DSCI-6612-02
Intro to Artificial Intelligence

Implementation of Graph Navigation System

Professor:

Vahid Behzadan

Team Members:

Akash Thakkar
&
Kiran Varma C S

Implementation of Graph Navigation System

Navigation System

- Find path from starting point to destination.
- The goal is to find shortest path from starting point to destination

Objectives

- Designing a search algorithm capable of traversing through graph and finding shortest path
- AI Design Agents
  - A* Algorithm
- Check consistency and admissibility for defined heuristic.
- Plot shortest path and whole graph on maps
- Compare Shortest path generated with google maps shortest path

Approach

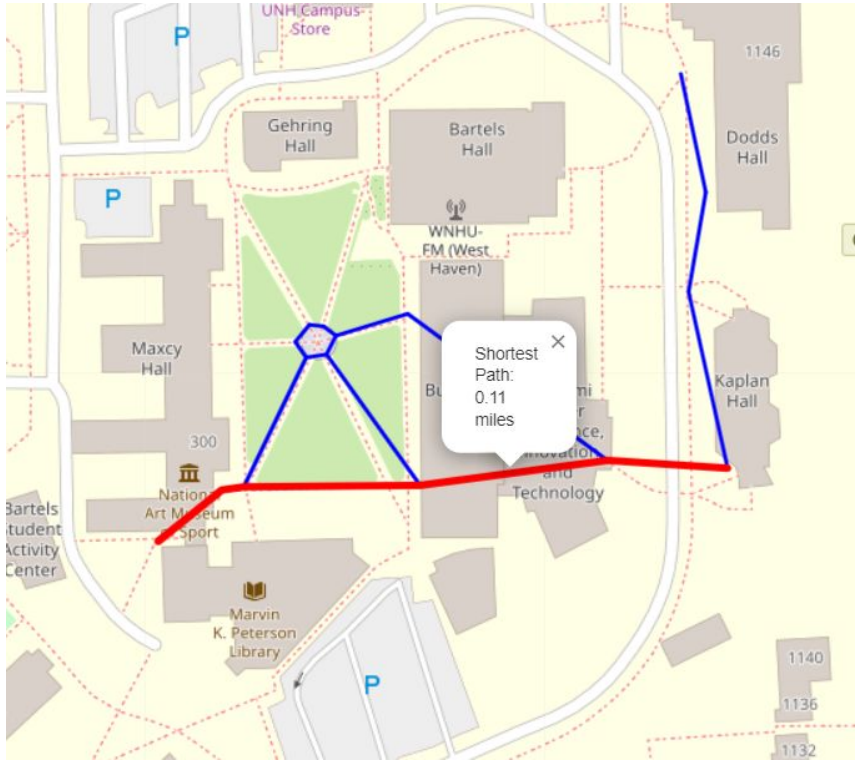
- Design A* Search algorithm with admissible and consistent heuristic.
- AI Design Concepts
  - A* Search
  - Search Heuristic
  - Admissibility and Consistency
- Find shortest path from provides start point to end point.
- Define performance metrics by plotting path on map and comparing with google maps provided path.

Deliverables

1. Comprehensive User Documentation
   - In-depth description of search implementation using A* Search.
2. Algorithm Development
   - Search Algorithm developed in the Python programming language for search with admissibility and consistency check implemented.
3. GitHub Repository
   - Access the Python code and associated files via the GitHub repository ink.
4. Project Showcase
   - YouTube video demonstrating the project's implementation and detailed information slides

Evaluation Methodology

1. Admissibility and Consistency Check
   - Thorough examination of heuristic in use.
2. Path Comparison
   - Comparison with google maps provided path and implemented algorithm path.



Results and Outputs

Number of Nodes Expanded: The least number of nodes expanded by search algorithm the faster it is able to search the shortest path with least amount of resources used.

