

MEDI-MOBILITY

• TUSHAR ARORA



TASK

Input the following attributes:

- Patient ID
- Pickup location
- Dropoff location
- Appointment time
- Medical conditions

The algorithm's output will be a list of ride groups, each containing a set of patients who will share a ride. The algorithm should also output the total travel time for each ride group.

EVALUATION

Efficiency: The total travel time for all patients should be minimized.

Effectiveness: Patients with similar medical conditions or appointment times should be matched together.

Scalability: The algorithm should be able to efficiently handle a large number of patients.

CREATE A DUMMY DATASET

Dataset With Random Alphabet & Appointment time

Patient ID	Pickup Location	Dropoff Location	Appointment Time	Medical Conditions
0	1	F	L	08:00:00 Heart Disease
1	2	J	K	08:15:00 Asthma
2	3	J	Q	08:30:00 Heart Disease
3	4	I	M	08:45:00 Diabetes
4	5	D	Q	09:00:00 Heart Disease



Location Problem

Dataset With Random Coordinates & Appointment time

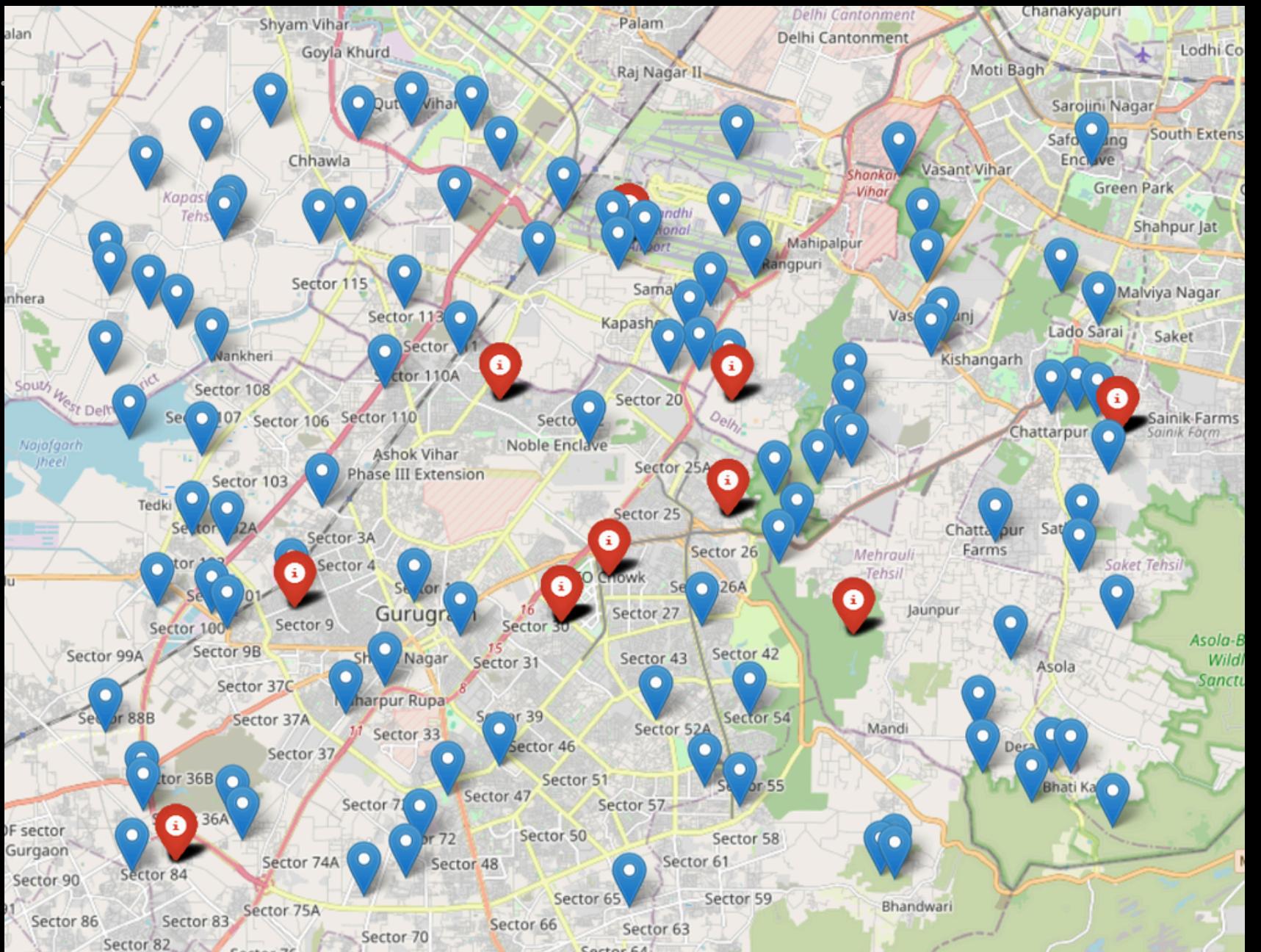
Patient ID		Pickup Location	Dropoff Location	Appointment Time	Medical Conditions
0	1	(17.2261419455118, 6.001012792952705)	(10.034907017690971, 16.816929149636252)	17:59:00	Diabetes
1	2	(1.2164881075297806, 1.5408486975058255)	(18.497227018265427, 1.27953969687167)	17:59:00	Diabetes
2	3	(12.657475023340544, 18.475967562847714)	(18.27225312716191, 19.34913216162095)	14:32:00	Heart Disease
3	4	(15.283500532909988, 8.326946948442648)	(8.465095523150092, 5.445770907213099)	11:47:00	Asthma
4	5	(17.816760738035516, 15.671331910894487)	(12.509497629452401, 10.056118769092503)	15:33:00	Diabetes



