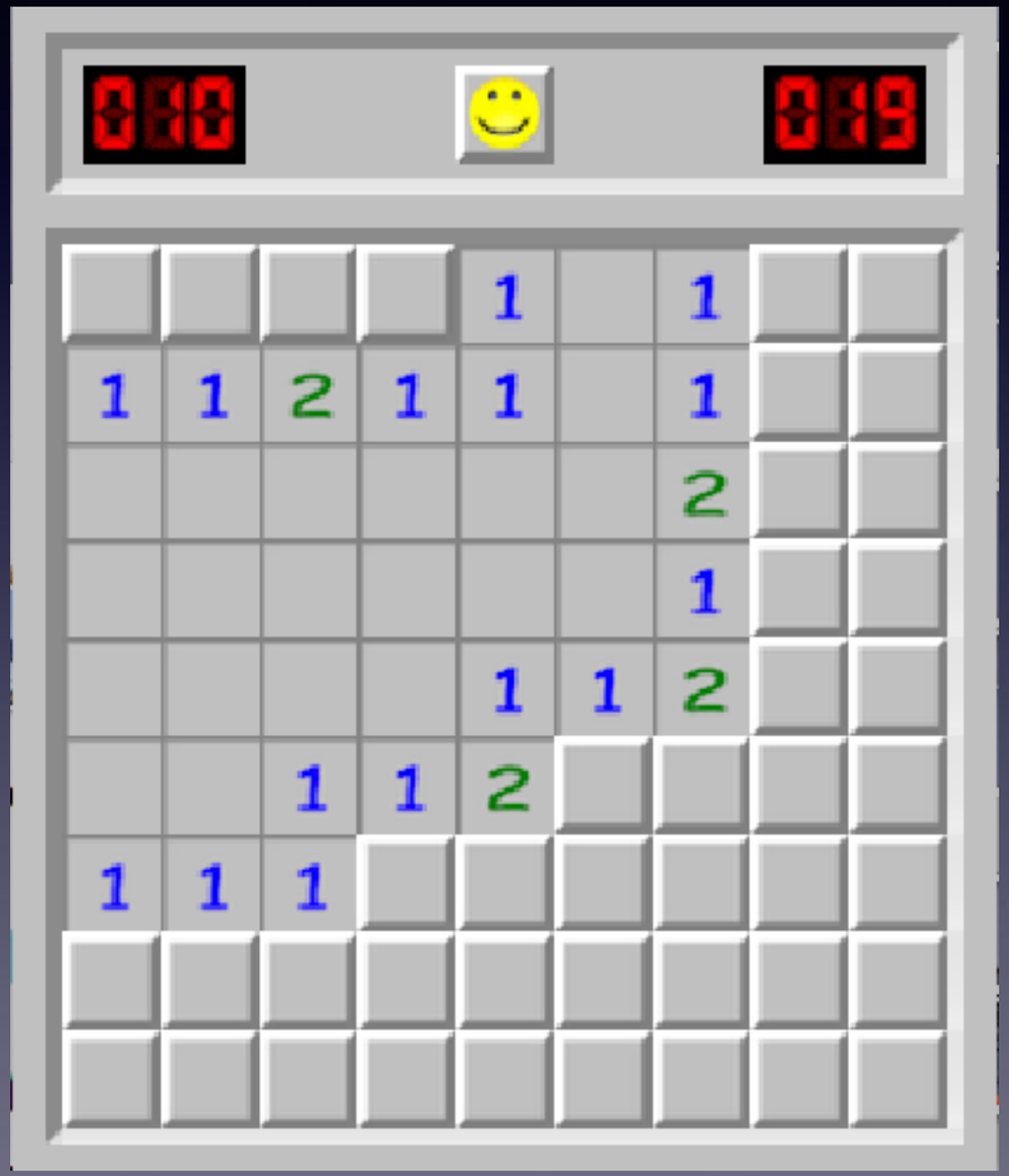
Minesweeper Rules

- Game starts with covered board



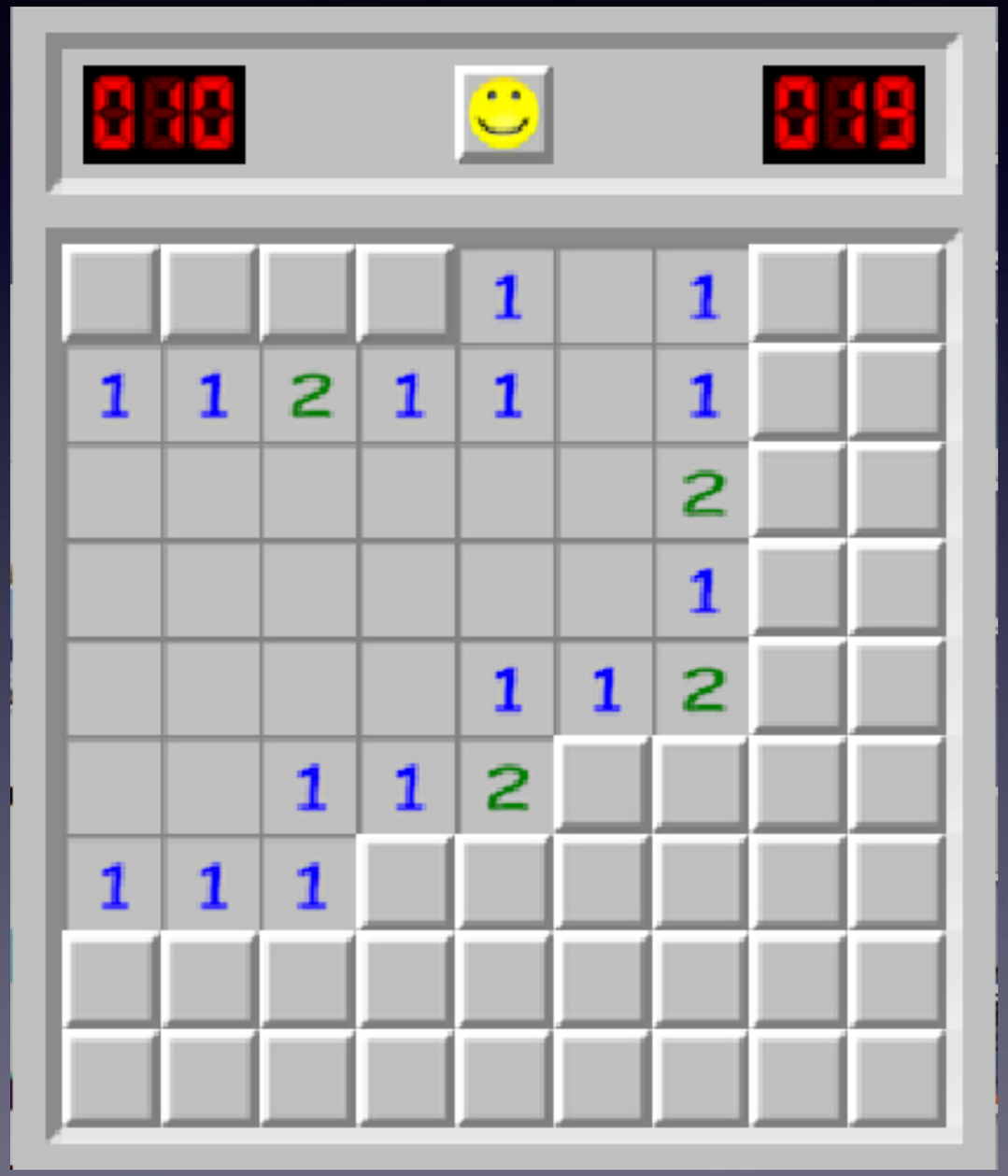
Minesweeper Rules

- Game starts with covered board
- Click on a square to reveal it



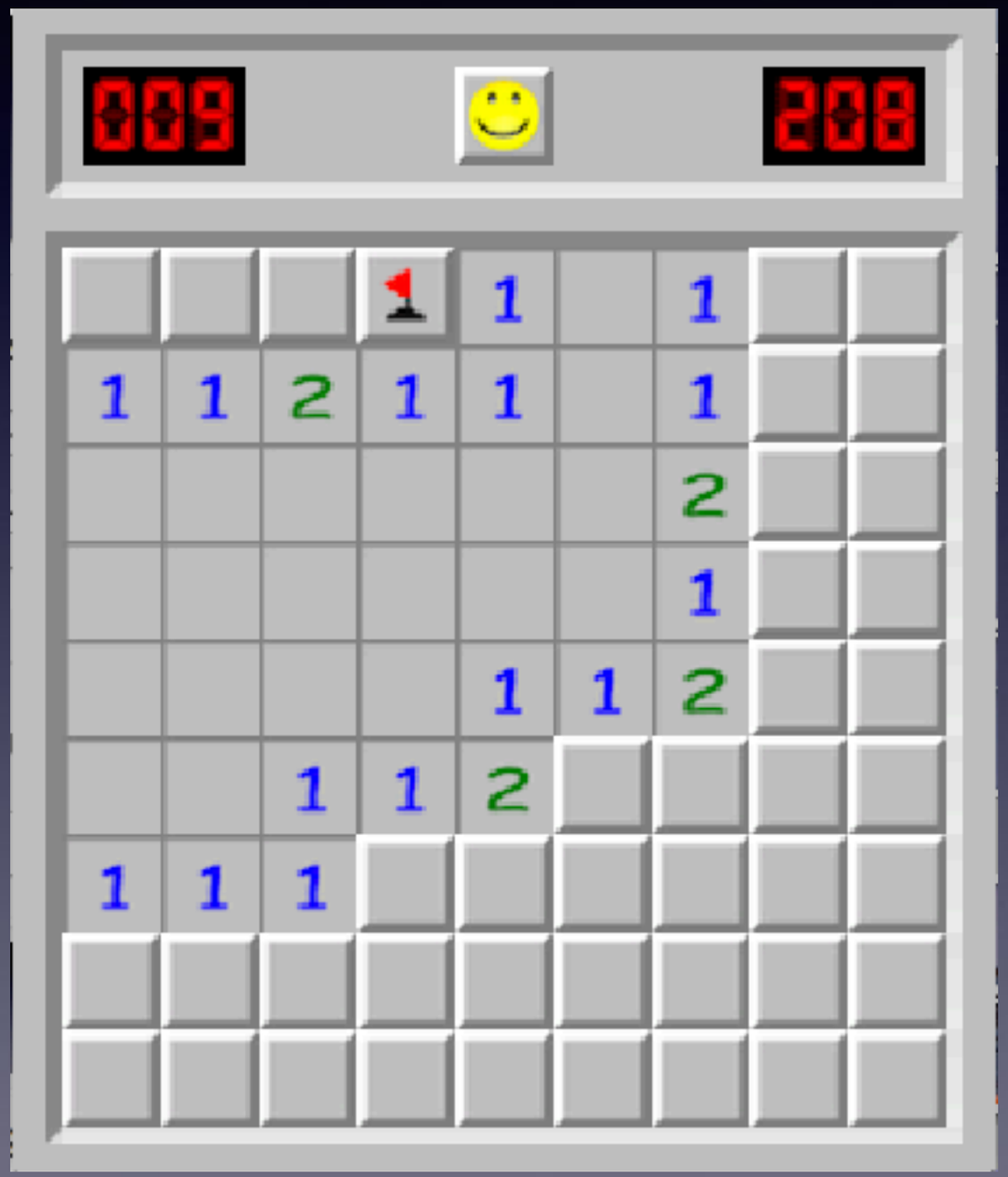
Minesweeper Rules

- Game starts with covered board
- Click on a square to reveal it
- Numbers refer to how many mines are adjacent



Minesweeper Rules

- Game starts with covered board
- Click on a square to reveal it
- Numbers refer to how many mines are adjacent
- Flags are used to mark mines



Minesweeper Rules

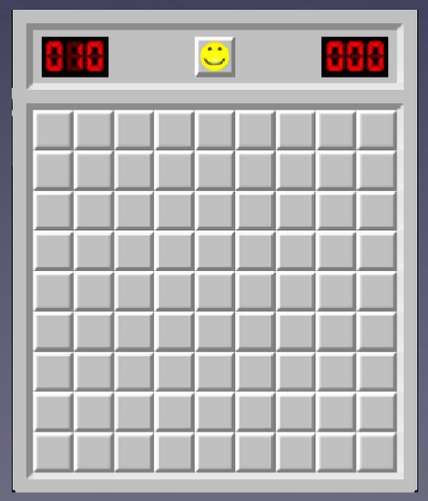
- Game starts with covered board
- Click on a square to reveal it
- Numbers refer to how many mines are adjacent
- Flags are used to mark mines
- If you click on a mine you lose