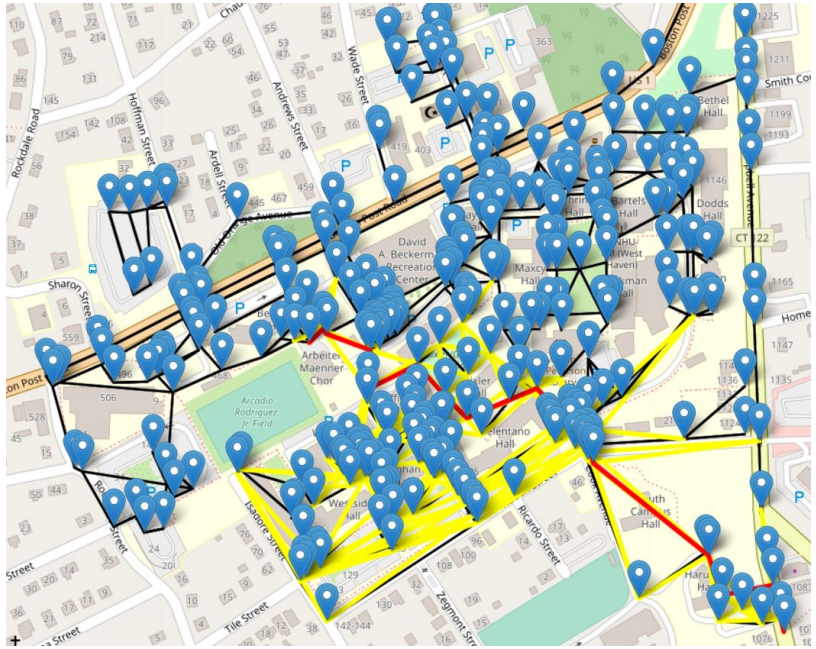
Start_test	end_test	start_location	end_location	a*null	a*haversine	a*euclidean	a*octile	a*chebyshev	dfs	bfs	shortest	Google
11254375555	6833111997	504 Boston Post Rd	Buckman Hall	196	58	196	196	196	312	1071		
						485.42			680.47	611	485.42	600
6833112050	11254263326	300 Boston Post Rd	459 Boston Post Rd	187	40	187	187	187	304	253		
						294.77			1147.07	300.98	294.77	300
1797727955	3437140692	1079 Campbell Ave	Bartels Student Activity Center	95	55	95	95	95	67	765		
						479.97			857.68	857.68	479.97	550
1797731663	3437140613	John and Leona Gehring H	Bixler Hall	118	60	118	118	118	238	208		
						229.14			3780.06	229.14	229.14	240
2096427235	3437140637	1079 Campbell Ave	300 Boston Post Rd	277	149	277	277	277	203	1515		
						660.56			1065.67	720.61	660.56	700

The above table shows number of nodes expanded for 5 randomly drawn node pair to search shortest path between them along with comparison from different A* algorithm heuristics and search algorithms.

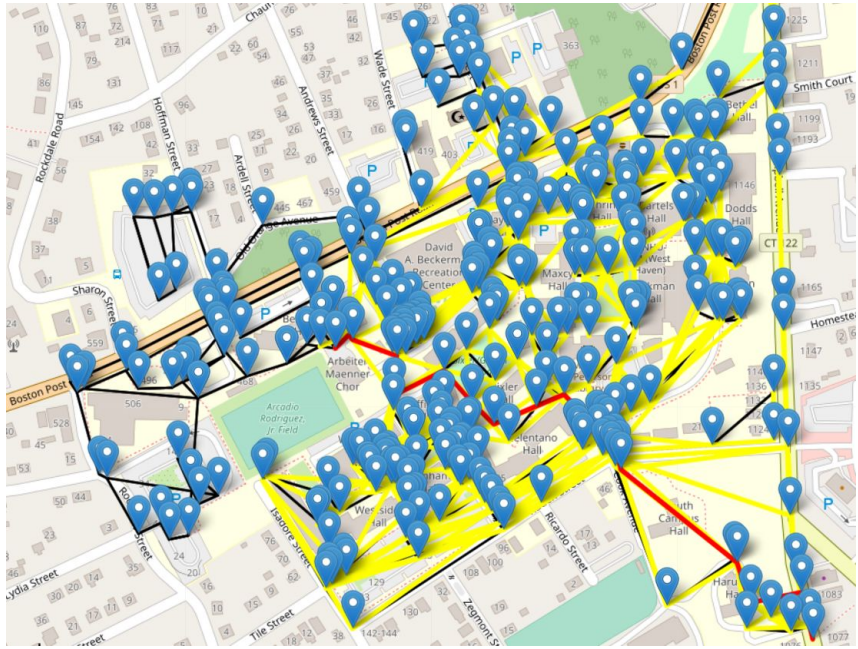
Similarly,In the line below size of shortest path found (in meters) between different algorithms and a comparison with Goggle maps is shown.

