Project Title: Visicrabble

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Course: AI

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1. Project Overview

Project Topic:

The project focuses on **modifying the classic Scrabble game** by introducing new mechanics and AI-driven enhancements. The twist includes:

- **Visible Tiles**: You can view your opponent’s tiles to make better judgements.
- **Power-Ups & Penalties**: Special tiles grant extra points or impose restrictions.
- **AI-Powered Opponent**: An intelligent AI that plays strategically using NLP-based word prediction and heuristics.

Objective:

- Implement **AI strategies** to create a **challenging virtual opponent**.
- Introduce **gameplay restrictions** that increase unpredictability and strategy.
- Develop a **word recommendation system** to assist or challenge players.

2. Game Description

Original Game Background:

Scrabble is a **word-building board game** where players form words using letter tiles on a 15×15 board, earning points based on word complexity and placement. The game follows turn-based mechanics, with double/triple-word score tiles adding strategic depth.

Innovations Introduced:

- **Visible Tiles:** Unlike regular scrabble, you can see enemies tiles too so now you have to maximize your score while minimizing theirs.
- **Power-Ups & Penalties:**
    - **Bonus Tiles**: Extra points for using uncommon words.
    - **Trap Tiles**: Reduce points or force letter swaps.
- **AI with NLP:** The AI opponent uses **Natural Language Processing (NLP) techniques** to predict and challenge words.

3. AI Approach and Methodology

AI Techniques to be Used:

- **Minimax Algorithm with Alpha-Beta Pruning**: For AI move decision-making.
- **Natural Language Processing (NLP)**:
    - **Word validation** (using a dictionary API or trained dataset).
    - **Smart move prediction** (based on letter frequency and board state).

Heuristic Design:

- Score evaluation based on **word length, rarity, and position bonuses**.
- AI **predicts opponent moves** to block high-scoring placements.

Complexity Analysis:

- **Minimax with Alpha-Beta Pruning** reduces unnecessary move searches, making the AI efficient.
- **Board modifications** introduce additional decision-making complexity.

4. Game Rules and Mechanics

Modified Rules:

- You can view enemy tiles and so you must minimize enemy score while trying to maximize yours.
- **Special tiles** provide power-ups or impose penalties, such as forcing the enemy to use a letter or penalty such as skipping your turn.
- AI **suggests words** but may also block the best spots.

Winning Conditions:

- The player with the **highest points** at the end wins.

- Players can **challenge AI decisions**, adding a competitive element.

Turn Sequence:

- Each player **places a word** and earns points.
- If a “skip turn” tile gets played, you skip your turn.

5. Implementation Plan

Programming Language:

- **Python** (Primary)

Libraries and Tools:

- **Pygame** (for GUI and board visualization)
- **NLTK / SpaCy** (for AI word prediction and validation)
- **NumPy / Pandas** (for game state handling)

Milestones and Timeline:

- **Week 1-2:** Research Scrabble mechanics and finalize rule changes.
- **Week 3-4:** Develop basic game structure and GUI.
- **Week 5-6:** Implement AI move logic (Minimax and heuristics).
- **Week 7:** Test AI against human players and refine strategy.
- **Week 8:** Final testing and project report submission.

6. References

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