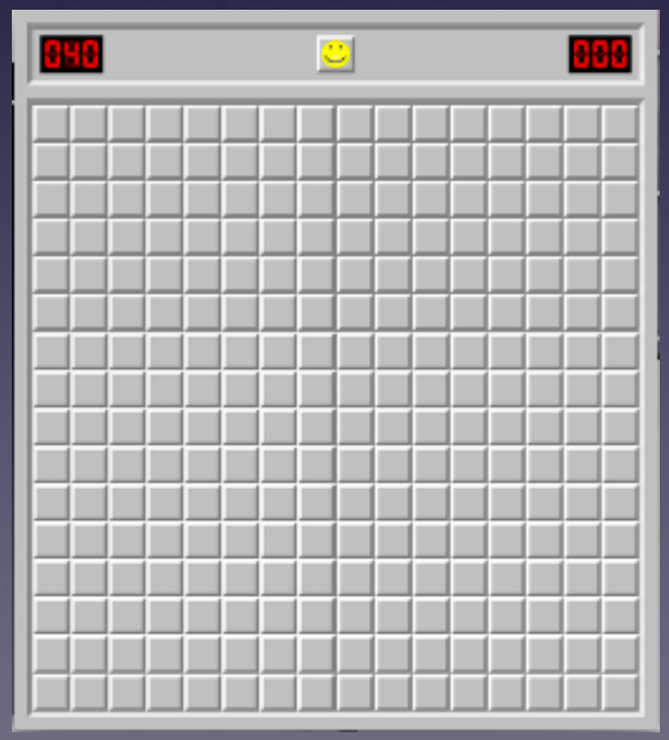
Minesweeper Rules

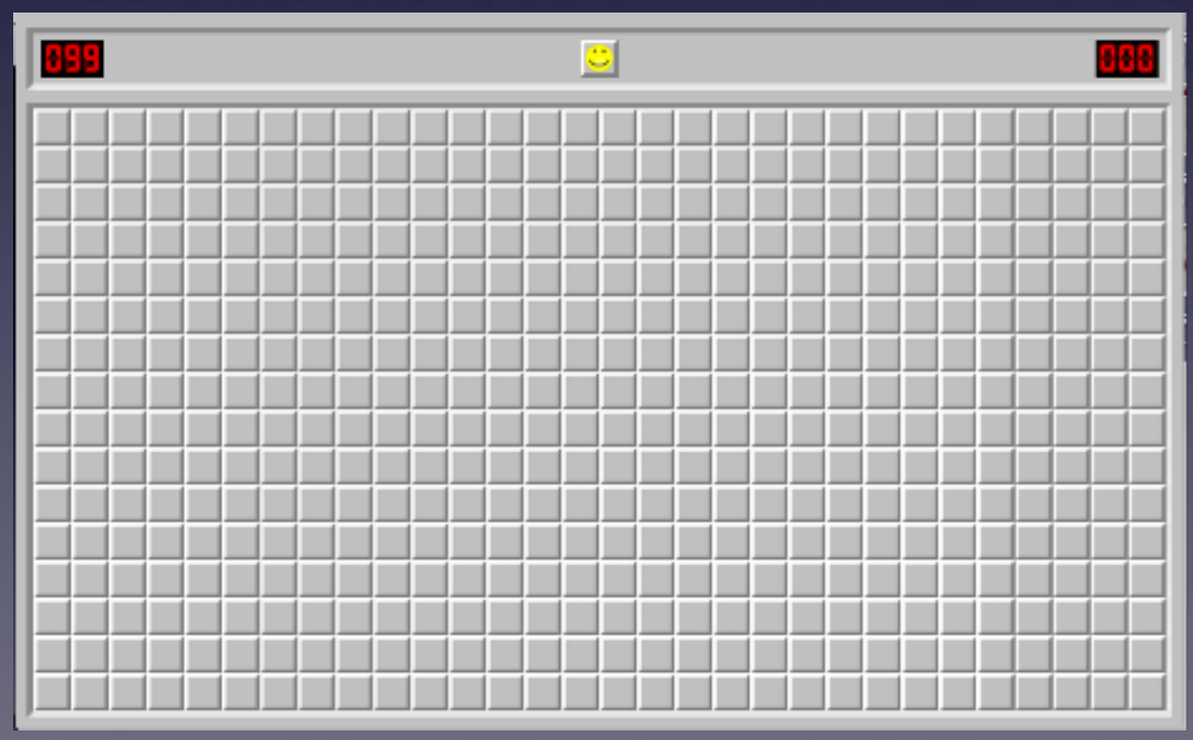
- Game starts with covered board
- Click on a square to reveal it
- Numbers refer to how many mines are adjacent
- Flags are used to mark mines
- If you click on a mine you lose
- Object of the game is to flag all mines

Difficulty Levels

Beginner	Intermediate	Expert
9x9 grid	16x16 grid	16x30 grid
10 mines	40 mines	99 mines

