



# Supervised Learning

## (A Numerical on K-Nearest Neighbor )

**Dr. Virendra Singh Kushwah**

**Assistant Professor Grade-II**

**School of Computing Science and Engineering**

**[Virendra.Kushwah@vitbhopal.ac.in](mailto:Virendra.Kushwah@vitbhopal.ac.in)**

**7415869616**

- We have a data from questionnaire survey and objective testing with two attributes (acid durability and strength) to classify whether a special paper tissue is good or bad. We have some sample data here.

|   | X1<br>(Acid Durability)<br>Seconds | X2<br>(Strength)<br>Sq/meter | Y    |
|---|------------------------------------|------------------------------|------|
| 1 | 7                                  | 7                            | Bad  |
| 2 | 7                                  | 4                            | Bad  |
| 3 | 3                                  | 4                            | Good |
| 4 | 1                                  | 4                            | Good |
| 5 | 4                                  | 5                            | Bad  |
| 6 | 7                                  | 7                            | Bad  |
| 7 | 8                                  | 2                            | Good |
| 8 | 2                                  | 6                            | Good |
| 9 | 3                                  | 7                            | ?    |



| X1<br>(Acid Durability)<br>Seconds | X2<br>(Strength)<br>Sq/meter | Y    | Euclidean<br>Distance |
|------------------------------------|------------------------------|------|-----------------------|
| 7                                  | 7                            | Bad  | 4                     |
| 7                                  | 4                            | Bad  | 5                     |
| 3                                  | 4                            | Good | 3                     |
| 1                                  | 4                            | Good | 3.6055513             |
| 4                                  | 5                            | Bad  | 2.236068              |
| 7                                  | 7                            | Bad  | 4                     |
| 8                                  | 2                            | Good | 7.0710678             |
| 2                                  | 6                            | Good | 1.4142136             |
|                                    |                              |      |                       |
| 3                                  | 7                            | ?    |                       |

✓.

