

Tango Puzzle

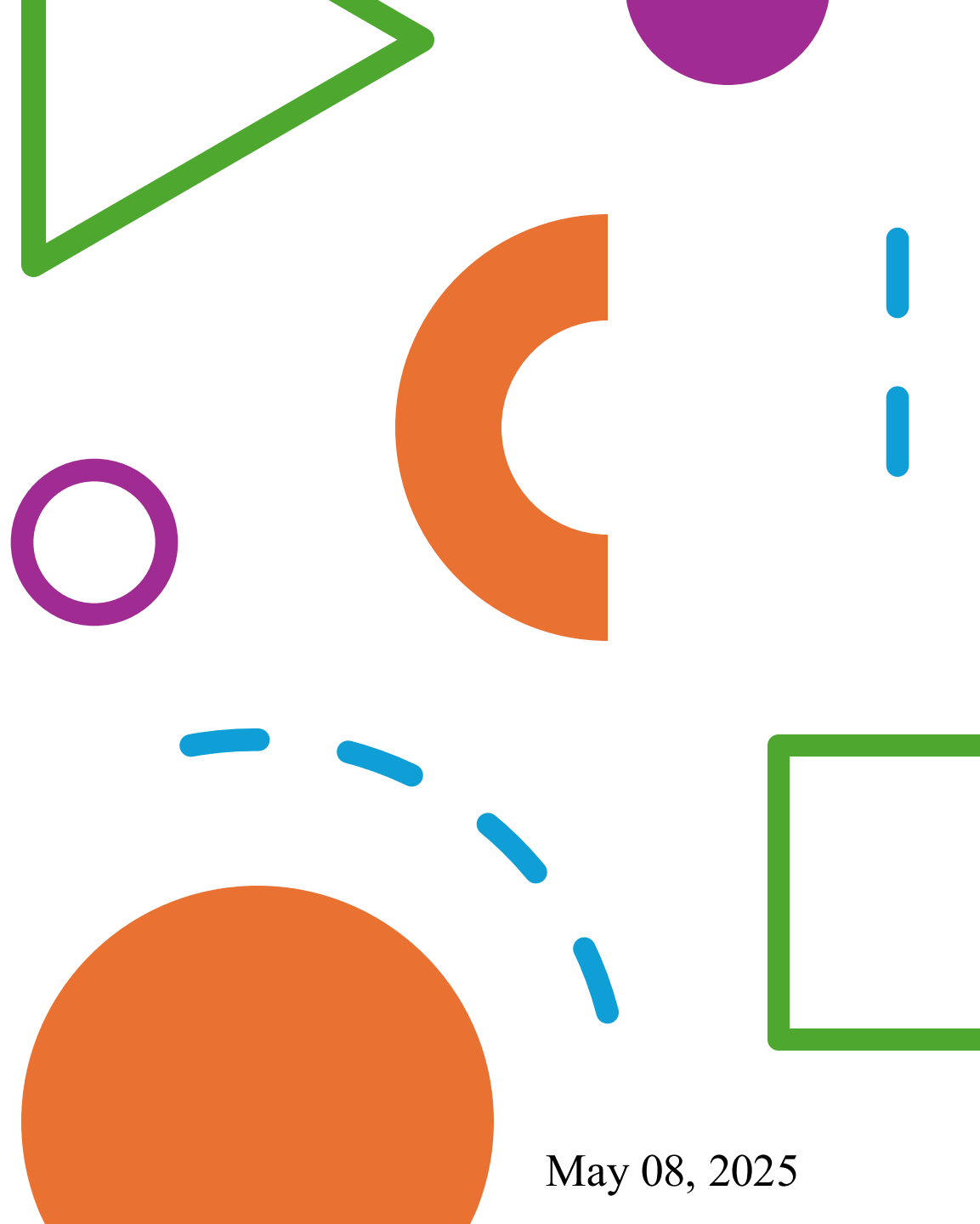
Team members:

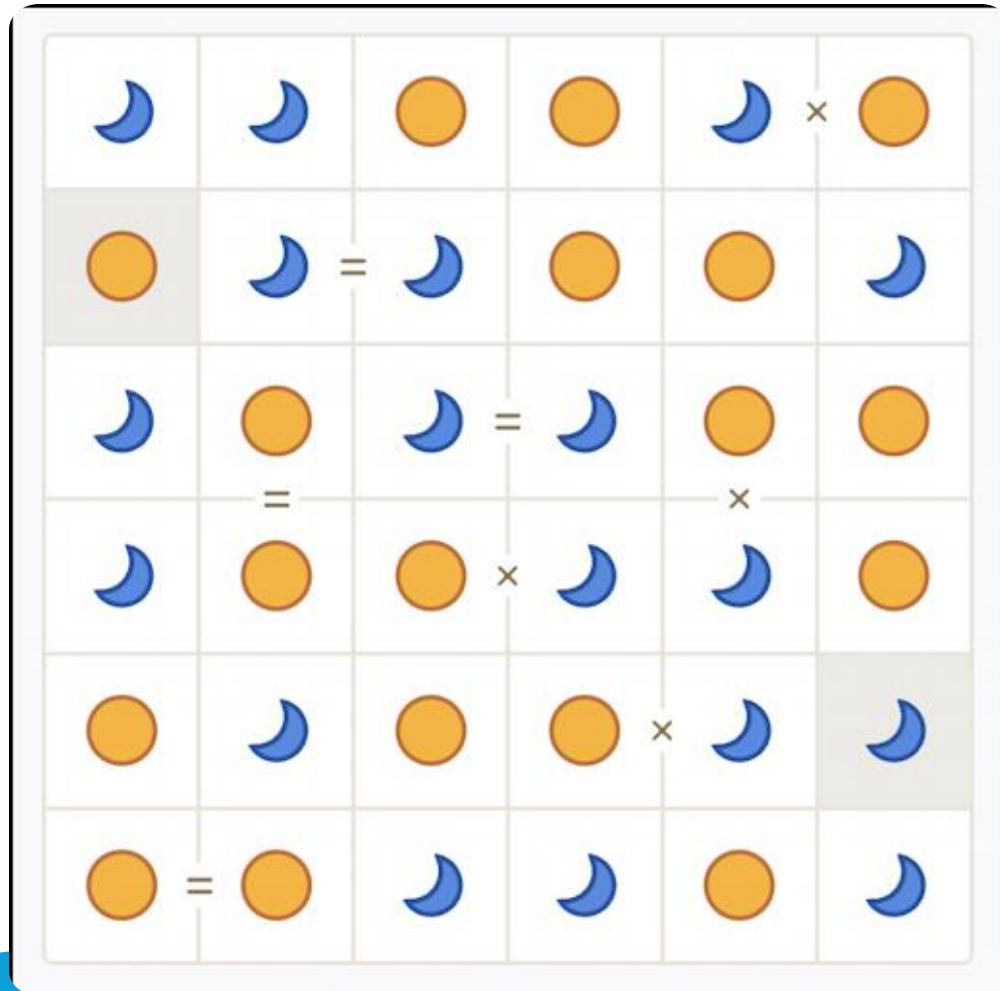
Suraj Thapa

Sadiksha Chitrakar

Lal Bahadur Reshmi Thapa

May 08, 2025



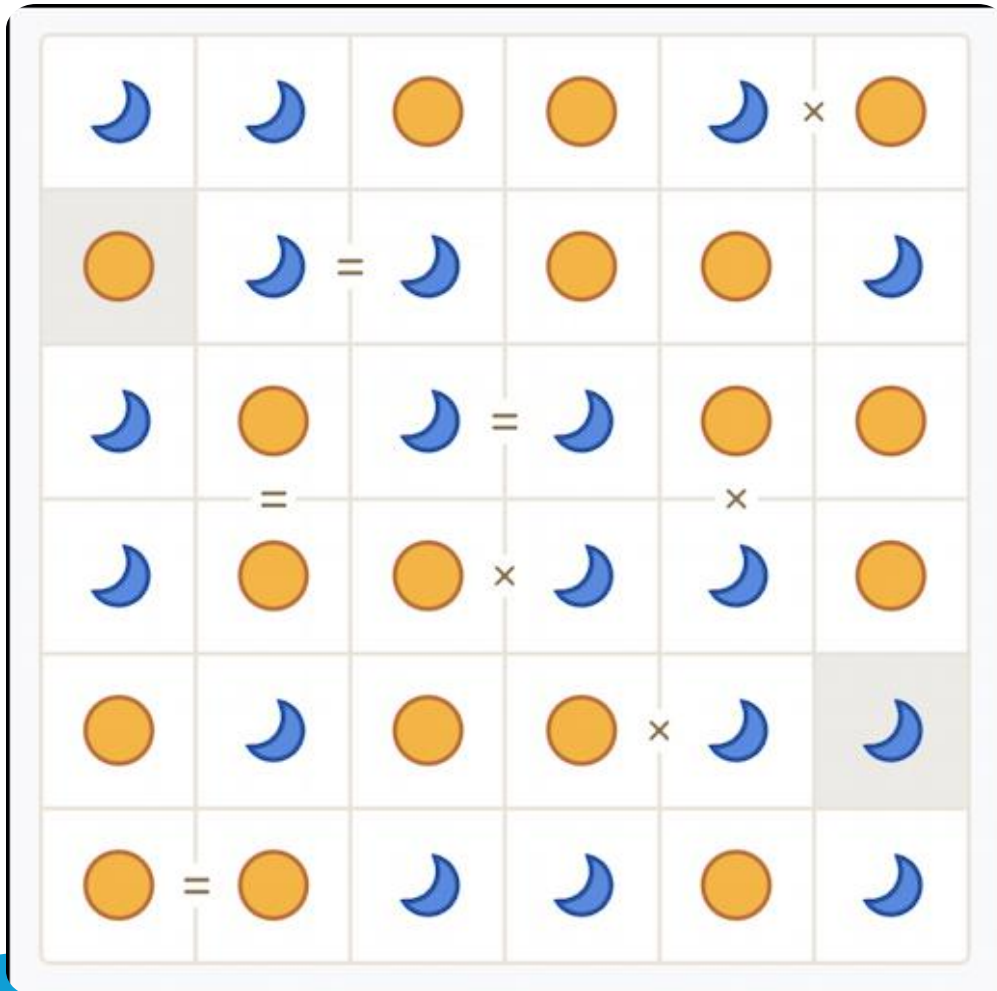


Tango

A daily brain teaser that engages players in solving a 6x6 grid puzzle using logical reasoning and pattern recognition, with alternating Sun and Moon symbols as key elements.

How to play:

- Fill each cell with either a suns or moons (for instance) can be any two distinct symbols
- No more than 2 of the same symbol may be next to each other, vertically or horizontally
- Each row and column must have an equal number of suns and moons
- Cells separated by = must be the same type
- Cells separated by \times must be opposite types
- Each puzzle has one right answer and can be solved via deduction



Objective

To simulate mental agility by requiring players to fill a grid with suns and moons while adhering to predefined rules and constraints

Target Audience

Puzzle enthusiasts and casual gamers looking for a mentally engaging yet relaxing gameplay experience

Levels:

Easy, Medium, Hard

Data Collection

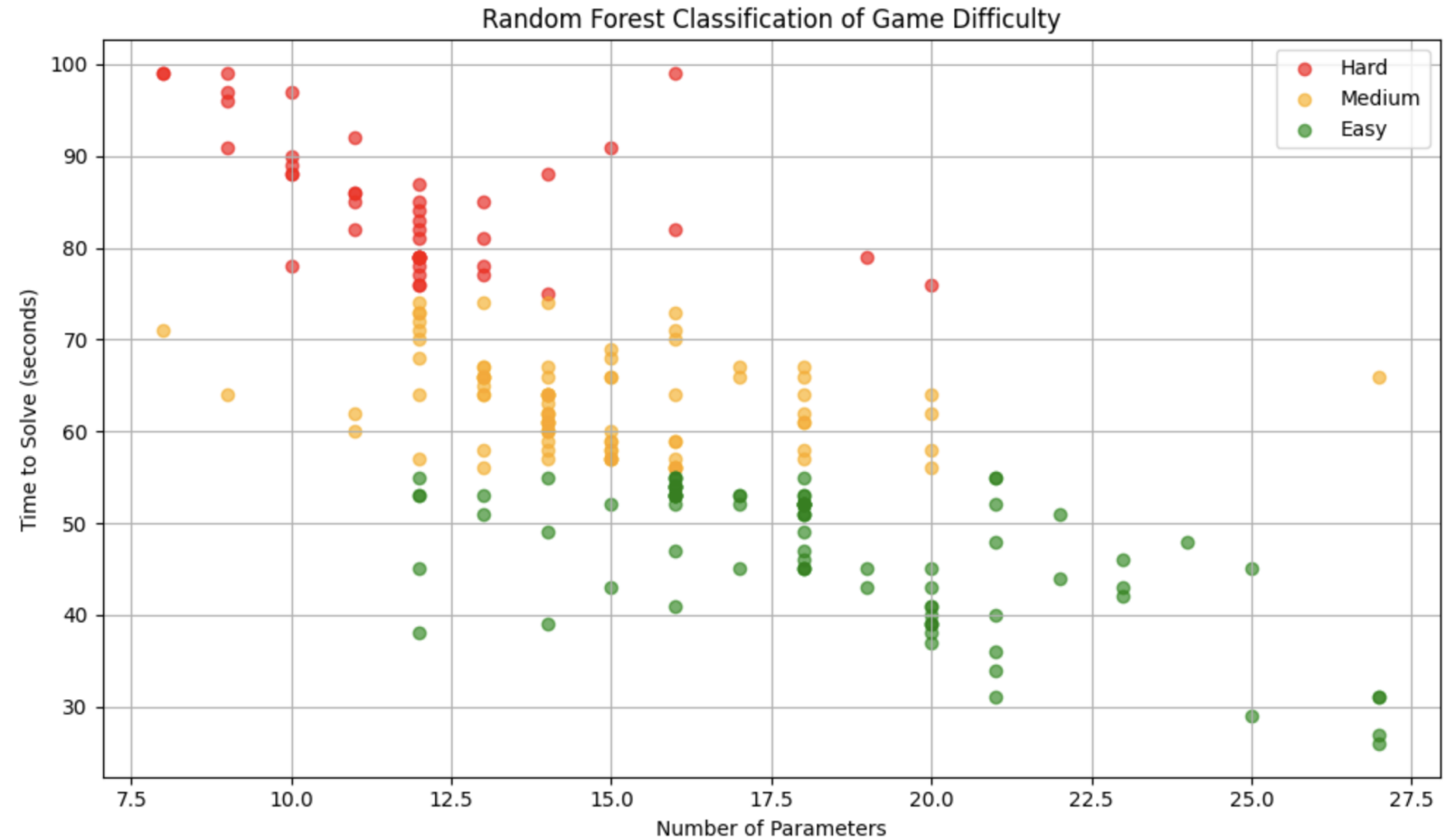
We developed the Tango Puzzle Game using Pygame, creating a visually engaging and interactive gameplay experience. Then, played game manually to record gameplay data and build a dataset for ML model training.