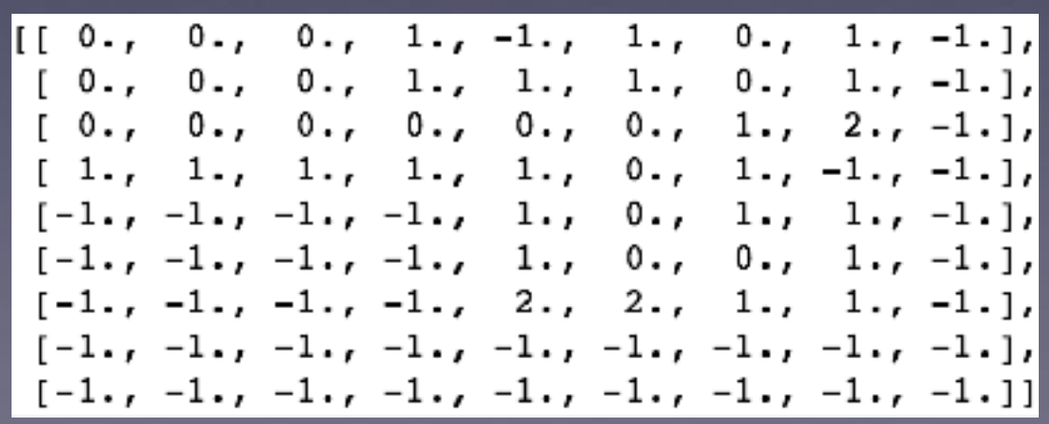






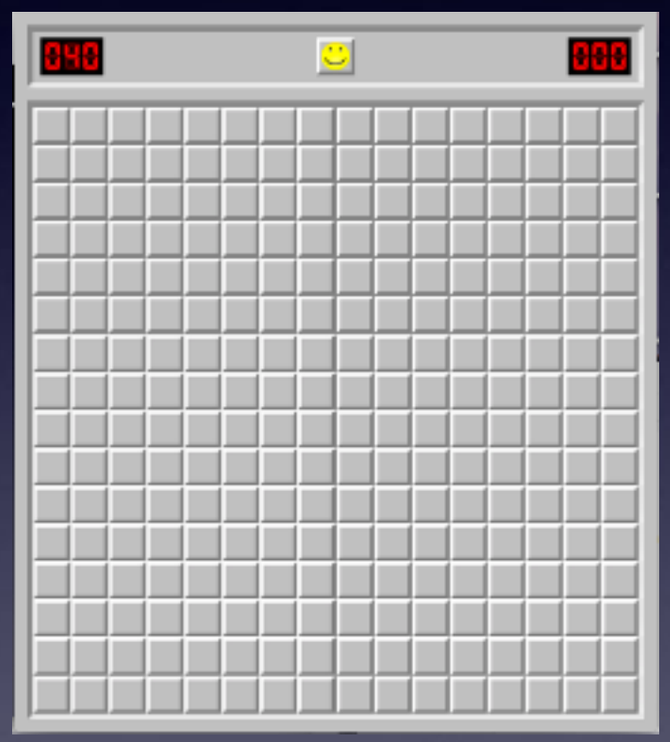
Computer Vision

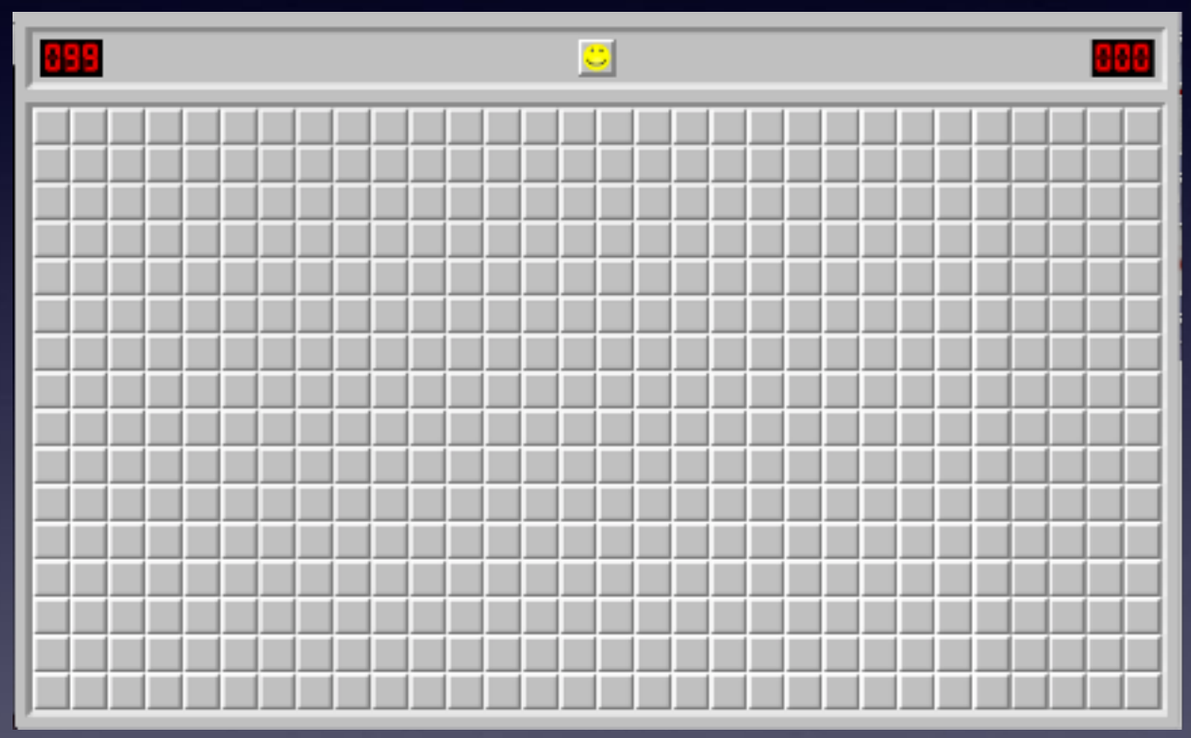
- Used OpenCV
- Takes screenshots and uses template matching
- Extracts the data so that the algorithm can go to work



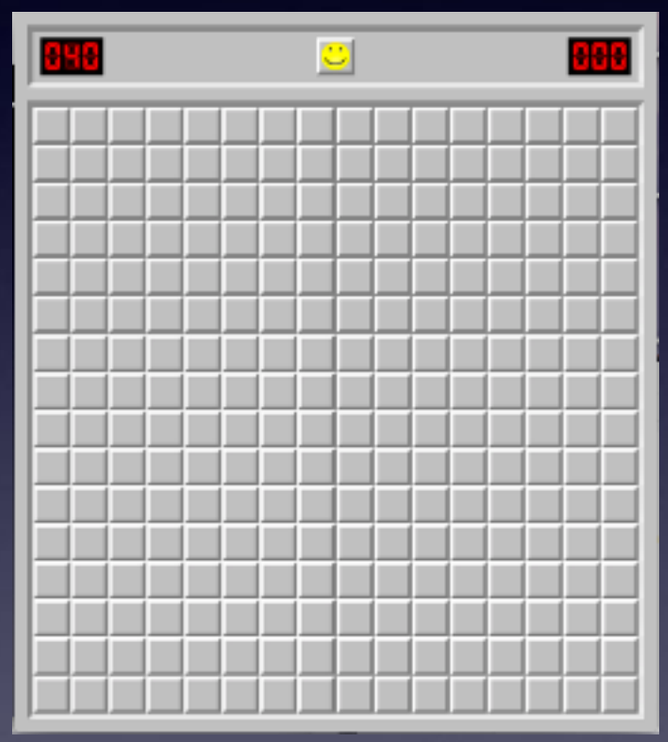
```
[[ 0.,  0.,  0.,  1., -1.,  1.,  0.,  1., -1.],
 [ 0.,  0.,  0.,  1.,  1.,  1.,  0.,  1., -1.],
 [ 0.,  0.,  0.,  0.,  0.,  0.,  1.,  2., -1.],
 [ 1.,  1.,  1.,  1.,  1.,  0.,  1., -1., -1.],
 [-1., -1., -1., -1.,  1.,  0.,  1.,  1., -1.],
 [-1., -1., -1., -1.,  1.,  0.,  0.,  1., -1.],
 [-1., -1., -1., -1.,  2.,  2.,  1.,  1., -1.],
 [-1., -1., -1., -1., -1., -1., -1., -1., -1.],
 [-1., -1., -1., -1., -1., -1., -1., -1., -1.]]
```