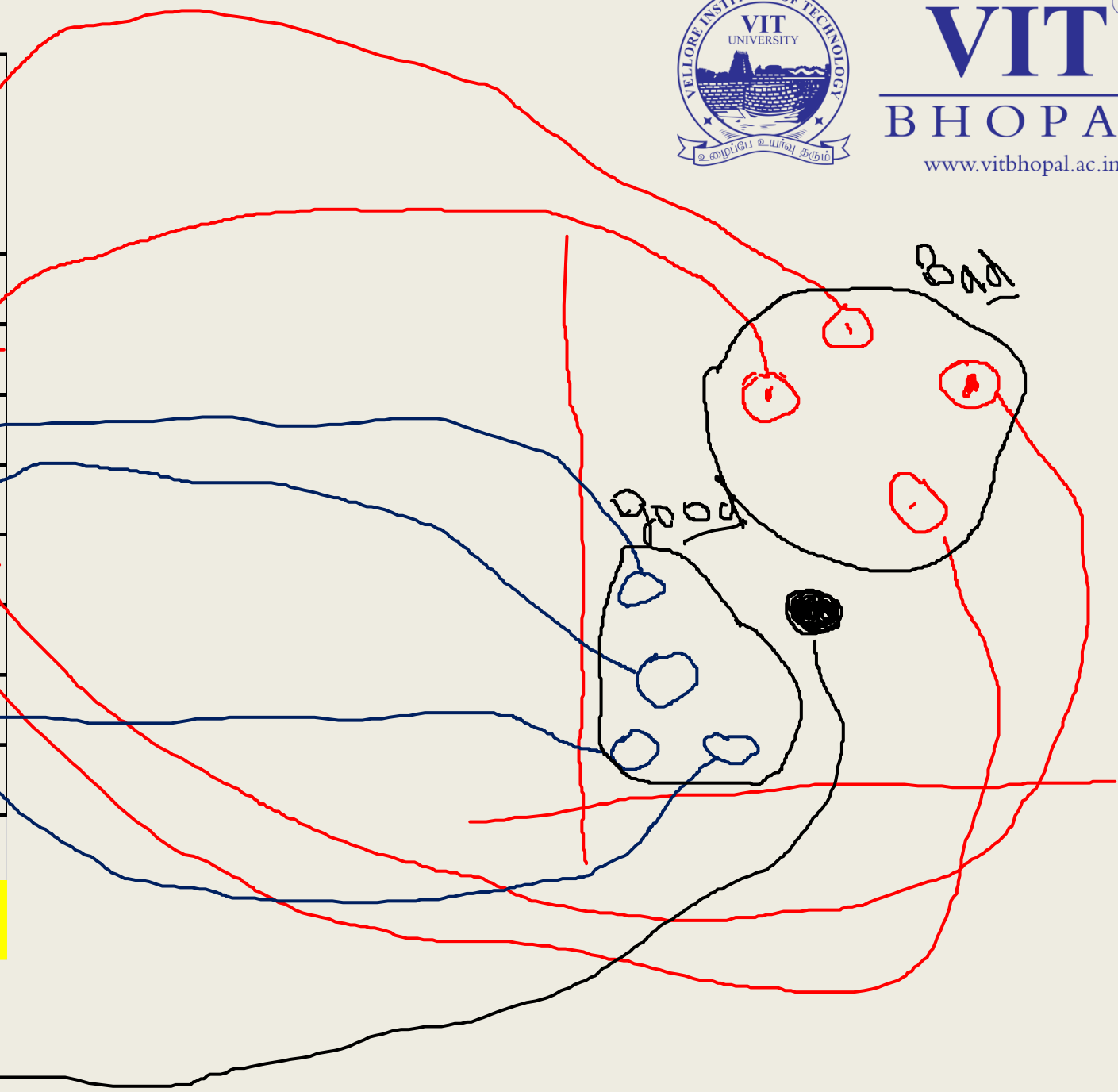
✓

✓.

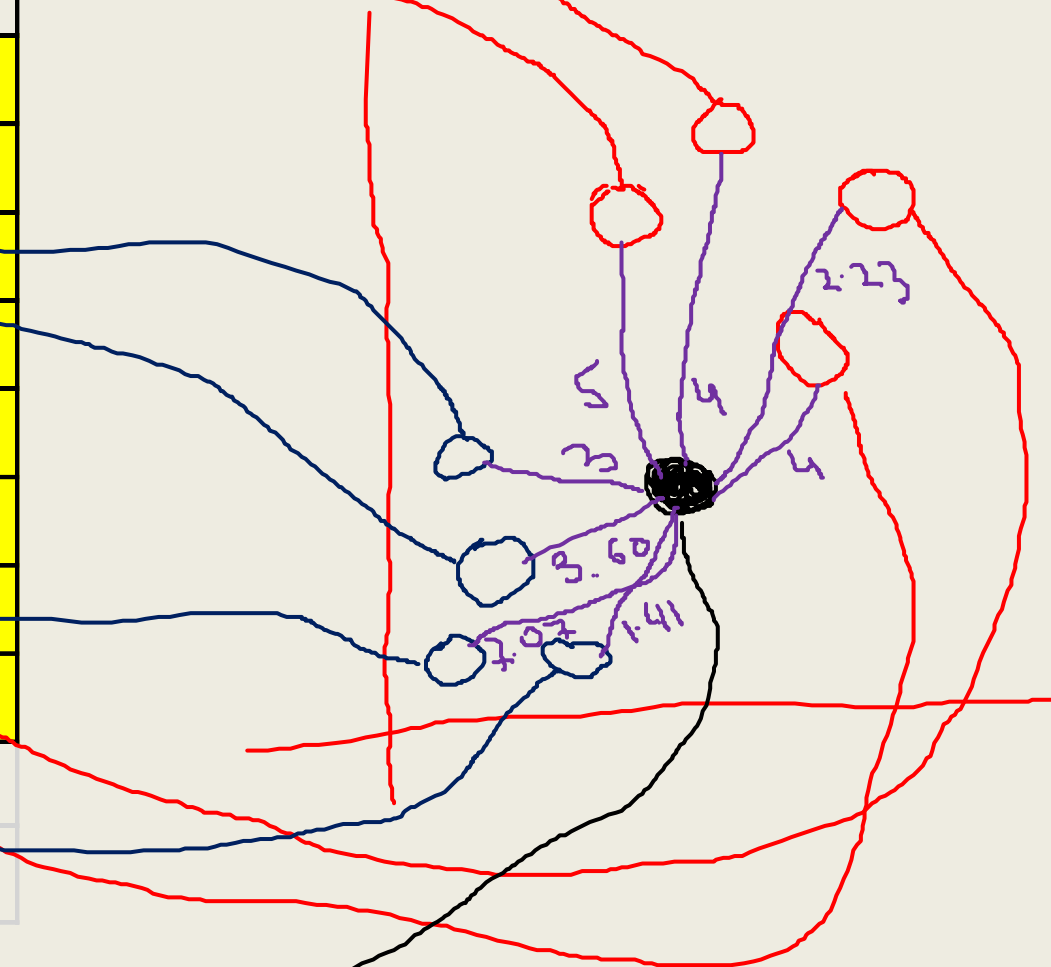
↓

| X1<br>(Acid Durability)<br>Seconds | X2<br>(Strength)<br>Sq/meter | Y      |
|------------------------------------|------------------------------|--------|
| 7                                  | 7                            | Bad ✓  |
| 7                                  | 4                            | Bad ✓  |
| 3                                  | 4                            | Good ✓ |
| 1                                  | 4                            | Good ✓ |
| 4                                  | 5                            | Bad ✓  |
| 7                                  | 7                            | Bad ✓  |
| 8                                  | 2                            | Good ✓ |
| 2                                  | 6                            | Good ✓ |