Visualise path found by different A* algorithms heuristics

A* Null heuristic



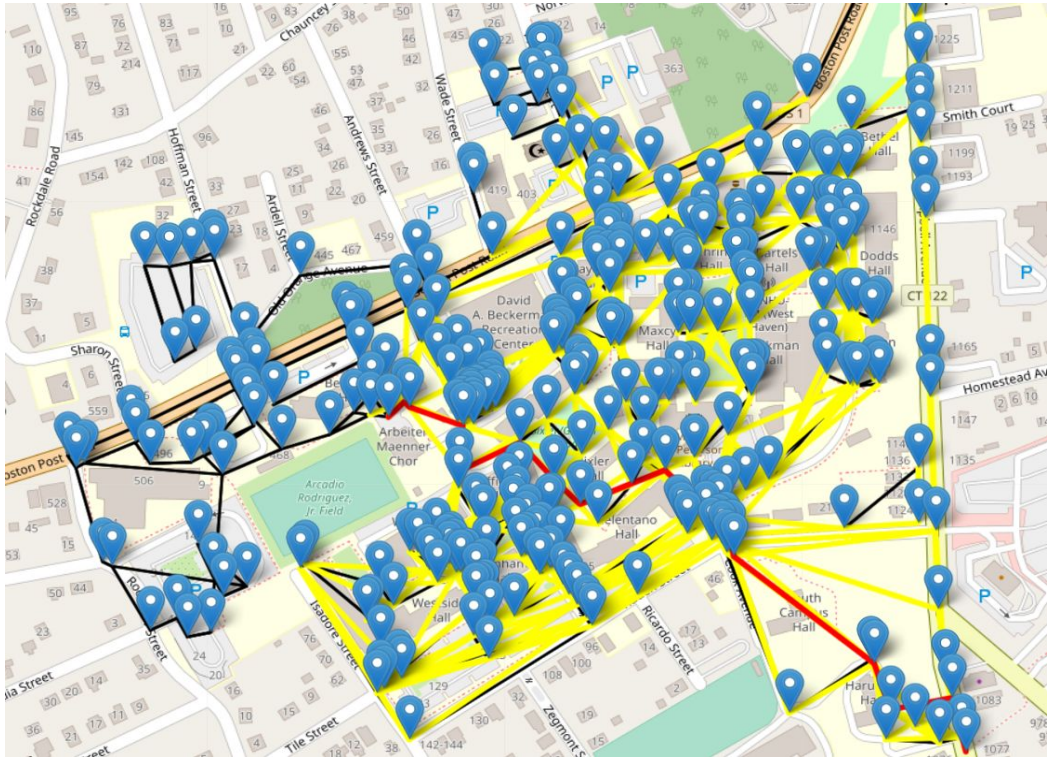
A* Haversine



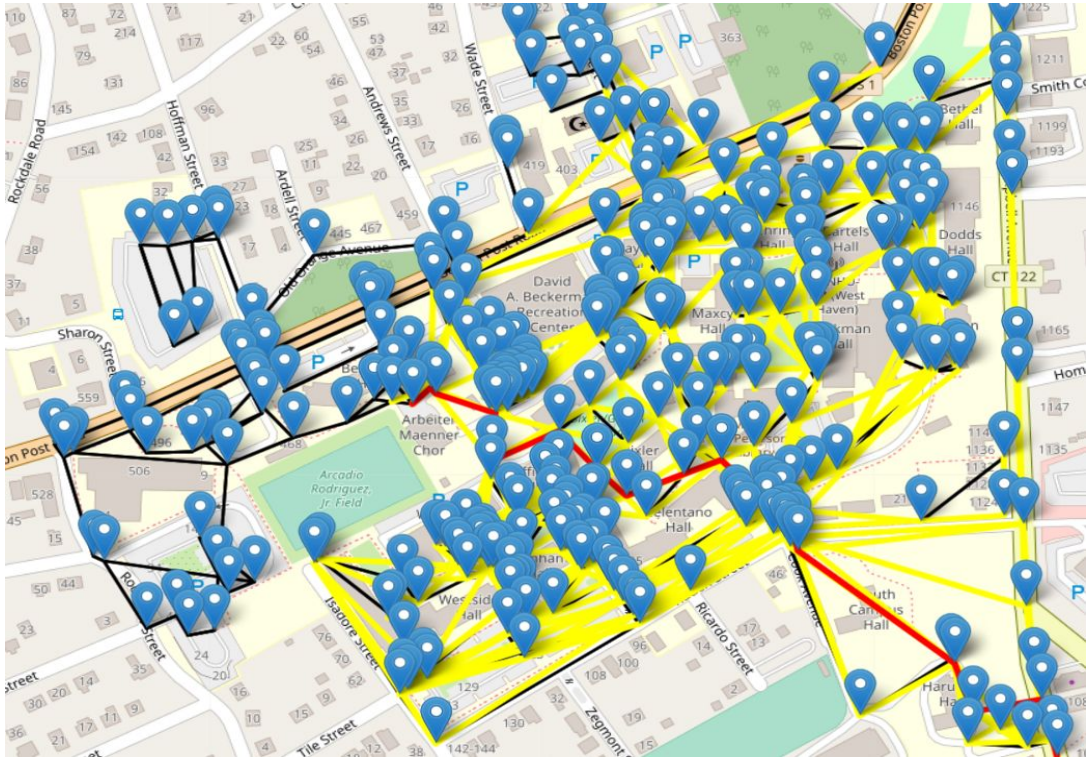
Euclidean

Black lines are edges of the graph,yellow lines show nodes that were expanded and red line highlights shortest path found.

