Tetris AI Genetic Algorithm Project

What if a computer could learn to play Tetris—not by being told the rules, but by evolving its own strategy through trial and error, just like nature evolves life?

In this project, we challenged an AI to master one of the world's most iconic games using nothing but the principles of evolution. No pre-written tactics. No neural networks. Just raw survival-of-the-fittest logic.

Join us as we explore how a Genetic Algorithm transformed random guesses into intelligent moves—and turned chaos into high scores.

M **by Moaz Gehad**

Genetic Algorithm Configuration

Number of GENERATIONS	10
POPULATION_SIZE	12
MUTATION_RATE	0.1
Random Seed	42
Crossover	Split at random point

This setup controls the evolutionary process of the AI, balancing exploration and exploitation to improve Tetris performance over multiple iterations.

Contribution Factors Explained

Max Height

Height of the tallest column on the board.

Removed Lines

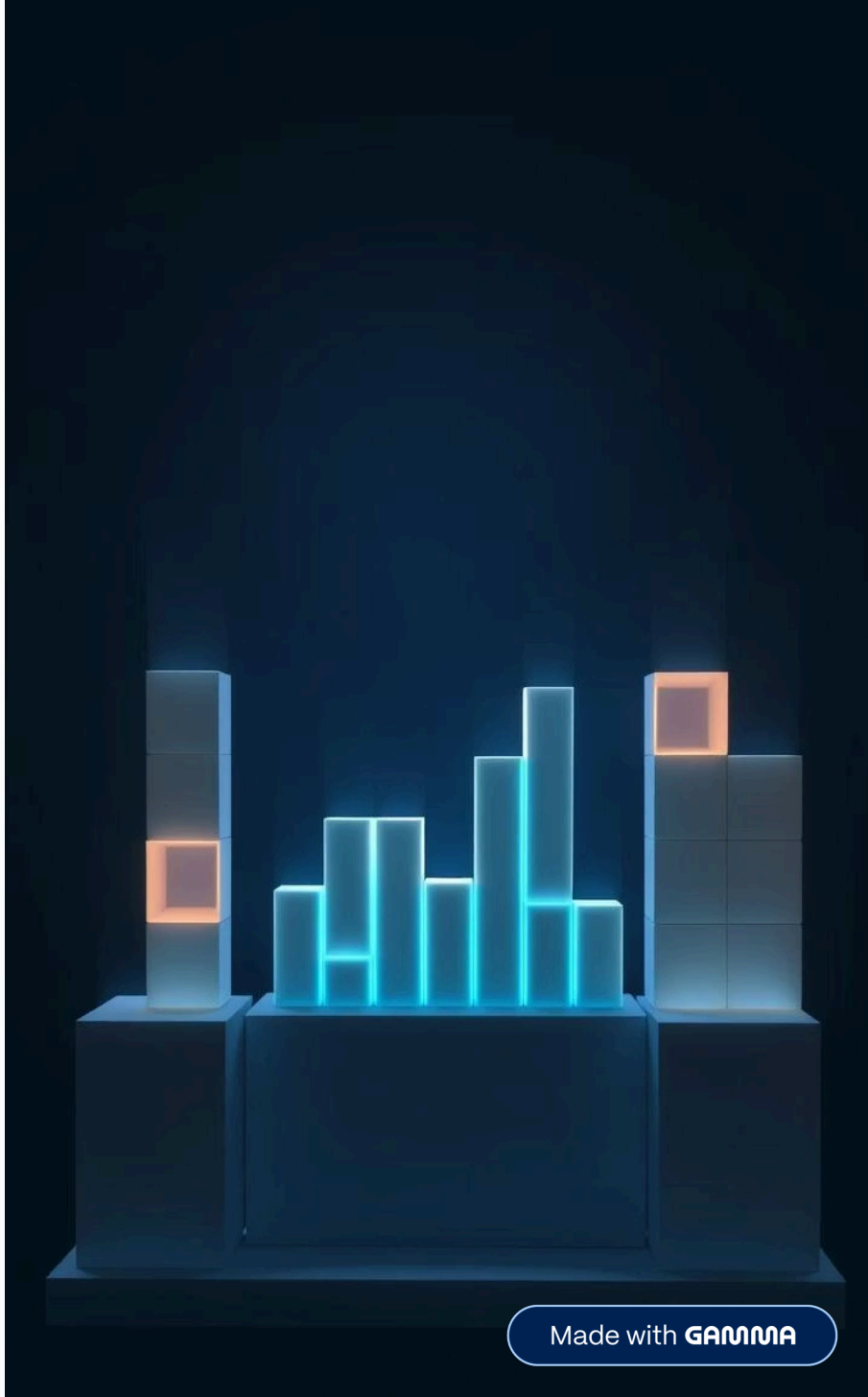
Number of lines cleared after placing a piece.