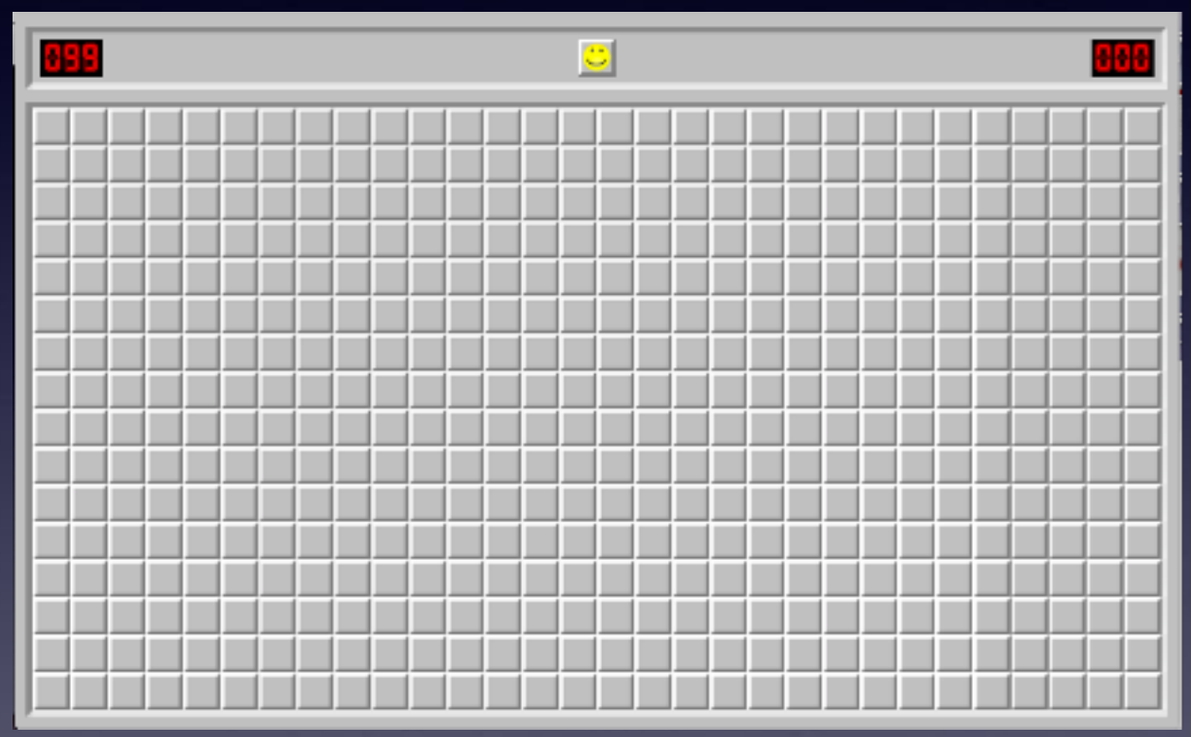
Naive Algorithm



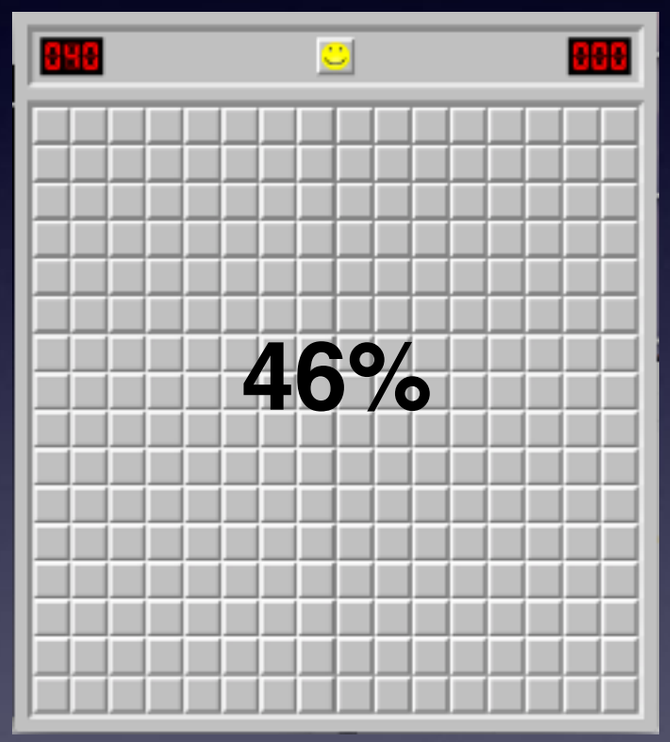


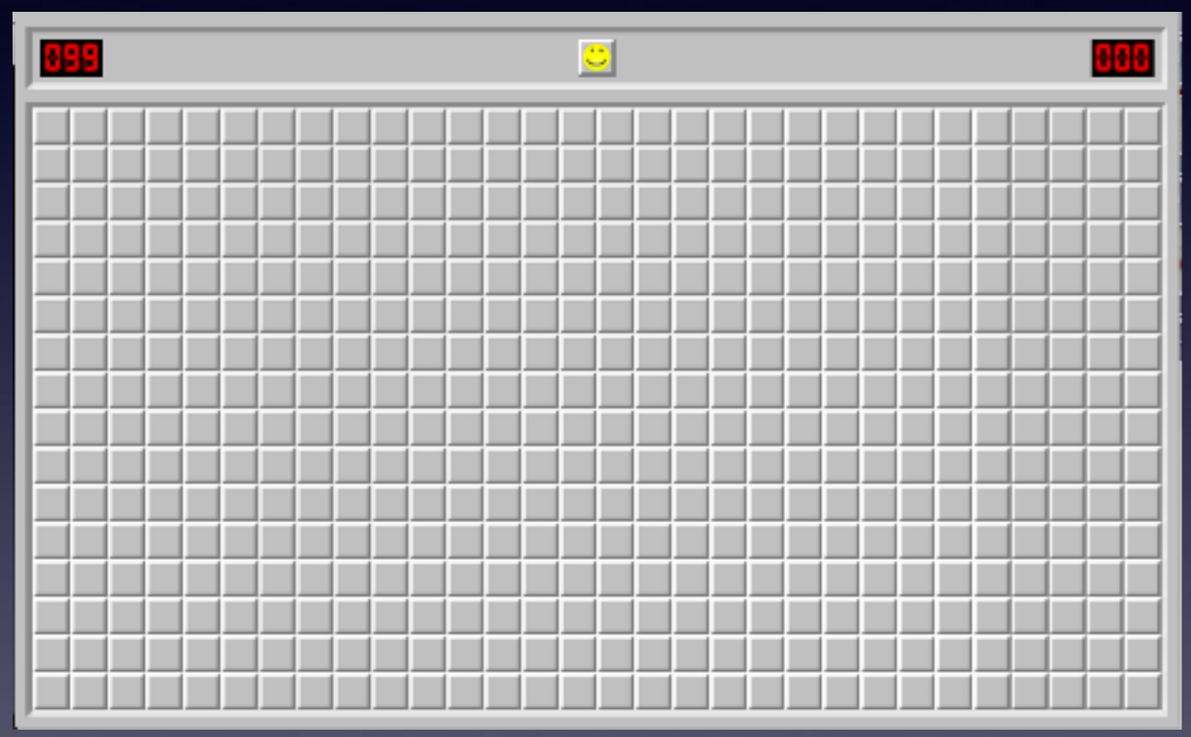
Naive Algorithm



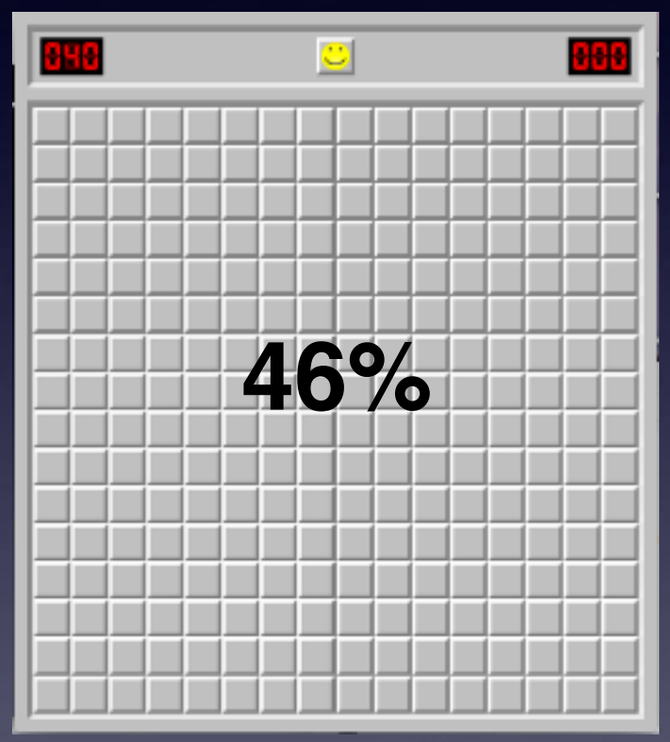


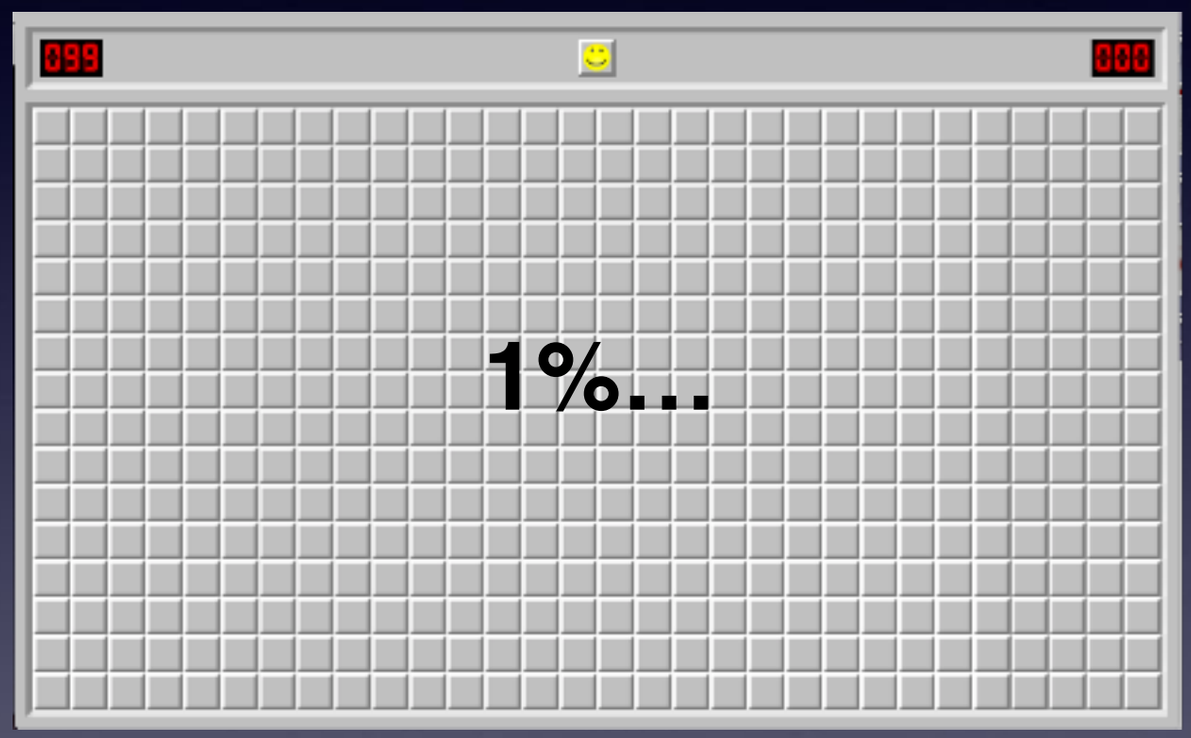
Naive Algorithm





Naive Algorithm

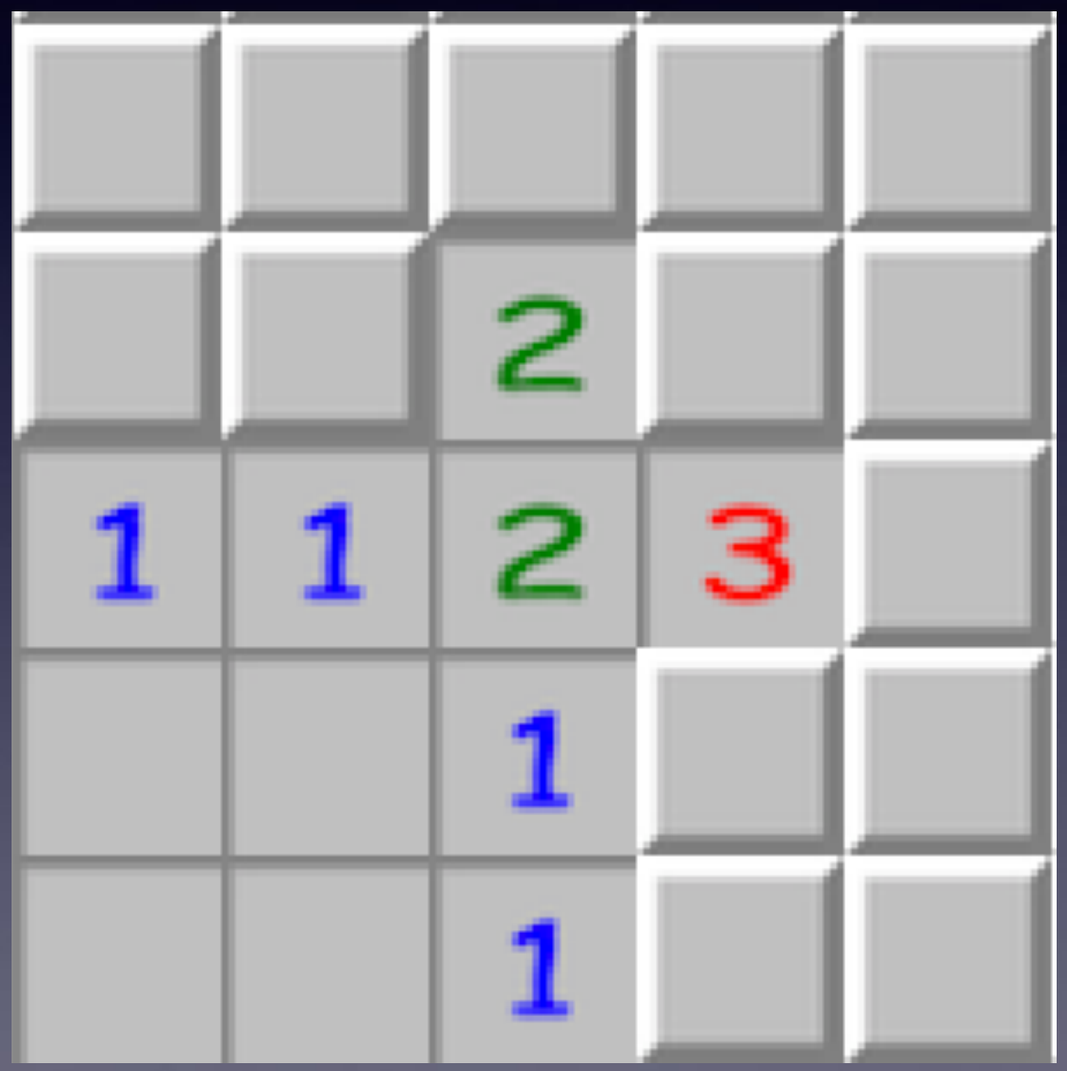




Rational Algorithm with Backtracking

- Algorithm mimics a rational human
- NP complete
- Enumerate every legal possibility
- Backtracking algorithm increases efficiency

Educated Guessing with Backtracker



- What do we do when random guessing is required?

Educated Guessing with Backtracker

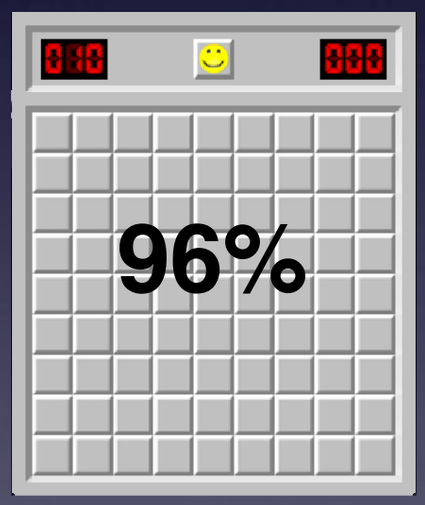
- What do we do when random guessing is required?

