Fakultät 1, Lehrstuhl Kommunikationstechnik
Prof. Dr.-Ing. habil. Matthias Wolff

Seminar Cognitive Systems II - Behavior Control

Seminar Task 1 – Sliding Block Puzzle

A sliding block puzzle is a (often square) puzzle in which the individual pieces are interlocked and bordered by a frame, so that they cannot be placed, but can only be slid past one another. In one $N \times N$ field there are $N \times N - 1$ puzzle pieces and a free field that allows movement of surrounding parts. The goal of the game is to arrange the blocks in ascending order.

Seminar Task: Create a simulation for solving a sliding block puzzle using at least two different search algorithms.

1. Write an algorithm to solve a sliding puzzle of size 2×2 (4 fields) as a minimal example. Use
   - A* search and
   - a brute force method!

   Choose a suitable heuristic for the A* search! Compare the performance of the search algorithms you implemented!
2. In a second step, expand your application to a sliding block puzzle of size 3×3 (9 fields).

Requirements: In order to compare algorithm performances, your program must count the node expansions and the maximum number of nodes held in memory at any point of time. Furthermore, the number of search steps (state transitions) must be determined.

The initial state of the search algorithm is descending order of the blocks from top-left to bottom-right. The final state is ascending order of the blocks from top-left to bottom-right. The following figure shows an example of the initial and final puzzle configurations for a 4×4 puzzle:

15	14	13	12
11	10	9	8
7	6	5	4
3	2	1	

	1	2	3
4	5	6	7
8	9	10	11
12	13	14	15

Form working groups of two persons! The choice of programming language is free (recommendation: Matlab). However, you must not use any libraries which contain implementations of the search algorithms! Prepare a 10-minute presentation of your results!

A total of 12 points is awarded: 3 for the 2×2 field, 4 for the 3×3 field, 5 for the presentation. The minimum requirement to pass the seminar is a working algorithm solving the minimal example and the presentation. The group with the best algorithm receives two additional points (comparison of groups is done for to the 3×3 field example).

The points awarded for the seminar will be added to the points earned in the final exam.

Date of Issue: June 29th, 2023
Date of Presentation: expected August 10th, 2023

Tutor: Dr. Ronald Römer, LG 3A Room 250, E: `ronald.roemer@b-tu.de`, T: 0355 69 5007