Minor Project

Under Amiya Dash
By team Sayan

Abstract

Neuroevolution—the process of evolving artificial neural networks using genetic algorithms has proven very successful in reinforcement learning tasks, especially when the states are hidden. NEAT leverages evolutionary principles to automatically develop the structure and connection weights of neural networks. Unlike traditional ANNs where the architecture is predefined, NEAT allows the network to grow and adapt its complexity during the training process.

Game learning is currently one of the most popular topics being researched in the field of artificial intelligence and is an efficient way to measure the progress of AI. AlphaGo, Agent57 and DecodeChess are some AI agents which even defeated human players. These AI agents need to go through a training phase. In this project, we propose a minimal training strategy to develop an Artificial Intelligence agent using the NeuroEvolution of Augmenting Topologies (NEAT) algorithm to play the Flappy Bird Game. The agent was not provided any prior information about the surroundings and in order to play the well-known "Flappy Bird" game as best it can, our agent learns how to carefully avoid all of the obstacles and flap its way through them.

Keywords: Artificial Intelligence; Artificial Neural network; Genetic algorithm; Flappy bird; Neuro-Evolution.

Introduction

An intelligent agent is anything that can detect its surroundings, act independently to accomplish goals, and learn from experience or use knowledge to execute tasks better. The method is a general one, capable of being applied to an extremely wide range of problems. One such approach is NEAT algorithms which are numerical optimization algorithms inspired by both natural selection and natural genetics.

This project explores the application of NEAT to evolve a neural network capable of controlling a virtual bird in the classic Flappy Bird game. Flappy Bird presents a challenging environment due to its fast-paced nature and the need for precise decision-making to avoid obstacles.

Existing AI approaches to Flappy Bird often rely on pre-defined rules or hand-crafted algorithms. While these methods can achieve success, they lack the ability to learn and adapt to unseen scenarios. NEAT, on the other hand, offers an evolutionary approach where a population of neural networks compete and evolve over generations. This allows the system to discover effective strategies for navigating the Flappy Bird environment without explicit programming.

This report details the development of a NEAT-based solution for Flappy Bird. It outlines the limitations of current approaches and explains the rationale behind using NEAT. The subsequent sections will delve into the specific implementation details, including the game environment, the NEAT configuration, and the evaluation process. Finally, the report will present the results obtained and discuss the potential for further improvements.