National University of Computer & Emerging Sciences
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Pong Evolved: The NEAT Revolution

Project Proposal
Artificial Intelligence [AI]
Section: BCS-6E

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Introduction

The goal of this project is to develop an AI-controlled Pong game using the NEAT algorithm. Pong is a simple two-player game where each player controls a paddle to bounce a ball back and forth. Our project aims to create an AI opponent that can play Pong effectively.

Existing System

Currently, Pong games are typically played by human players against each other or against a basic computer-controlled opponent. However, we want to enhance the gaming experience by introducing an AI opponent that adapts and learns over time.

Problem Statement

The existing Pong game lacks an intelligent opponent. Human players may find it repetitive and less challenging. Our project addresses this limitation by implementing an AI player that can dynamically adjust its gameplay strategy based on the ball's movement and position.

Proposed Solution

Environment Setup:

- Set up the Pong game environment using Python and a suitable game library (e.g., Pygame).
- Define the game rules, paddle movement, and ball physics.

Our project aims to create an AI-controlled Pong game by leveraging the NEAT (NeuroEvolution of Augmenting Topologies) algorithm. First, we'll set up the Pong game environment using Python and a suitable library (such as Pygame). Next, we'll delve into the NEAT algorithm, which evolves neural networks with varying topologies. We'll create a population of neural networks (genomes) using a Python NEAT library (such as neat-python or python-neat). These networks will serve as our AI players. The neural networks will be trained by playing Pong games, and their performance will be evaluated based on their ability to play the game. Genetic operators (mutation and crossover) will evolve the networks over generations. Finally, we'll test the trained AI against human players or other AI opponents and fine-tune parameters for optimal performance. The resulting AI opponent will adapt its gameplay dynamically, enhancing the Pong experience for players.

Salient Features

- **Adaptive Gameplay**: The AI opponent adapts its paddle movement based on the ball's trajectory.
- **Challenging Difficulty Levels**: The AI can be adjusted to different difficulty levels (easy, medium, hard).
- **Real-time Learning**: The AI learns from each game session and improves over time.

Tools and Technologies

- **Python**: The primary programming language for game development and AI implementation.
- **Pygame**: A Python library for creating 2D games and handling graphics, sound, and user input.
- **NEAT Library**: We'll use a suitable NEAT implementation (e.g., neat-python or python-neat).
- **IDE (Integrated Development Environment)**: Choose an IDE like PyCharm, Visual Studio Code, or Jupyter Notebook for development.