Distance Problem

- **Dataset With Random Coordinates of a particular City(Gurugram)**
- **Pickup Location is Random**
- **Randomly 10 from Random coordinates for Dropoff Location**
- **Appointment time (9 am to 7 pm with 30 min Gap)**

Patient ID		Pickup Location	Dropoff Location	Appointment Time	Medical Conditions
0	1	(28.52941546346842, 77.05684707033254)	(28.491920120401616, 77.08620379553835)	11:00:00	Asthma
1	2	(28.429005036129887, 77.11356813781062)	(28.508040658459162, 77.02591667124886)	12:00:00	Asthma
2	3	(28.500274026141707, 77.05252237972167)	(28.555049747892415, 76.9839406098839)	10:30:00	Asthma
3	4	(28.429687994578828, 77.13023125704495)	(28.45753212653886, 77.06773526767962)	10:30:00	Heart Disease
4	5	(28.45902109652401, 77.06293881720185)	(28.517594709045476, 77.10542127824901)	11:30:00	Diabetes



PREPROCESSING STEPS

1. Convert the Appointment date to numerical
2. Calculate Travel Time
3. Encoding Medical Condition

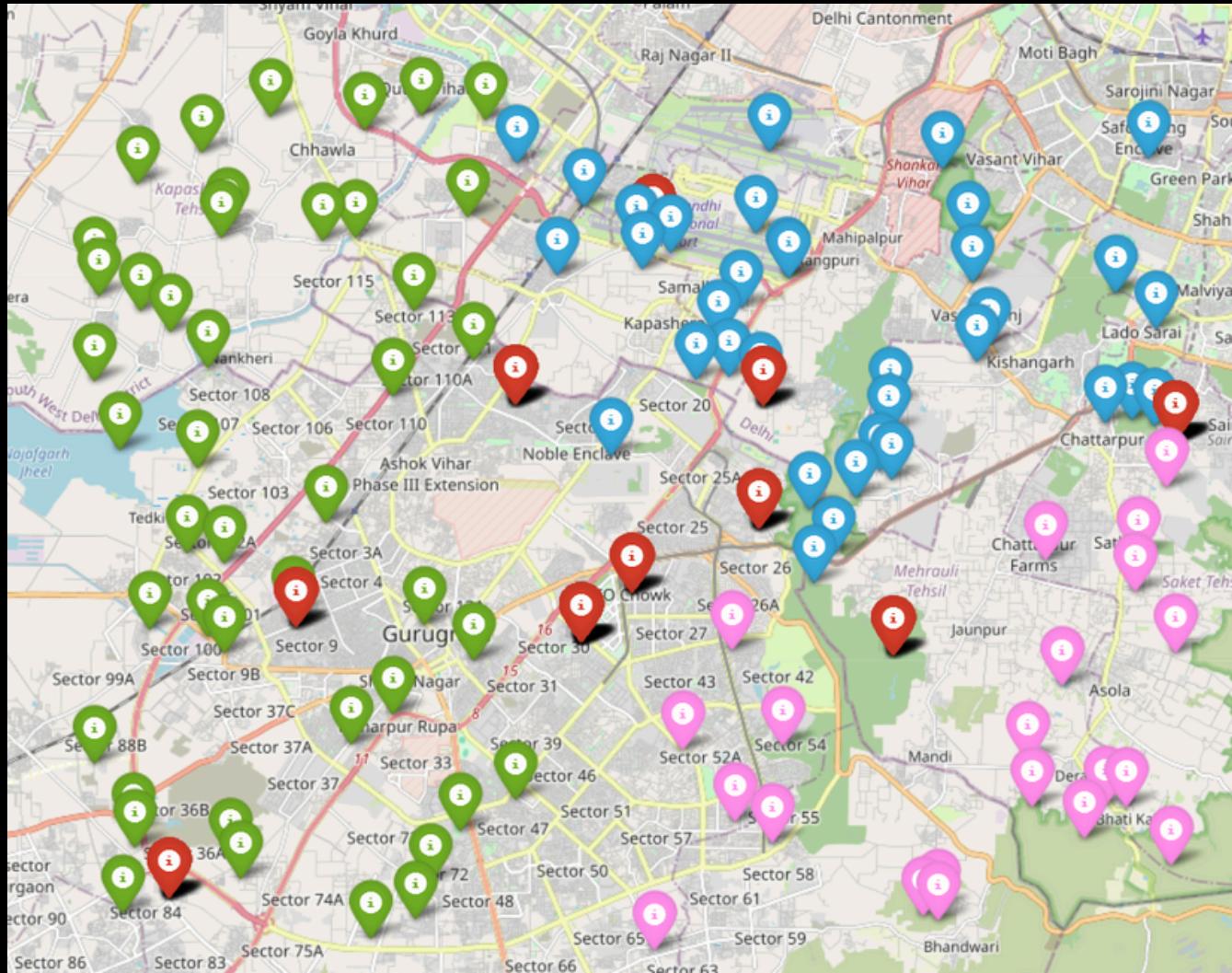
CLUSTERING



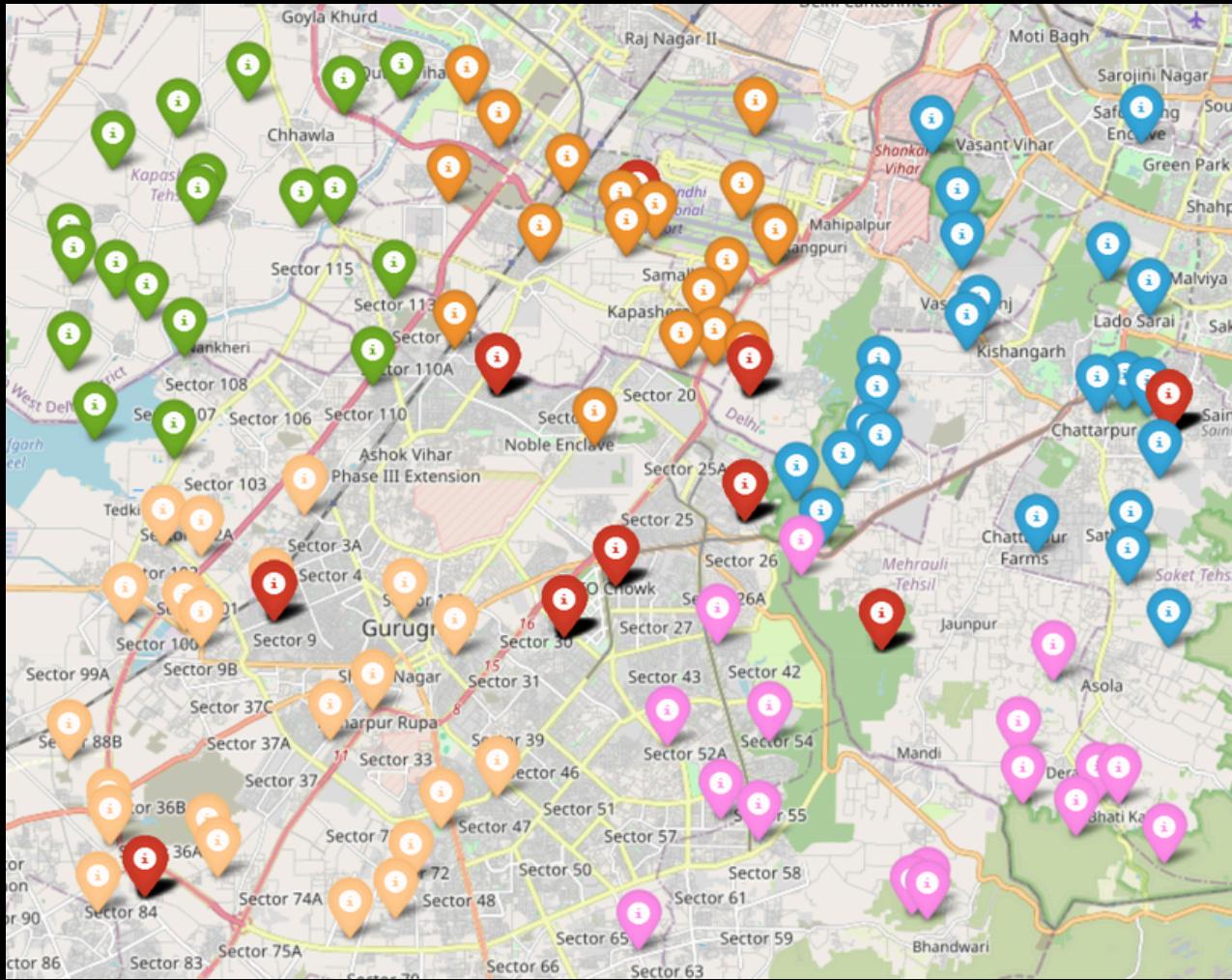
1. Cluster-based on medical conditions and appointment times

