Smallest Enclosing Circle

CS648A
Course Project
Under Prof. **Surender Baswana**

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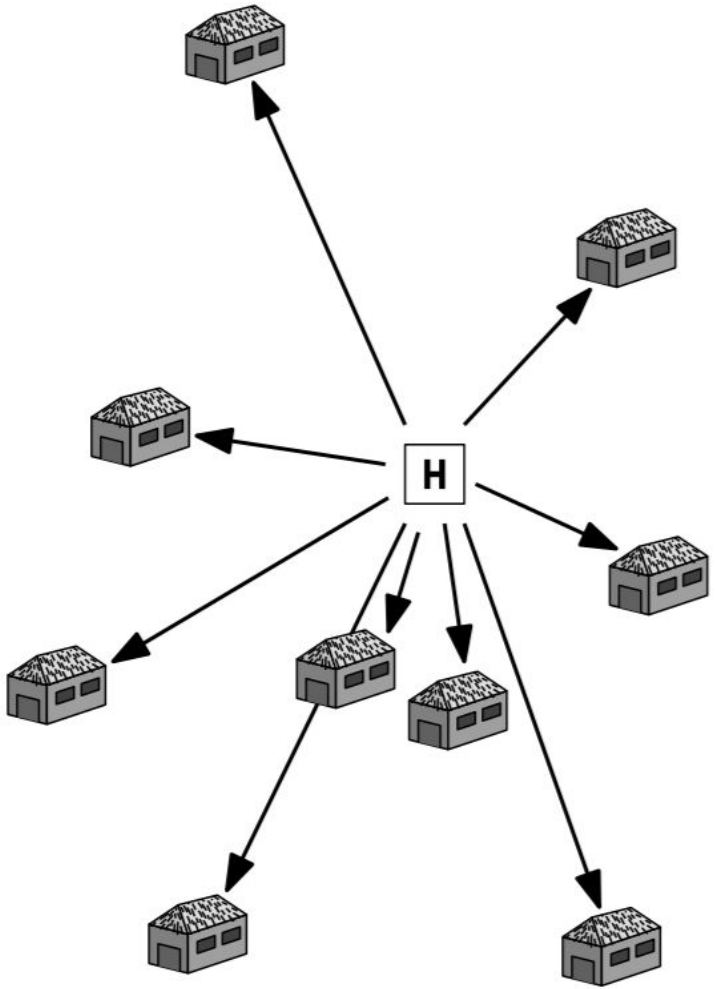
Motivation

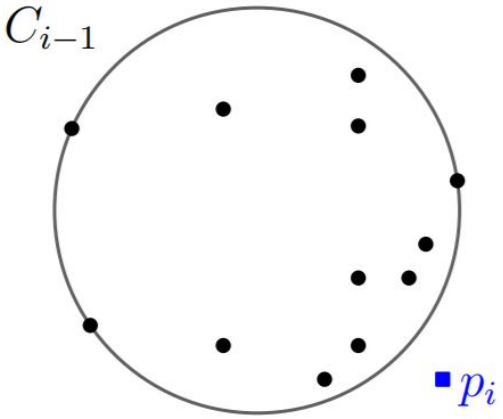


- Facility Location
- Gaming
- Strategy making

Example

Given a set of houses in an isolated village. Can we build a hospital so that an ambulance from the hospital can reach each house within 15 minutes?

Inspiration



- Point p_i lying outside the circle will be a ***Defining Point*** for the next circle.
- Number of such points will be very ***small***.

Definition

- ***Defining Point***: It is one of 2 or 3 points lying on the circle which is used to define the circle.

