2023 LSE-Warwick Workshop on Search Games and Patrolling

Monday 3rd July

10:30-11:45 Tutorial:
Thomas Lidbetter, Rutgers Business School

12:00-12:30
Spyros Angelopoulos, CNRS and Sorbonne University

12:30-14:00 Lunch (provided by LSE)

14:00-14:30
Matthew Darlington, Lancaster University

14:45-15:15
Leszek Gasieniec, University of Liverpool

15:45-16:15
Jan-Tino Brethouwer, Delft University of Technology

16:30-17:00

Li Zeng, University of Warwick

Tuesday 4th July

10:30-11:00
Thuy (Christy) Bui, Rutgers Business School

Abstracts

Monday 3

bamboo to the next one which is proportional to the distance (in some metric space) between the two bamboos. The problem is known to be NP-hard and several constant approximation algorithms for discrete BGT have been designed. In contrast, for continuous BGT only $O(\log n)$ approximation is currently known.

Tuesday 4

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Speaker: Kieran Drury, University of Warwick
Title:
Abstract: This research analyses the performance of certain algorithms that search a maze for an exit or hider with the aim to minimise the expected time to finish the search. We consider a maze mathematically as an undirected graph G with vertices representing junctions and dead ends in the maze and edges representing passages between these vertices. We have a searcher who starts at a given location s in the graph G and we provide certain assumptions that we use to build and analyse algorithms that determine how the searcher traverses the maze. In particular, we assume that the searcher has no prior information about the maze - the searcher only has information about the parts of the maze they have traversed, but not of parts of the maze they have not traversed. This distinguishes this problem from typical shortest path problems. We focus on four main algorithms - a simple symmetric random walk, the Random Limited Backtracking Algorithm, the Randomised Tarry Algorithm and the Earlier In Later Out Algorithm – named the 'normal strategy' by Edward Anderson in his 1981 paper. For algorithms that guarantee a search within a finite number of steps, we present a method for generating all search paths the searcher can take, as well as the probability of each search path being taken in one search of the maze for the given algorithm. Therefore, we can calculate an exact expected search time. However, the combinatorial complexity of this method deems it unsuitable for analysis of even medium-sized graphs, and we rely on a simulation-based approach to draw conclusions by simulating each algorithm on a range of graphs. We determine which algorithm produces the lowest expected search time for hider who is distributed uniformly at random over the maze and which algorithm provides the lowest cover time of the maze, providing the worst-case scenario for the searcher who finds the hider located at the last point of the search. We find that there are significant differences in the performances of these algorithms, especially as the maze being searched becomes more complex.