Recorded Parameters:

1. Number of Default Sun and Moon: The count of initially locked symbols.
2. Number of x and =: Constraint markers present in the grid.
3. Time to Solve (in seconds): Time taken to complete each puzzle.
4. Sum of Parameters: Total of locked symbols and constraint markers, serving as an indicator of puzzle complexity.

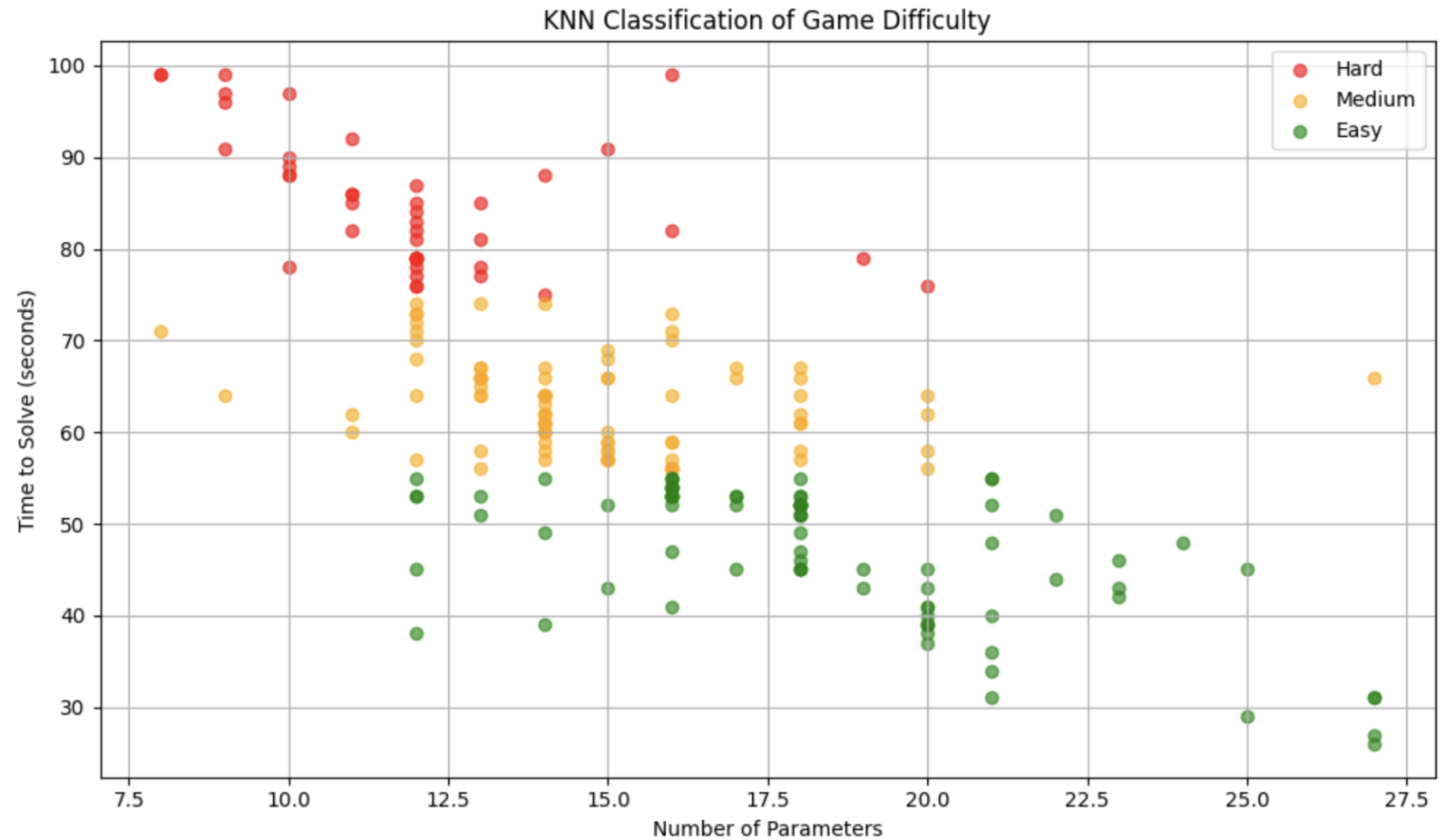
Random Forest Classifier(RFC)

- An ensemble learning method that uses multiple decision trees to classify data based on majority voting, enhancing prediction accuracy and reducing overfitting.



