# Street Fighter II Bot Project Description

This project develops an AI bot for Street Fighter II that uses machine learning instead of rule-based logic. The bot learns to play the game by analyzing game state data and predicting optimal button inputs in real-time.

## Key Components and Steps

- **Environment Setup**
  - BizHawk emulator running Street Fighter II Turbo ROM
  - Python 3.11+ with required libraries (PyTorch, NumPy, Pandas, scikit-learn)
  - Socket connection between the Python API and the emulator
- **Data Collection & Processing**
  - Recording gameplay data into a structured CSV format
  - Features include player positions, health, game state variables, and button inputs
  - Data cleaning and normalization using MinMaxScaler
  - Feature engineering: distance between players, relative positions, velocity, health changes
  - Balancing the dataset by reducing over-represented idle states and simple movements
- **Model Development**
  - LSTM neural network architecture to capture temporal patterns in gameplay
  - Sequence-based approach with 25 frames of history to predict next button presses
  - Binary cross-entropy loss with weighted classes to handle imbalanced button distributions
  - Training over 50 epochs with validation to prevent overfitting
- **Implementation**
  - Replacing rule-based logic in bot.py with the trained ML model
  - Processing real-time game state data into model input format
  - Converting model predictions to button commands for the game
- **Deployment**
  - Model can control either player 1 or player 2
  - Support for both single-player (vs CPU)
  - Designed to be character-agnostic, working with any fighter selection

## Technical Architecture

The system uses a sequence-to-binary classification approach, where each frame's button press is predicted based on the previous 25 frames of game state. The LSTM model captures the temporal dependencies in fighting game strategy, allowing the bot to learn combos, defensive maneuvers, and positioning tactics from human gameplay data