

MPI Chess Engine with GUI

This project is a distributed chess engine that uses MPI (Message Passing Interface) for parallel computation to distribute the workload of evaluating chess positions among multiple processes.

Requirements

- Python 3.6+
- mpi4py
- python-chess
- pygame

Installation

1. Install the required packages:

```
pip install mpi4py python-chess pygame
```

2. Make sure you have a working MPI implementation (like OpenMPI or MPICH) installed on your system.

Running the Chess Game

With GUI

To run the chess game with the GUI:

```
mpirun -n <number_of_processes> python chess_gui.py
```

Where **<number_of_processes>** is the number of processes you want to use (recommended at least 2: 1 for the GUI/master and 1+ for workers).

For example:

```
mpirun -n 4 python chess_gui.py
```

This will start the game with 1 master process (which also runs the GUI) and 3 worker processes.

Console Mode

To run the original console-based version:

```
mpirun -n <number_of_processes> python run.py
```

GUI Controls

- Click on a piece to select it
- Click on a valid destination square to move the selected piece
- Press **N** to start a new game
- Press **U** to undo the last two moves (your move and the AI's response)

Folder Structure

- **run.py** - Entry point for the application
- **chess_gui.py** - GUI implementation using Pygame
- **master.py** - Master process implementation for distributed computation
- **worker.py** - Worker process implementation
- **chess_engine.py** - Chess AI and evaluation functions
- **utils.py** - Utility functions for serialization and logging

Chess Pieces Images

For the best experience, create a **chess_pieces** folder in the same directory as the scripts and add PNG images for each chess piece with the following naming convention:

- White pieces: **wp.png**, **wr.png**, **wn.png**, **wb.png**, **wq.png**, **wk.png**
- Black pieces: **bp.png**, **br.png**, **bn.png**, **bb.png**, **bq.png**, **bk.png**

If images are not found, the application will fall back to displaying piece symbols.