Intuition

Randomized Incremental Construction

Incremental Construction

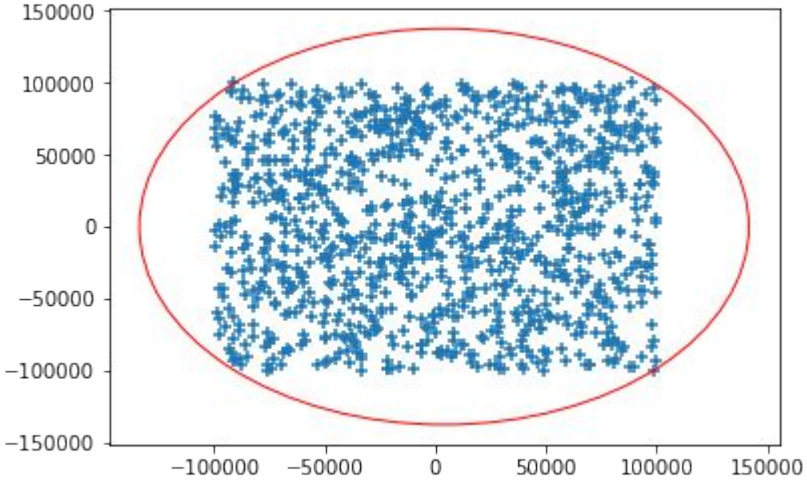
Add points one by one and maintain the solution so far

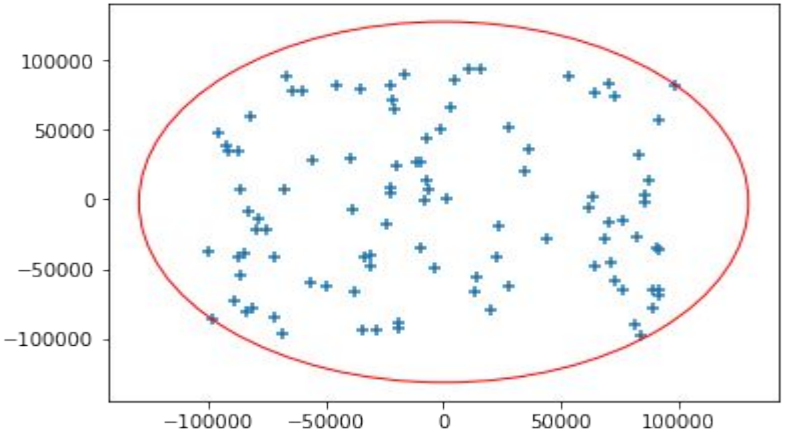
Randomization

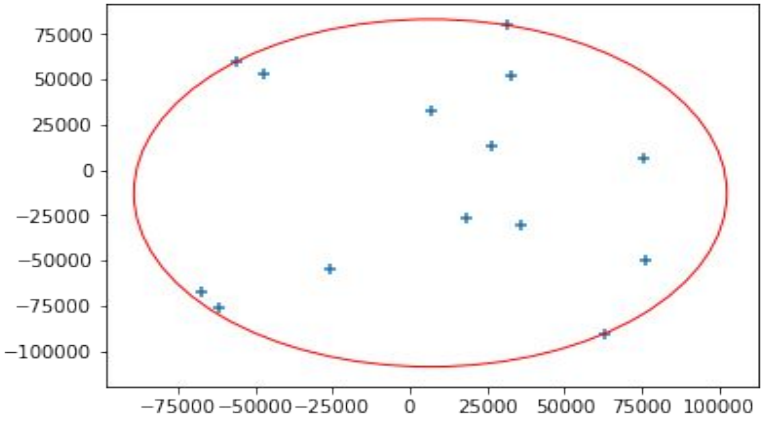
Use random permutation/order to add points