New Holes

Holes created by the latest piece placement.

Piece & Floor Sides

Number of sides of the piece touching other blocks or the floor.



Additional Contribution Factors

Wall Sides

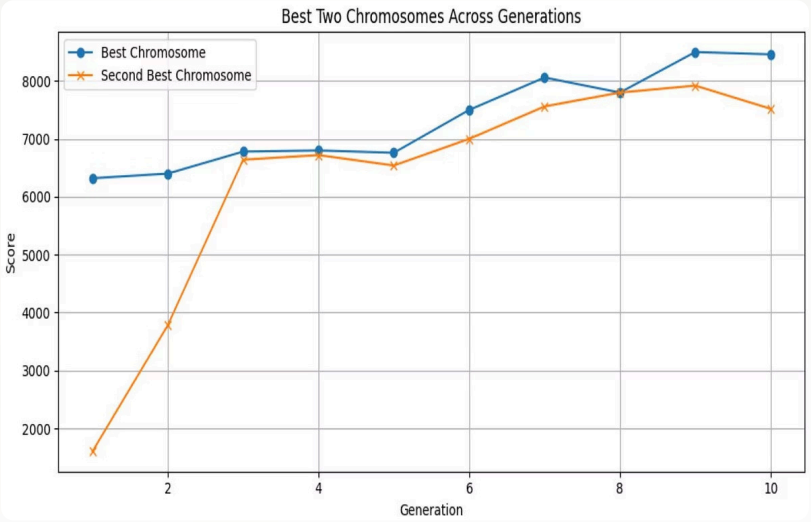
Sides of the piece touching the wall.

Total Holes

Empty cells with filled cells above them on the board.

Total Blocking Blocks

Blocks sitting above holes, potentially blocking line clears.



Evolution of Top Chromosomes Over Generations

The genetic algorithm's top chromosomes improved their scores steadily from generation 0 to 9. The best chromosome started with a score of 6320 and reached up to 8500 by generation 8. This progression demonstrates the effectiveness of evolutionary optimization in enhancing Tetris AI performance.

