CS250 - ARTIFICIAL INTELLIGENCE LAB

ASSIGNMENT-2: AO* Search

Date: April 03, 2024

Total Credit: 10

- Markings will be based on the correctness and soundness of the outputs.
- Marks will be deducted in case of plagiarism.
- Proper indentation and appropriate comments are mandatory.
- *All code needs to be submitted in '.py' format.* Even if you code it in '.IPYNB'format, download it in '.py' format and then submit
- You should zip all the required files and name the zip file as:
  - <roll_no>_assignment_<#>.zip, eg. 1501cs11_assignment_01.zip.

Problem Statement: Matrix Factorization with AO* Search

Task: Develop a program that utilizes the AO* search algorithm with an AND-OR graph to factorize a given matrix into two lower-dimensional matrices.

Components:

1. **Matrix Representation:**
   - Implement functions to represent and manipulate matrices.
   - Include functions for reading a matrix from a **file or user input.**
2. **AND-OR Graph Construction:**
   - Design an AND-OR graph to represent the search space for matrix factorization.
   - Nodes in the graph should represent potential factor matrices.
   - AND nodes represent the requirement of both factors being determined.
   - OR nodes represent alternative ways to choose values for a factor matrix entry.
3. **Heuristic Function:**
   - Define a heuristic function to estimate the remaining error in factorization for a given node in the AND-OR graph.
   - The heuristic should consider the difference between the original matrix and the product of the current factor matrices.

4. **AO Search Implementation:**
   - Implement the AO* search algorithm to explore the AND-OR graph.

    - Utilize the heuristic function to prioritize node expansion.
    - Maintain a single data structure (e.g., priority queue) to manage both AND and OR nodes.
5. **Result Extraction:**
    - Once the AO* search finds a goal node (representing a complete factorization), extract the factor matrices from the corresponding path in the graph.

Note:

- Allow the program to handle matrices with different dimensions.
- Visualize the constructed AND-OR graph for a small example.

For any queries regarding this assignment, contact:

Utsav Kumar Nareti (utsavkumarnareti@gmail.com)
Kumari Priya(kumaripriya.manit@gmail.com)
Akash Zingade(akashzingade@gmail.com)