K-Nearest Neighbors(KNN)

- A simple yet effective algorithm that classifies data points based on the majority class among its closest neighbors.



RFC vs KNN's accuracy

Accuracy of Random Forest Classifier (RFC)

Training: Testing Dataset = 80:20

Training Data Accuracy = 72.09%

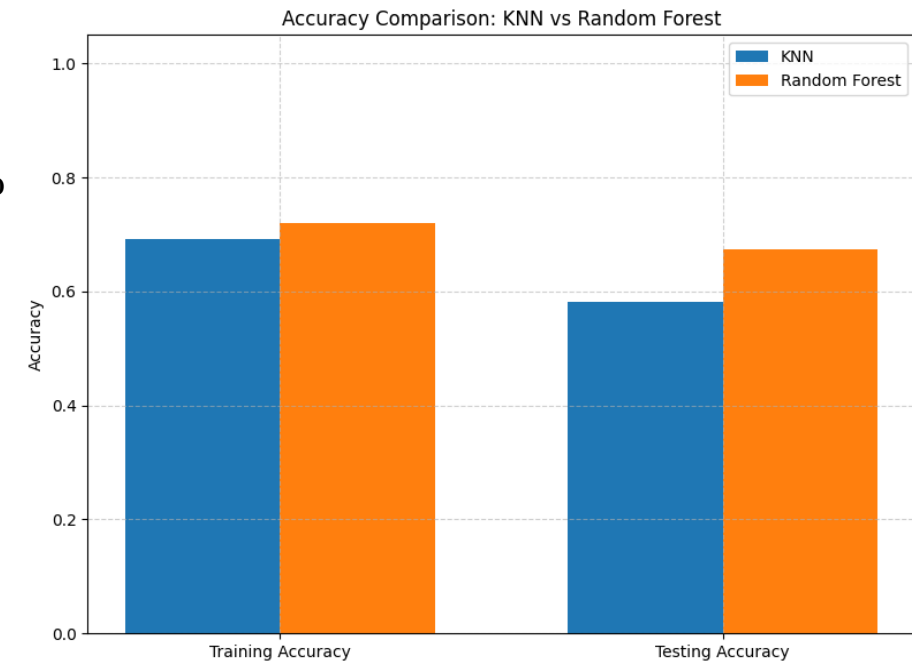
Testing Data Accuracy = 67.44%

Accuracy of K-Nearest Neighbors(KNN)

Training: Testing Dataset = 80:20

Training Data Accuracy = 69.18%

Testing Data Accuracy = 58.14%





What we get?

Game Difficulty Thresholds (Based on Time to Solve)

- **Easy:** Time to solve ≤ 55 seconds
- **Medium:** 55 seconds $<$ Time to solve ≤ 74 seconds
- **Hard:** Time to solve > 74 seconds