2. Cluster-based on Patients

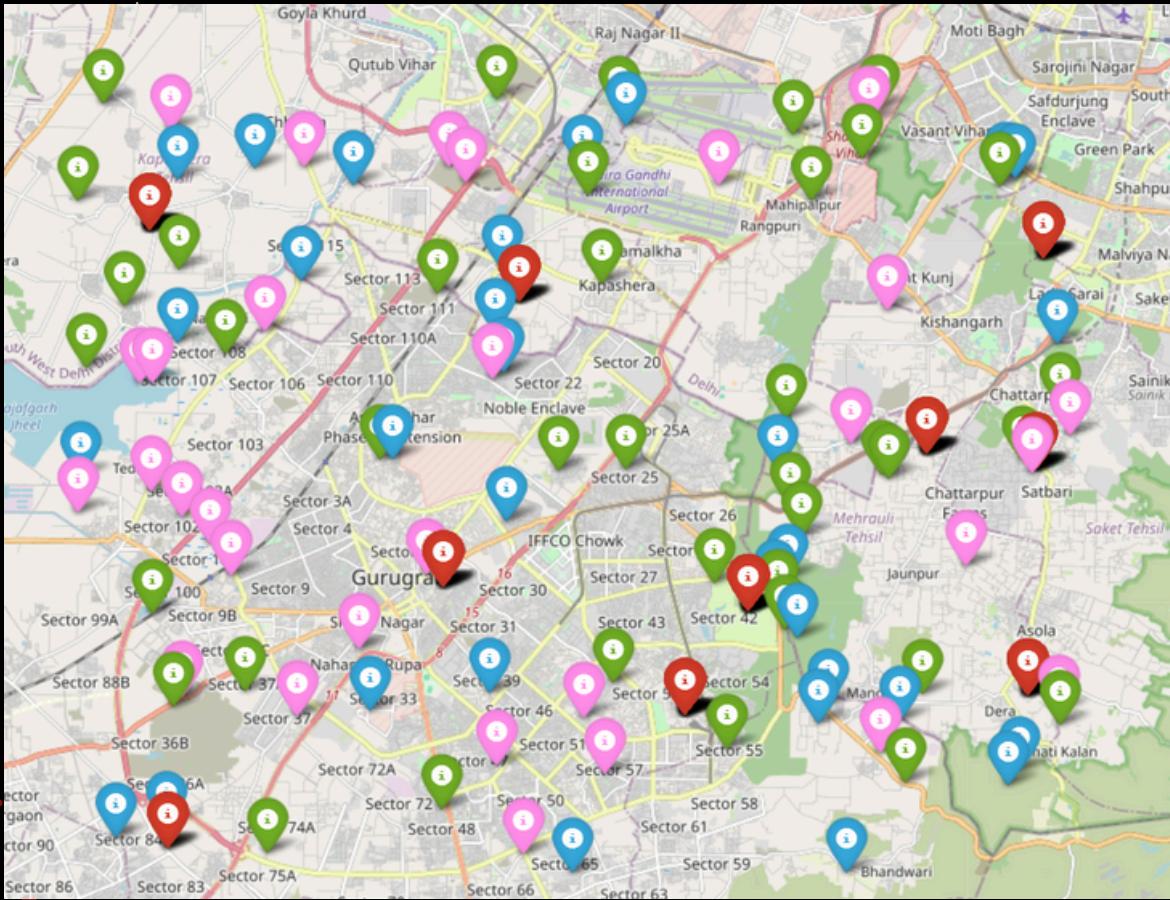
BASED ON PATIENTS



BASED ON MEDICAL CONDITIONS OR APPOINTMENT TIMES



WITH ONEHOT ENCODER



APPROACHES

Graph Based
(More computational resources, optimal Solution)

Clustering Based
(More flexible and scalable)

Combination Approach

GRAPH BASED APPROACHS

- Nodes: Each patient is a node in the graph.
- Edges: Edges connect nodes and represent the travel distances (or times) between the patients' pickup and dropoff locations.
- Edge Weights: The weight of each edge represents the travel time between two patients.
- Matching Algorithm:
 - We use the Hungarian Algorithm (Kuhn-Munkres) to find the optimal matching in the graph. This algorithm finds the minimum-weight matching in a bipartite graph, which minimizes the total travel time.
- Combine Matched Process:
 - After finding the optimal matching, we combine the matched patients into ride groups.

Ride Group: (1, 62), Total Travel Time: 6.44 minutes

Ride Group: (3, 25), Total Travel Time: 2.70 minutes

Ride Group: (8, 18), Total Travel Time: 23.11 minutes