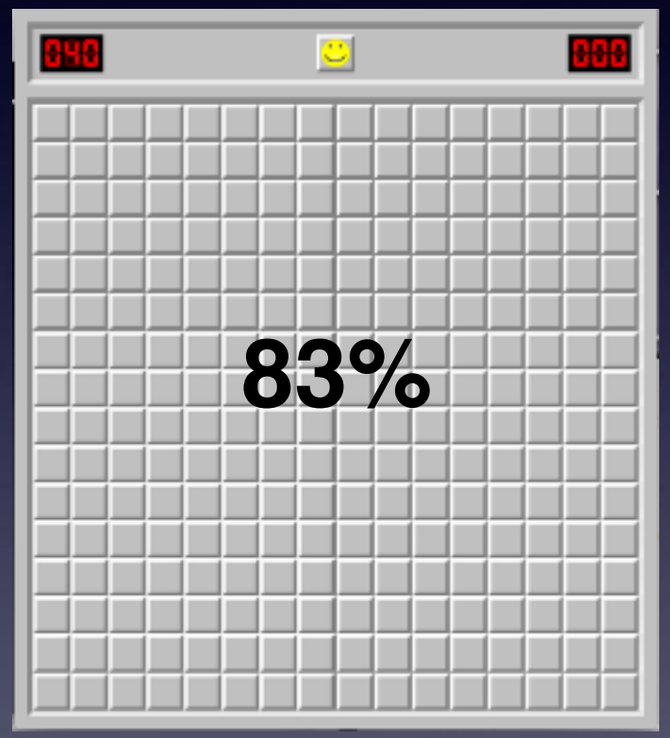
Educated Guessing with Backtracker

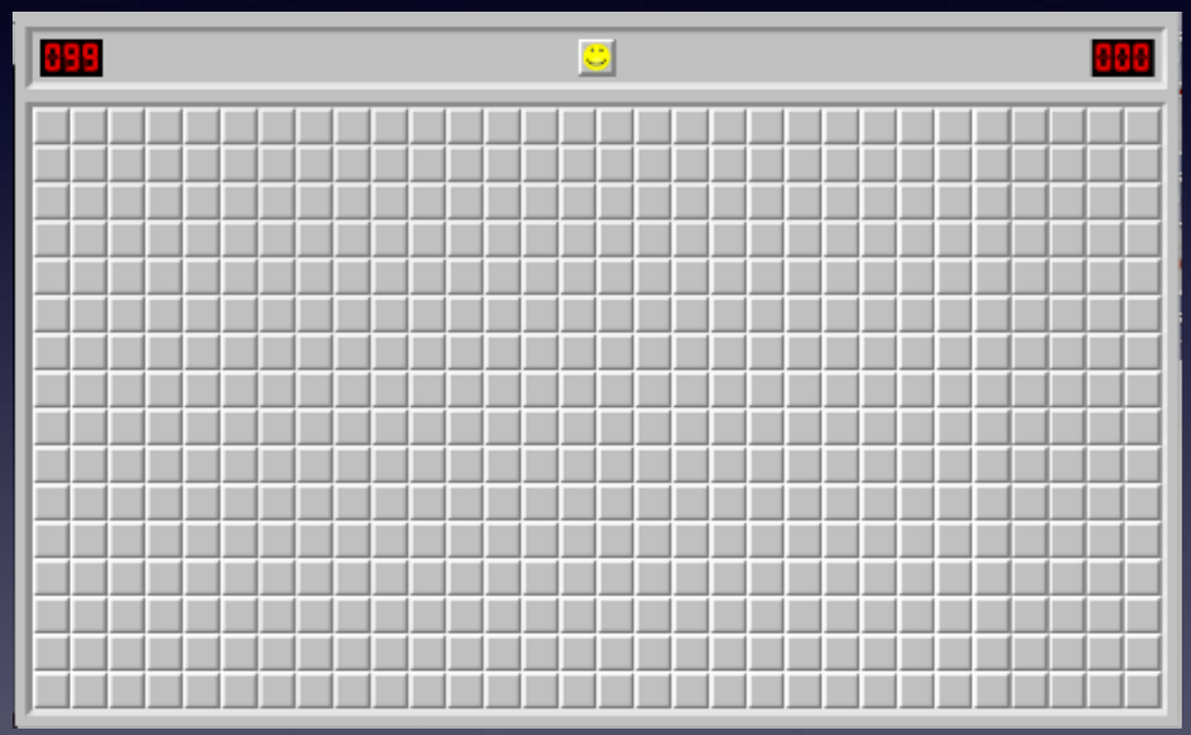
- What do we do when random guessing is required?

How well does the model perform?

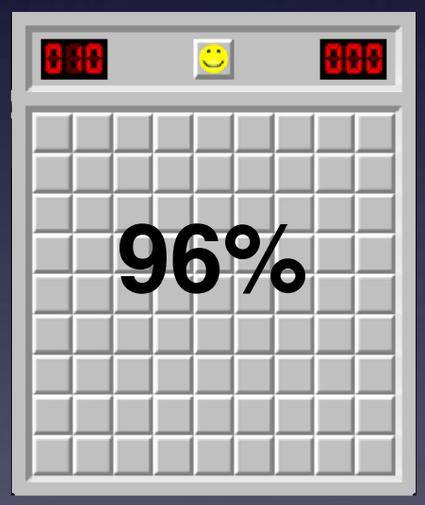
How well does the model perform?

