SNS COLLEGE OF ENGINEERING

Coimbatore-107

COURSE NAME: ANALYSIS OF ALGORITHM

II YEAR/ IV SEMESTER

UNIT – II

BRUTE FORCE METHOD

Topic

Closest Pair Algorithm

Brute force method — Unit II

Closest pair Algorithm

* This method finds the closest pair of points by computing distance between every possible pair.
* Easy to implement but slower than Divide & conquer.

Example:

P = [(1,2), (3,5), (4,8), (10,12), (12,14)]

Step 1:

We calculate Euclidean distances between all pairs with formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

(i) Take $(1,2)$ & $(3,5)$: (x_1, y_1 ; x_2, y_2)

$d = \sqrt{(3-1)^2 + (5-2)^2}$

$= \sqrt{4+9} = \sqrt{13} = 3.6$

$\therefore d = 3.6$

(ii). Take $(1,2)$ & $(4,8)$: (x_1, y_1 ; x_2, y_2)

$d = \sqrt{(4-1)^2 + (8-2)^2}$

$= \sqrt{3^2 + 6^2} = \sqrt{9+36}$

$= \sqrt{45}$

$\therefore d = 6.7$

$= \sqrt{162}$

$\therefore d = 12.7$

(viii) Take $(4, 8)$ & $(10, 12)$: (x_1, y_1 ; x_2, y_2)

$d = \sqrt{(10 - 4)^2 + (12 - 8)^2}$

$= \sqrt{6^2 + 4^2}$

$= \sqrt{36 + 16}$ $= \sqrt{44}$

$= \sqrt{52}$ =

$\therefore d = 7.2$

(ix). Take $(4, 8)$ & $(12, 14)$: (x_1, y_1 ; x_2, y_2)

$d = \sqrt{(12-4)^2 + (14-8)^2}$

$= \sqrt{8^2 + 6^2}$

$= \sqrt{64 + 36} = \sqrt{100}$

$\therefore d = 10$

(x) Take $(10, 12)$ & $(12, 14)$: (x_1, y_1 ; x_2, y_2)

$d = \sqrt{(12-10)^2 + (14-12)^2}$

$= \sqrt{2^2 + 2^2}$

$= \sqrt{4+4} = \sqrt{8}$

$\therefore d = 2.8$

Step 2:

From the above, we find smallest distance is 2.8.

So the closest pair is (10, 12) & (12, 14)

(iii) Take $(1,2), (10,12)$:

$$d = \sqrt{(10-1)^2 + (12-2)^2}$$
$$= \sqrt{(9)^2 + (10)^2}$$
$$= \sqrt{81 + 100} = \sqrt{181} = 13.4$$

$\therefore d = 13.4$

(iv) Take $(1,2)$ & $(12,14)$:

$$d = \sqrt{(12-1)^2 + (14-2)^2}$$
$$= \sqrt{(11)^2 + (12)^2}$$
$$= \sqrt{121 + 144} = \sqrt{265}$$

$\therefore d = 16.3$

(V). Take $(3,5)$ & $(4,8)$:

$$d = \sqrt{(4-3)^2 + (8-5)^2}$$
$$= \sqrt{1 + 9} = \sqrt{10}$$

$\therefore d = 3.2$

(vi) Take $(3,5)$ & $(10,12)$:

$$d = \sqrt{(10-3)^2 + (12-5)^2}$$
$$= \sqrt{(7)^2 + (7)^2}$$
$$= \sqrt{49 + 49} = \sqrt{98} =$$

$\therefore d = 9.9$

(vii) Take $(3,5)$ & $(12,14)$:

$$d = \sqrt{(12-3)^2 + (14-5)^2}$$
$$= \sqrt{(9)^2 + (9)^2} = \sqrt{81+81}$$

Page

Algorithm:

```
Algorithm closestpair (points[][], n)
{
for (i=0; i<n; i++)
{
for (j=i+1; j<n; j++)
{
d = distance (points[i][0], points[i][1]
       points[j][0], points[j][1]);
if (d < minDist)
{
minDist = d;
p1_x = points[i][0];
p1_y = points[i][1];
p2_x = points[j][0];
p2_y = points[j][1];
} } }
Algorithm distance (x1, y1, x2, y2)
{ return sqrt ((x2-x1) * (x2-x1) +
        (y2-y1) * (y2-y1));
}
```

Time complexity:

$O(n^2)$ → since all pairs must be checked.

Space complexity:

$O(1)$ → No Extra memory space required