Ride Group: (11, 42), Total Travel Time: 14.98 minutes

Ride Group: (17, 36), Total Travel Time: 2.08 minutes

Ride Group: (18, 17), Total Travel Time: 14.47 minutes

Ride Group: (23, 66), Total Travel Time: 12.07 minutes

Ride Group: (25, 51), Total Travel Time: 1.63 minutes

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CLUSTERING BASED APPROACHES

- calculate similarity score based on appointment times and medical conditions
- Group patients within each cluster
- Output ride groups and total travel time

Ride Group 1: Patient ID: 1 Patient ID: 5 Patient ID: 11
Patient ID: 56 Patient ID: 77 Patient ID: 79 Patient ID: 85
Total Travel Time: 139.34996573492498 minutes
Ride Group 2: Patient ID: 2 Patient ID: 3 Patient ID: 6 Patient
ID: 20 Patient ID: 22 Patient ID: 31 Patient ID: 39

COMBINATION BASED APPROACHS

- Graph-Based Matching
- Apply Hungarian Algorithm
- Group Formation

EVALUATION

- Test on Different dataset and Exact Match Matrix

HANDLE A LARGE NUMBER OF PATIENTS

1. Consider parallelization, distributed computing, or using approximate algorithms
2. Optimize data structures and algorithms for scalability