Tic-Tac-Toe AI Game

Created and Developed by Khaled Ziadi

Overview

This project is a web-based **Tic-Tac-Toe** game where the player competes against an AI powered by a machine learning model. The game uses a combination of:

- **Streamlit** for the web interface
- **Keras/TensorFlow** for AI model training
- **Scikit-learn** for preprocessing
- **Minimax algorithm** for optimal gameplay

The application enables players to:

- Play against an intelligent AI opponent
- Save game data for future model improvement
- Retrain the AI model with newly gathered data
- Predict game outcomes based on user moves

Components

1. AI Model Training Script (`train_model.py`)

Functionality:

- Reads game data from a CSV file (`Tic tac initial results.csv`)

- Cleans and processes the data

- Trains a Keras Sequential model to classify the outcome (win/draw/loss)

- Saves the trained model and label encoder

Model Architecture:

- Input Layer: 7 neurons (for `MOVE1` to `MOVE7`)

- Hidden Layers: Dense(128) -> Dense(64) -> Dense(32)

- Output Layer: Dense(3, softmax) - for 3 possible outcomes

Label Encoding:

- win = 2

- loss = 1

- draw = 0

Output:

- `tic_tac_toe_model.h5`

- `label_encoder.pkl`

2. Web App (`app.py`)

Main Features:

- A 3x3 Tic-Tac-Toe board implemented using Streamlit UI elements

- CSS styling for a visually clean and responsive interface

- Player plays as "X" and the AI as "O"

Game Mechanics:

- Game logic uses the Minimax algorithm with alpha-beta pruning to calculate the best AI move

- Player and AI alternate turns until a win/draw occurs

User Actions:

- ? **Predict:** Predict game result based on current player moves

- ? **Save:** Save finished game and its result

- ? **Retrain:** Retrain model with accumulated game data

- ? **Reset:** Reset the game board

Data File: `game_data.csv`

- Stores new games in format: `MOVE1` to `MOVE7` and `CLASS`

Folder Structure

project/

??? app.py # Main Streamlit app

??? train_model.py # Initial model training script

??? tic_tac_toe_model.h5 # Trained Keras model

??? label_encoder.pkl # LabelEncoder for class labels

??? game_data.csv # Collected game data

??? Tic tac initial results.csv # Original training dataset

Author

Khaled Ziadi

- Creator and Developer of the project

- Designed both the AI model and the Streamlit web application

Feel free to reach out for improvements, feedback, or contributions!

Future Improvements

- Add player difficulty levels

- Allow online multiplayer

- Visualize prediction probabilities

- Export game history

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