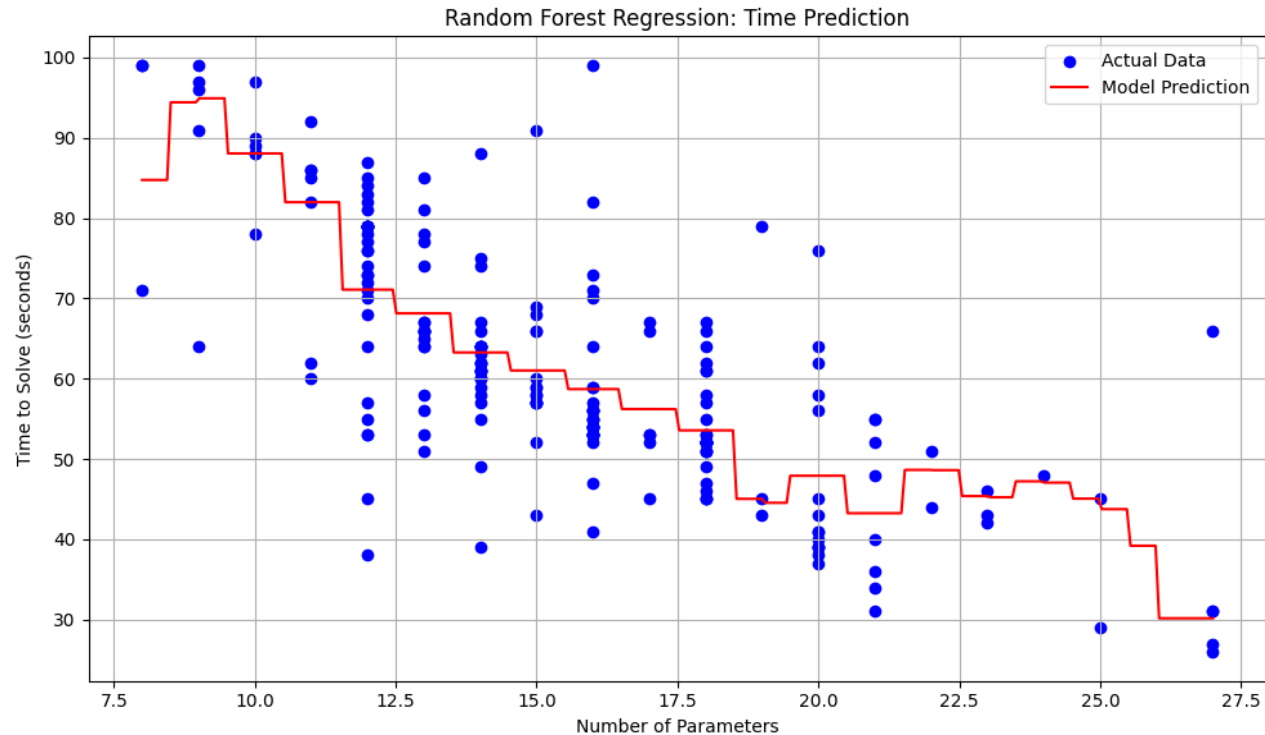
```
Enter the number of parameters (0-36), or 'q' to quit: 10
Predicted Level: Hard
Enter the number of parameters (0-36), or 'q' to quit: 15
Predicted Level: Medium
Enter the number of parameters (0-36), or 'q' to quit: 20
Predicted Level: Easy
```

Game Time Prediction Based on Parameters

- We predicted the **time to solve the game** based on the **number of parameters** (i.e., number of suns, moons, crosses, and equal signs).

Example:

For 12 parameters, our model predicted a completion time of 72 seconds.



Summary

Why Tango Puzzle Game is Engaging :

1. Daily Brain Teaser: Provides a quick yet challenging mental exercise, perfect for short breaks.
2. Dynamic Difficulty: Adaptive gameplay ensures a balanced challenge, keeping players engaged and motivated.
3. Cognitive Boost: Enhances logical reasoning and pattern recognition through strategic puzzle-solving.
4. Replayability: Multiple difficulty levels and randomized puzzles encourage repeated play.
5. Engaging Visuals: Simple yet captivating design fosters user interaction and retention.

Future Improvements

- **Enhance Prediction Accuracy**

Explore additional machine learning algorithms to improve the accuracy of both difficulty level classification and game time prediction.

- **Optimize Difficulty Thresholds**

Adjust the time-based thresholds for classifying game difficulty to better reflect actual player performance.

- **Visual Analysis with Heatmaps**

Use heatmaps to visualize how changes in thresholds affect difficulty classification and model behavior.



Thank you!