Top Chromosome Scores and Variations

Chromosome Example

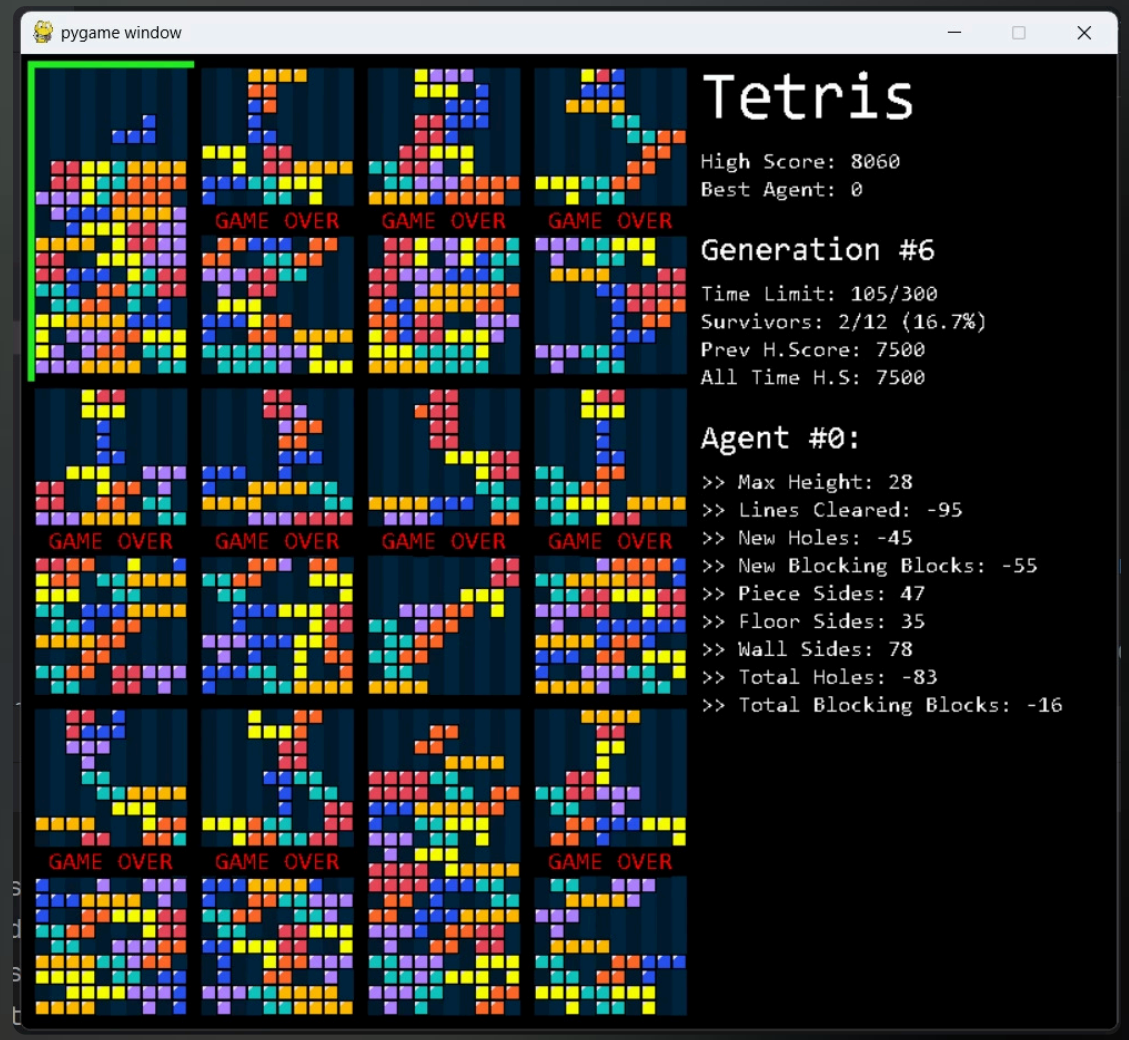
One top chromosome's gene sequence: [28, -95, -45, -55, 47, 35, 78, -83, -16]

This chromosome consistently achieved high scores across generations.

Score Progression

Scores ranged from 6320 at generation 0 to 8500 at generation 8, showing steady improvement.

Variations in gene values contributed to performance differences.