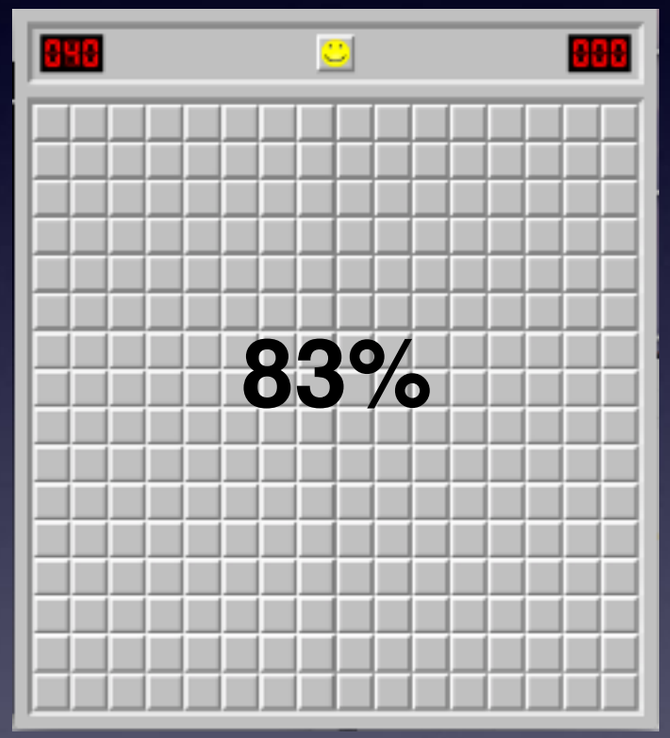


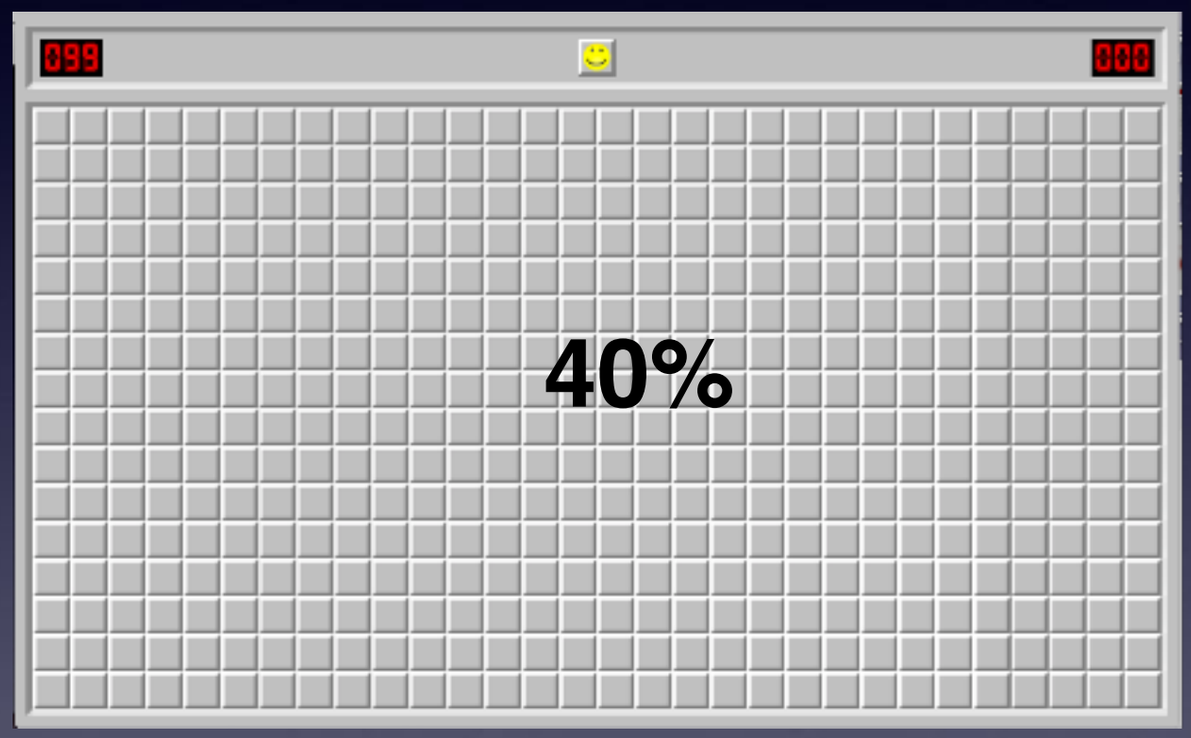




How well does the model perform?





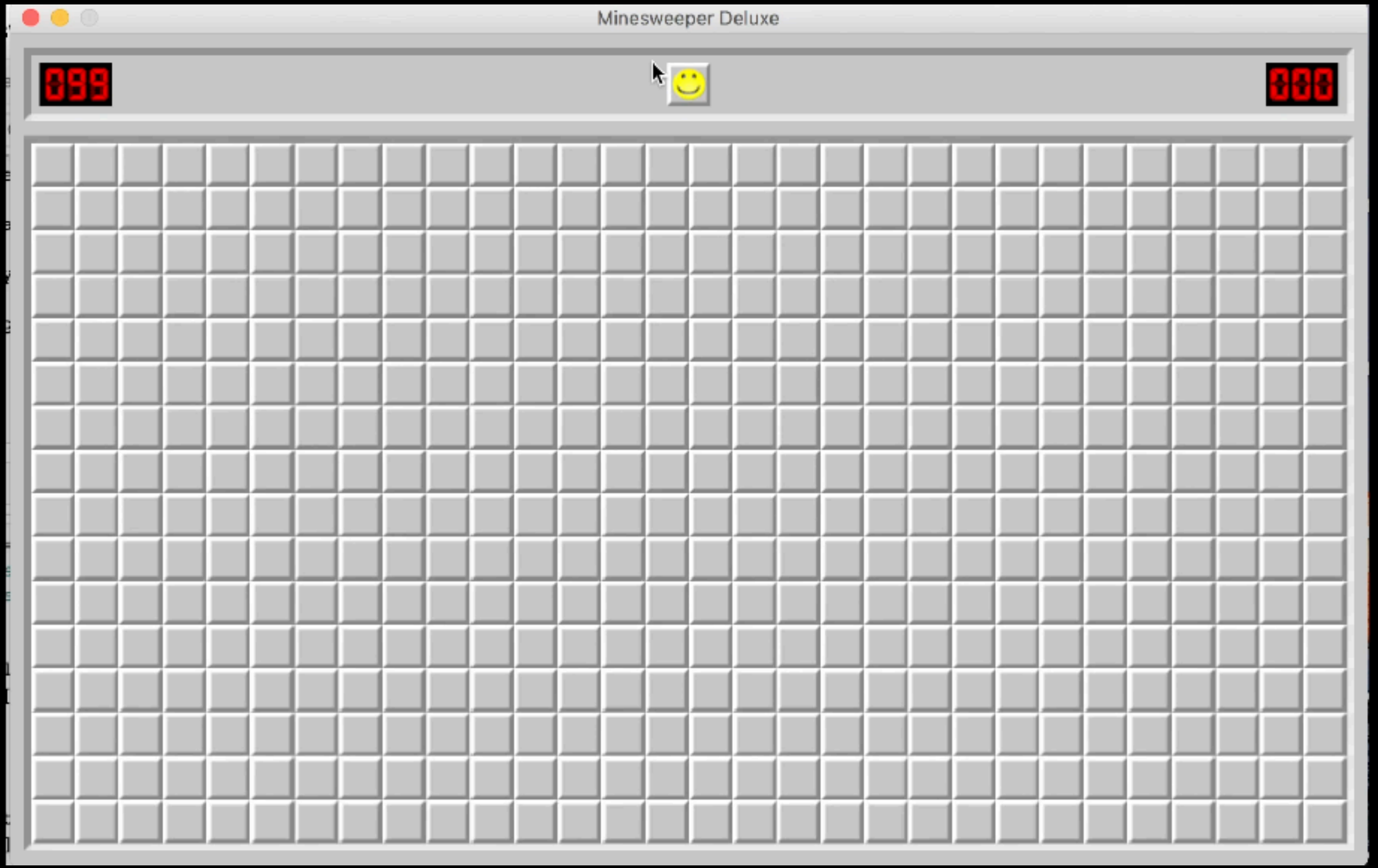


Comparison to human players

- The best human players win at a rate of roughly 35% on expert
- World record for time for a human on expert is 32 seconds

Comparison to human players

- The best human players win at a rate of roughly 35% on expert
- World record for time for a human on expert is 32 seconds
- MinesweeperMind's best time is 19 seconds


Minesweeper Deluxe

Contact Info

- Karl Rudeen
- karlrudeen@gmail.com
- github.com/needurlrak
- linkedin.com/in/karlrudeen