Overview of Algorithm

Experimental Results





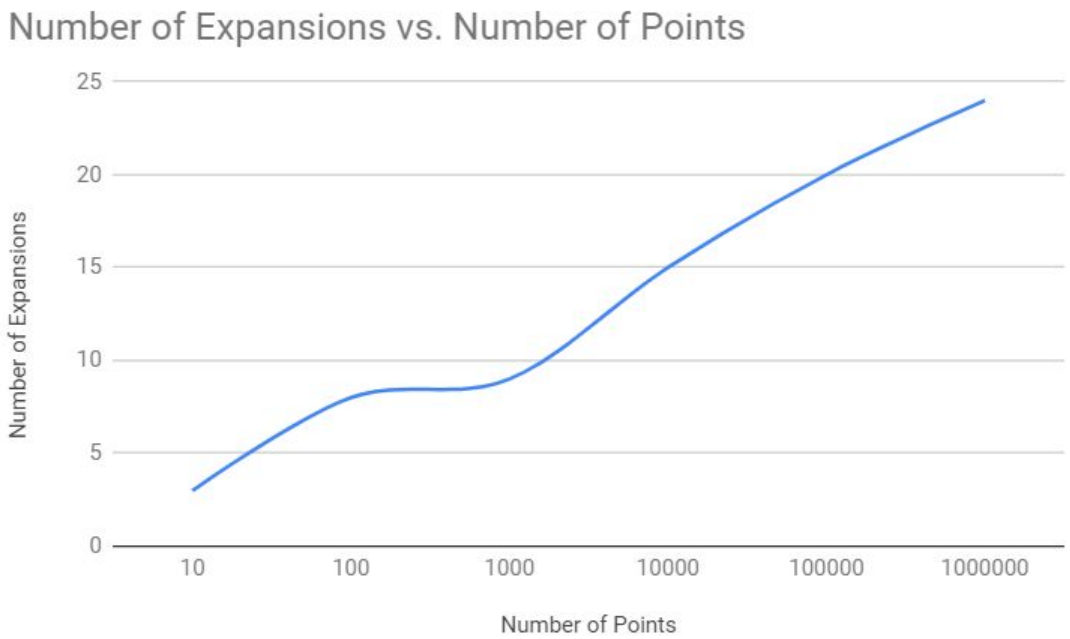


Some outputs obtained from running the algorithm

Statistics 1

Number of Expansions

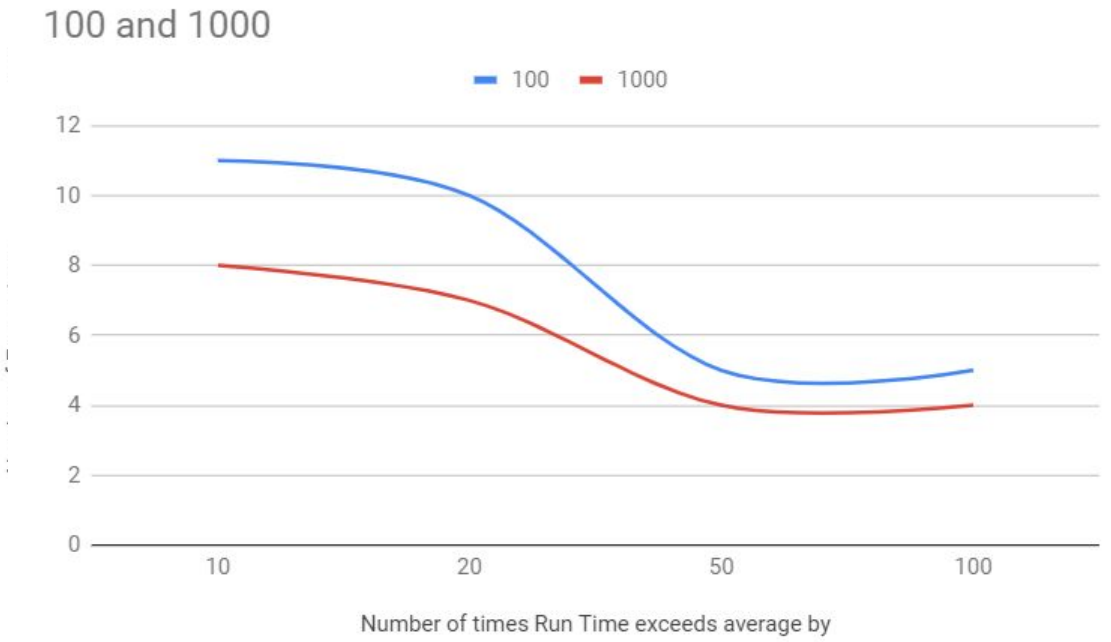
Number of Points	Number of Expansions
10	3
100	8
1000	9
10000	15
100000	20
1000000	24


Number of Expansions vs. Number of Points
25
20
15
10
5
0
Number of Expansions
10
100
1000
10000
100000
1000000
Number of Points

Statistics 2

Running Time

Number of times run time exceeds average by	100	1000	10000	100000	1000000
10%	11	8	29	34	33
20%	10	7	27	26	30
50%	5	4	5	13	16
100%	5	4	2	4	1


100 and 1000
100
1000
12
10
8
6
4
2
0
10
20
50
100
Number of times Run Time exceeds average by

Special Thanks

Prof. **Surender Baswana**

This work would not have been possible without the advice and support of our beloved Professor.

Thank you