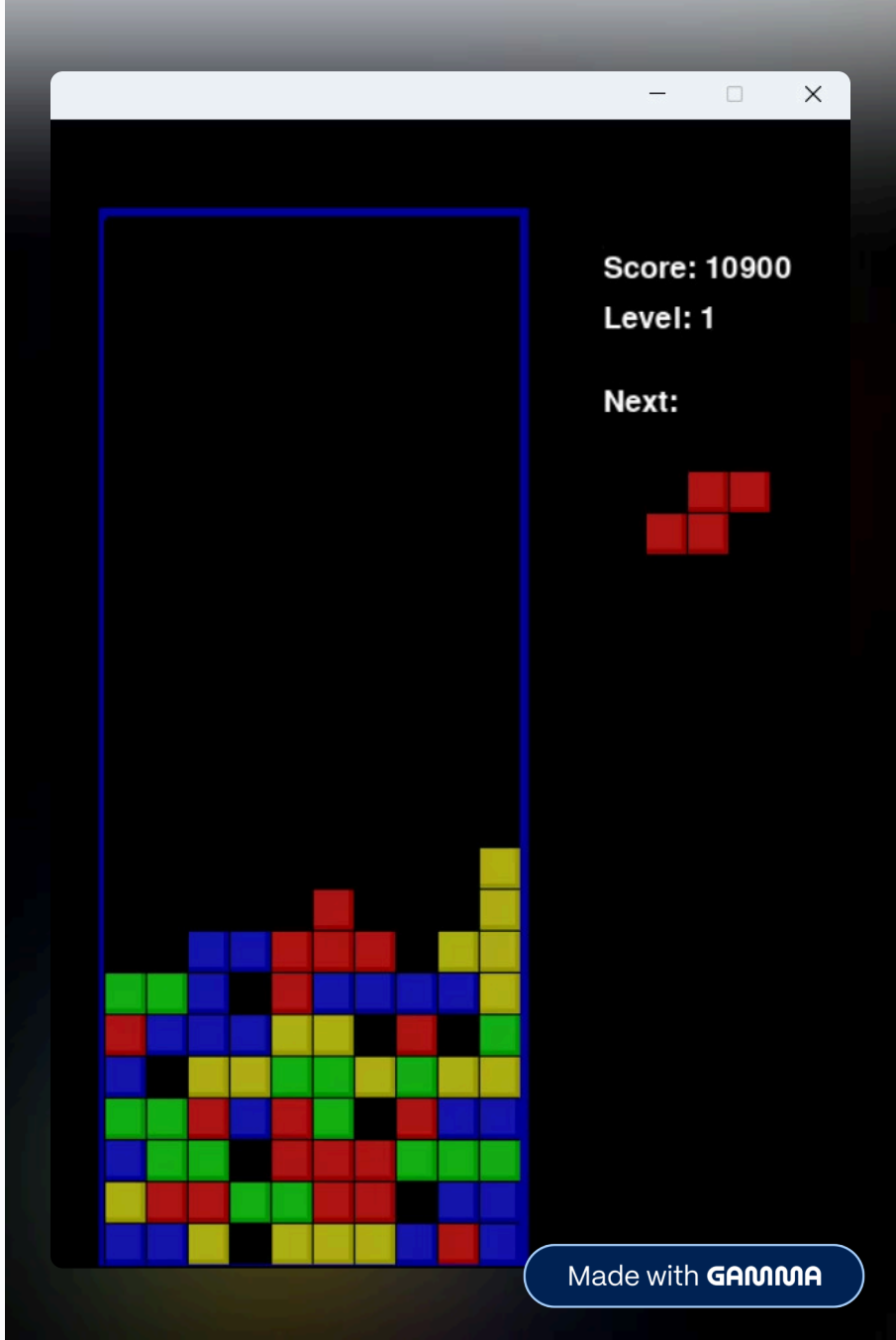
Test Chromosome

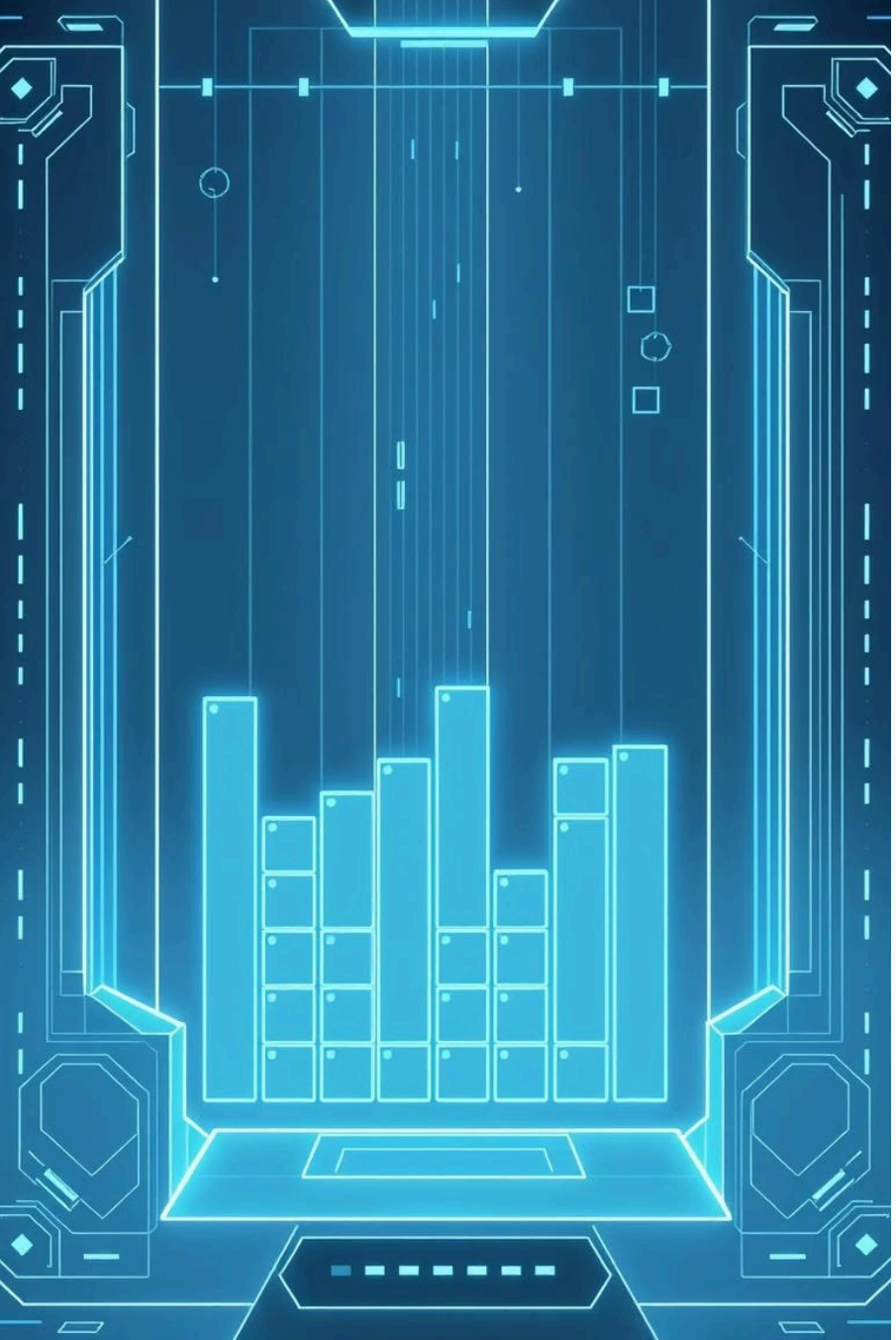
We tested the top scoring chromosome for 600 iterations to check if it wins or not

Chromosome: [-54, -80, -45, -55, 47, 35, 78, -83, -16]

Score after 600 iterations : 11460

Status : Win





Genetic Algorithm Impact on Gameplay

Optimized Piece Placement

AI uses evolved chromosomes to minimize holes and maximize line clears.

Adaptive Strategy

Mutation and selection refine strategies over generations for better scores.