Comparison between A* algorithms with different heuristics.

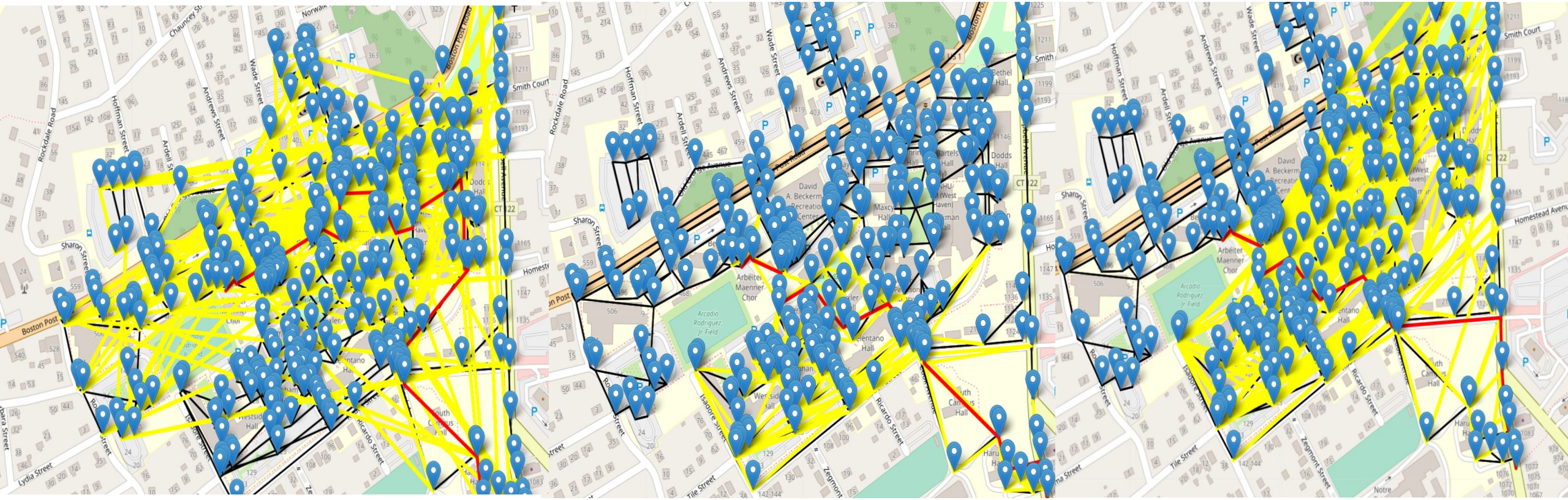


A* Octile



A* Chebyshev

Comparison between A* and other search algorithms



Depth First Search A* Breadth First Search

Thank You!