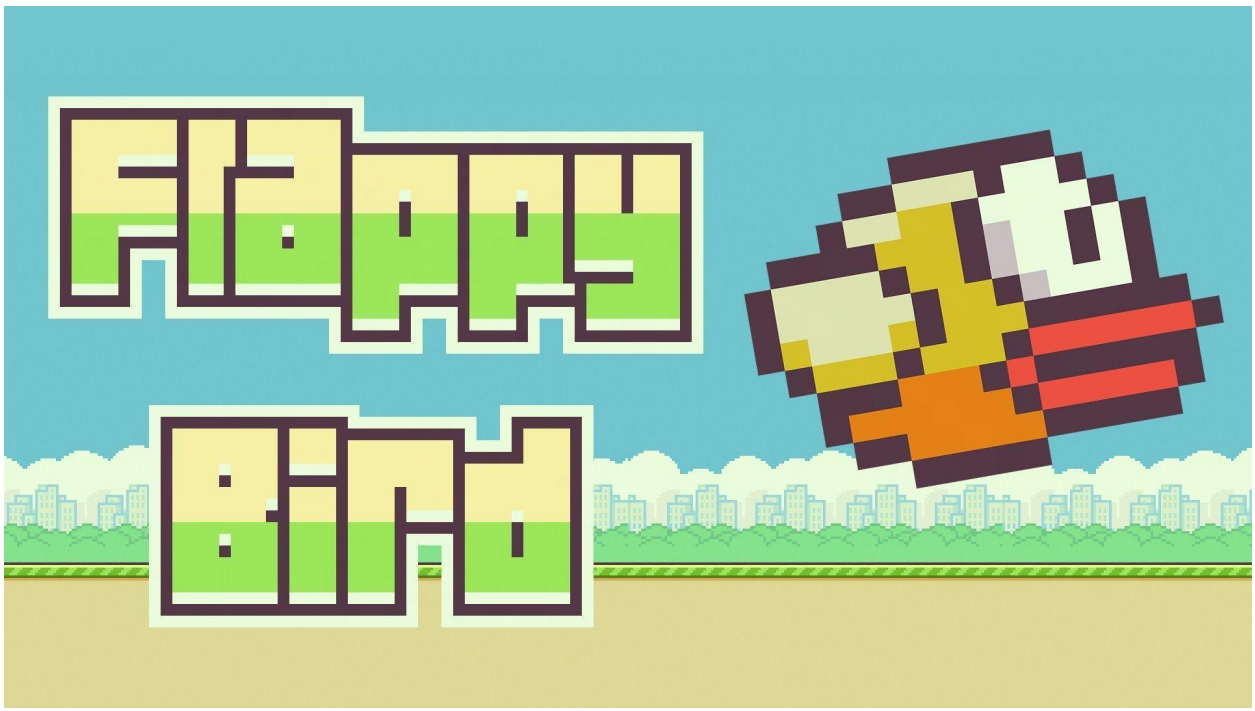
Dt. 15th August, 2023

AI Learning to play Flappy Bird

AI Mini - Project submitted to Dr. Shabir Ah. Sofi



Project Description: Flappy Bird Game with NEAT-Python AI

This project consists of two main components:

1. **Creating the Game - Flappy Bird**
2. **The AI Component**

Creating the Game - Flappy Bird

The game is developed using the popular pygame module. The initial steps involve importing necessary libraries and modules. The dimensions of the game window are

defined, and the window is created with the title "Flappy Bird." Images for various game components are loaded and managed using the os module. The game components are organized into classes, each representing a different aspect of the game. The primary functions within these classes handle initialization, movement, and other functionalities. A "draw" function is implemented in each class to render images on the game window. These draw functions are collectively called in the main loop of the game.

The AI Component

The AI aspect of the project is powered by the **NEAT-Python module**, a pure Python implementation of NEAT (NeuroEvolution of Augmenting Topologies). **NEAT is an evolutionary algorithm that creates artificial neural networks.** The project maintains a population of individual genomes, each containing two gene sets that describe the construction of an artificial neural network:

- **Node genes,** specifying individual neurons.
- **Connection genes,** specifying interconnections between neurons.

The process of evolution requires a fitness function that assesses the quality of each individual in the population. Generations progress through reproduction and mutation of the fittest individuals from the previous generation. Reproduction and mutation operations may lead to the addition of nodes and connections, resulting in increasingly complex genomes and neural networks.

The algorithm continues until a predefined number of generations is reached or when at least one individual surpasses the fitness threshold. In this project, the population of genomes (i.e. birds) is set to 100, and the fitness threshold is 100, indicating that the program terminates if an individual achieves a fitness score of 100.

The AI operates in the game as follows:

- When a bird collides with the floor or ceiling of the game window, its fitness decreases, and it's removed from the population.
- Colliding with a pipe results in more fitness reduction and removal from the population.
- Birds earn 0.1 fitness points for each second of survival.
- Passing through pipes safely adds 2 fitness points.
- The next generation of 100 birds is produced from the fittest bird of the previous generation, determined by the bird's distance traveled or the number of pipes crossed.
- In this way. The new generation is capable of going through more numbers of pipes in each try.
- Dynamic changes in pipe gap positions and sizes increase the game's difficulty.

This project brings together *game development using pygame* and *AI implementation with NEAT-Python* to create an engaging and adaptive Flappy Bird game experience.

The Project Submission has been done by -

- **Zeeshan Sharif - 2020BITE'012**
- **Jameel Kaiser Khan - 2020BITE'001**