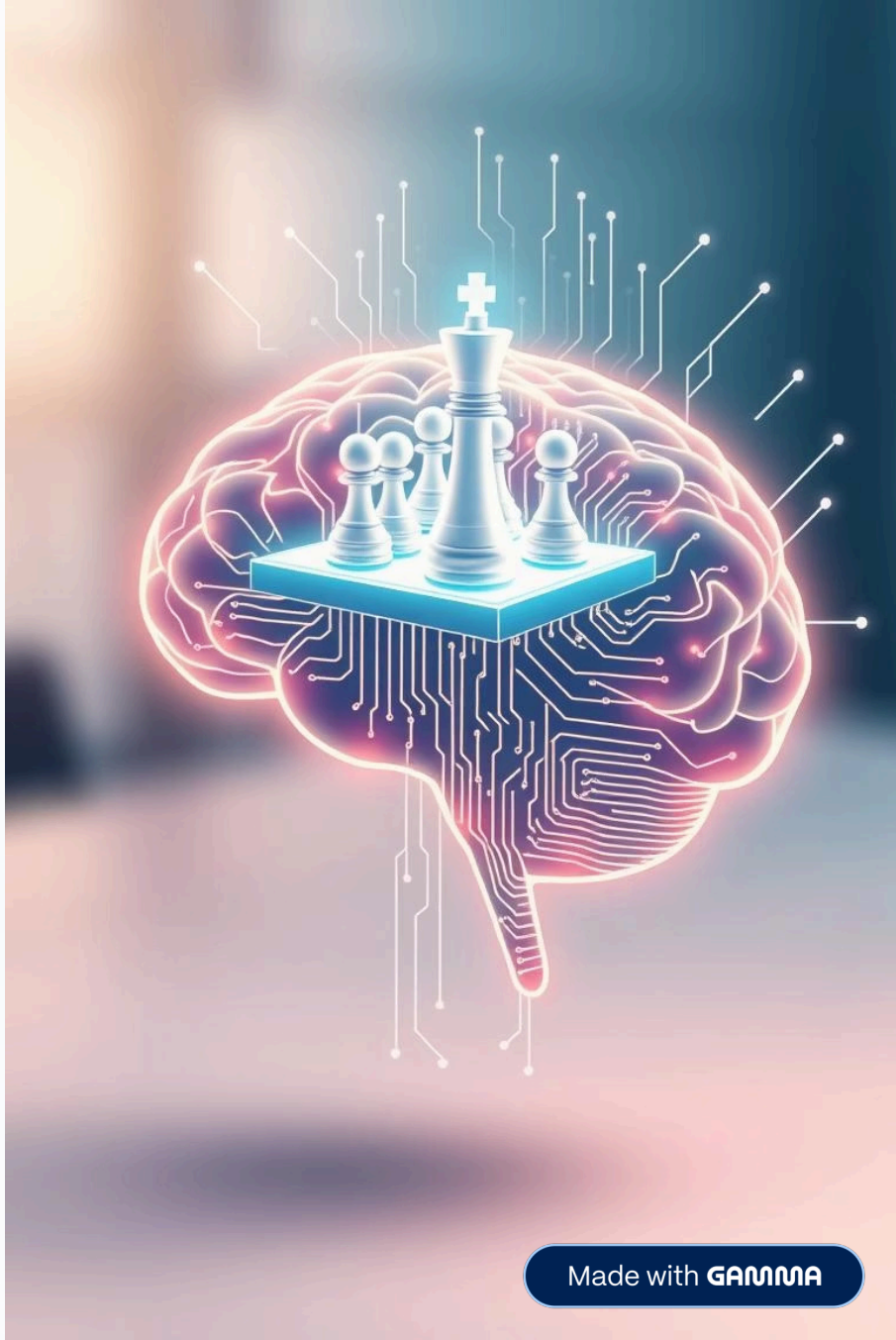
Balance of Factors

Contribution factors guide AI to balance height, holes, and block contacts.

Summary and Future Directions

The genetic algorithm successfully improved Tetris AI performance by evolving chromosomes over 10 generations. Key contribution factors were effectively balanced to optimize gameplay. Future work could explore larger populations, more generations, or additional factors to further enhance AI capabilities.

This approach demonstrates the power of evolutionary algorithms in complex game strategy optimization.



Team

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