**Project report**



Hybrid International-Turkish Checkers: A Strategic Board Game Innovation

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# **1. Project Overview**

## **Project Topic:**

We present a hybrid board game that merges Turkish Draughts and International Draughts. This innovative fusion combines orthogonal and diagonal mechanics, enhancing gameplay depth and strategic diversity.

## **Objective:**

The main objective is to develop a playable, visually interactive, and AI-powered version of the Hybrid International-Turkish Checkers. The game will integrate customized rule sets and strategic AI logic using techniques like Minimax and Alpha-Beta Pruning, enabling competitive human-vs-AI and AI-vs-AI gameplay.

# **2. Game Description**

## **Original Games Background:**

- **International Draughts**: Played on a 10x10 board using dark squares. Pieces move diagonally. Kings move across any number of squares. Capturing is mandatory and allows for multiple jumps.  
**- Turkish Draughts:** Played on an 8x8 board with orthogonal moves (forward/sideways). Captures are done in straight lines. No diagonal movement for men.

## **Innovations in the Hybrid Version:**

**- Combined Movement Rules:**  
 • Men can move orthogonally (forward, left, right) and diagonally forward.  
 • Kings can move in all directions across any distance.  
**- Mandatory Captures:**  
 • Captures must be made in any direction.  
 • Maximum capture route must be taken.  
**- Gameplay Expansion:**  
 • 10x10 board increases decision space.  
 • Multiple captures and flexible movement increase complexity.

# **3. AI Approach and Methodology**

## **Techniques Used:**

- **Minimax Algorithm:** Evaluates all possible moves assuming optimal opponent moves.  
**- Alpha-Beta Pruning:** Optimizes Minimax by pruning non-impactful branches.

## **Heuristic Design:**

**- Piece Value:** Kings have higher weights.  
**- Positional Advantage:** Center control and mobility.  
**- Capture Potential:** Prioritize multi-jumps and threats.

## **Complexity Analysis:**

Due to the 10x10 board, hybrid movements, and multi-directional captures, the branching factor is high. Efficient heuristics and pruning are essential to maintain real-time performance.

# **4. Game Rules and Mechanics**

**Modified Rules Summary:**  
• Board: 10x10 squares (dark/light alternating)  
• Setup: 20 pieces per player on first four rows (dark squares)  
• Movement - Men: 1 step orthogonally and diagonally forward  
• Movement - Kings: Any distance in all directions  
• Captures: Mandatory in all directions, including backward  
• Multi-Captures: Required if available; must choose maximum capture route  
• Promotion: Men reaching final row become Kings  
• Win Conditions: Opponent has no legal moves or all pieces are captured

# **5. Implementation Plan**

**Technology Stack:**  
• Language: Python  
• Libraries & Tools:  
 - Pygame – for GUI and game mechanics  
 - NumPy – for efficient board handling  
  
**Development Stages:**  
1. Phase 1: Rulebook enforcement and GUI  
2. Phase 2: AI with Minimax and Alpha-Beta Pruning  
3. Phase 3: Optional reinforcement learning  
4. Phase 4: Testing and UI refinement

# **6. References**

- World Draughts Federation – The Rules of International Draughts  
- Turkish Mind Sports Federation – Turkish Draughts Rules  
- Russell, S., & Norvig, P. (2020). Artificial Intelligence: A Modern Approach  
- Online checkers AI projects and resources