**3      7      ?**



| X1<br>(Acid Durability)<br>Seconds | X2<br>(Strength)<br>Sq/meter | Y      | Euclidean<br>Distance |
|------------------------------------|------------------------------|--------|-----------------------|
| 7                                  | 7                            | Bad ✓  | 4                     |
| 7                                  | 4                            | Bad ✓  | 5                     |
| 3                                  | 4                            | Good ✓ | 3                     |
| 1                                  | 4                            | Good ✓ | 3.6055513             |
| 4                                  | 5                            | Bad ✓  | 2.236068              |
| 7                                  | 7                            | Bad ✓  | 4                     |
| 8                                  | 2                            | Good ✓ | 7.0710678             |
| 2                                  | 6                            | Good ✓ | 1.4142136             |
| 3                                  | 7                            | ?      |                       |

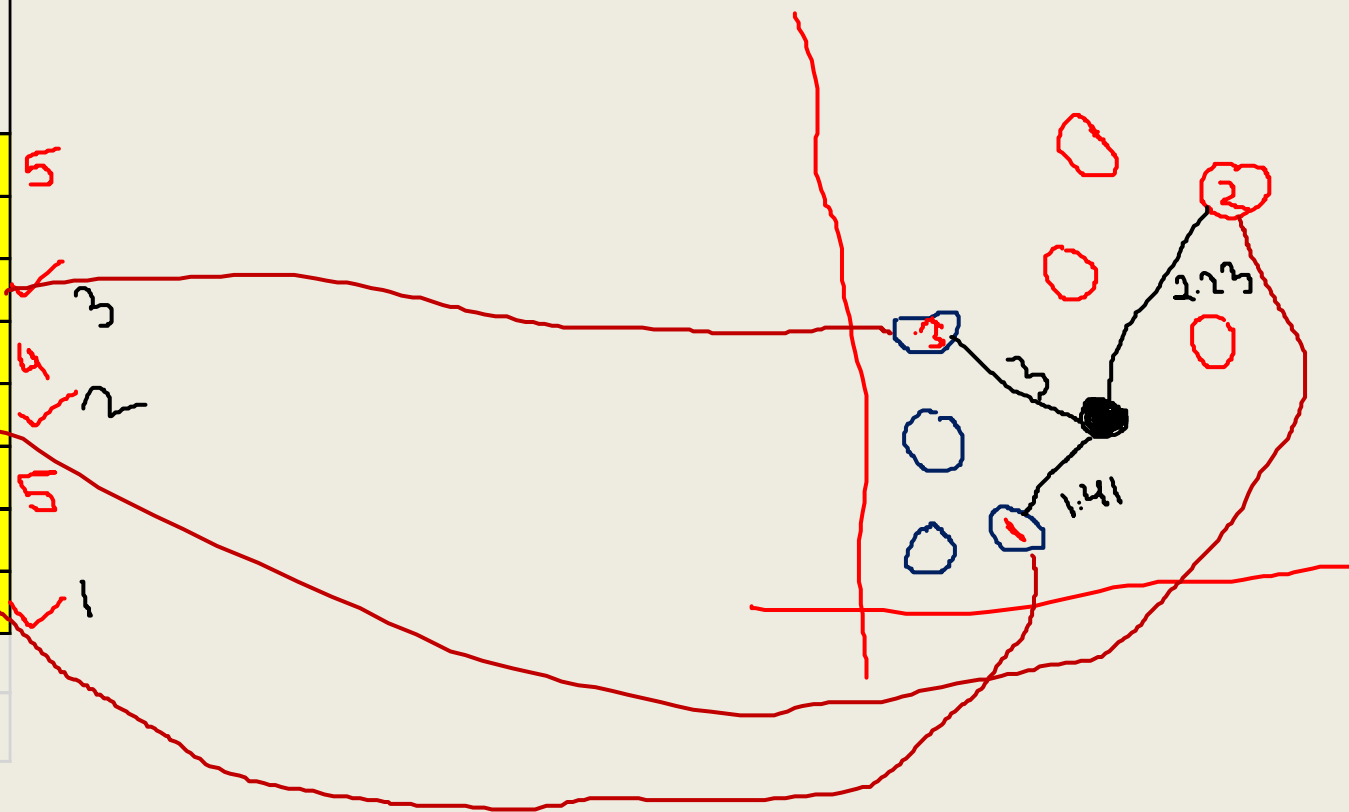


K=3

Good = 2  
Bad = 1

| X1<br>(Acid Durability)<br>Seconds | X2<br>(Strength)<br>Sq/meter | Y    | Euclidean<br>Distance |
|------------------------------------|------------------------------|------|-----------------------|
| 7                                  | 7                            | Bad  | 4                     |
| 7                                  | 4                            | Bad  | 5                     |
| 3                                  | 4                            | Good | 3                     |
| 1                                  | 4                            | Good | 3.6055513             |
| 4                                  | 5                            | Bad  | 2.236068              |
| 7                                  | 7                            | Bad  | 4                     |
| 8                                  | 2                            | Good | 7.0710678             |
| 2                                  | 6                            | Good | 1.4142136             |
| 3                                  | 7                            | ?    |                       |

good



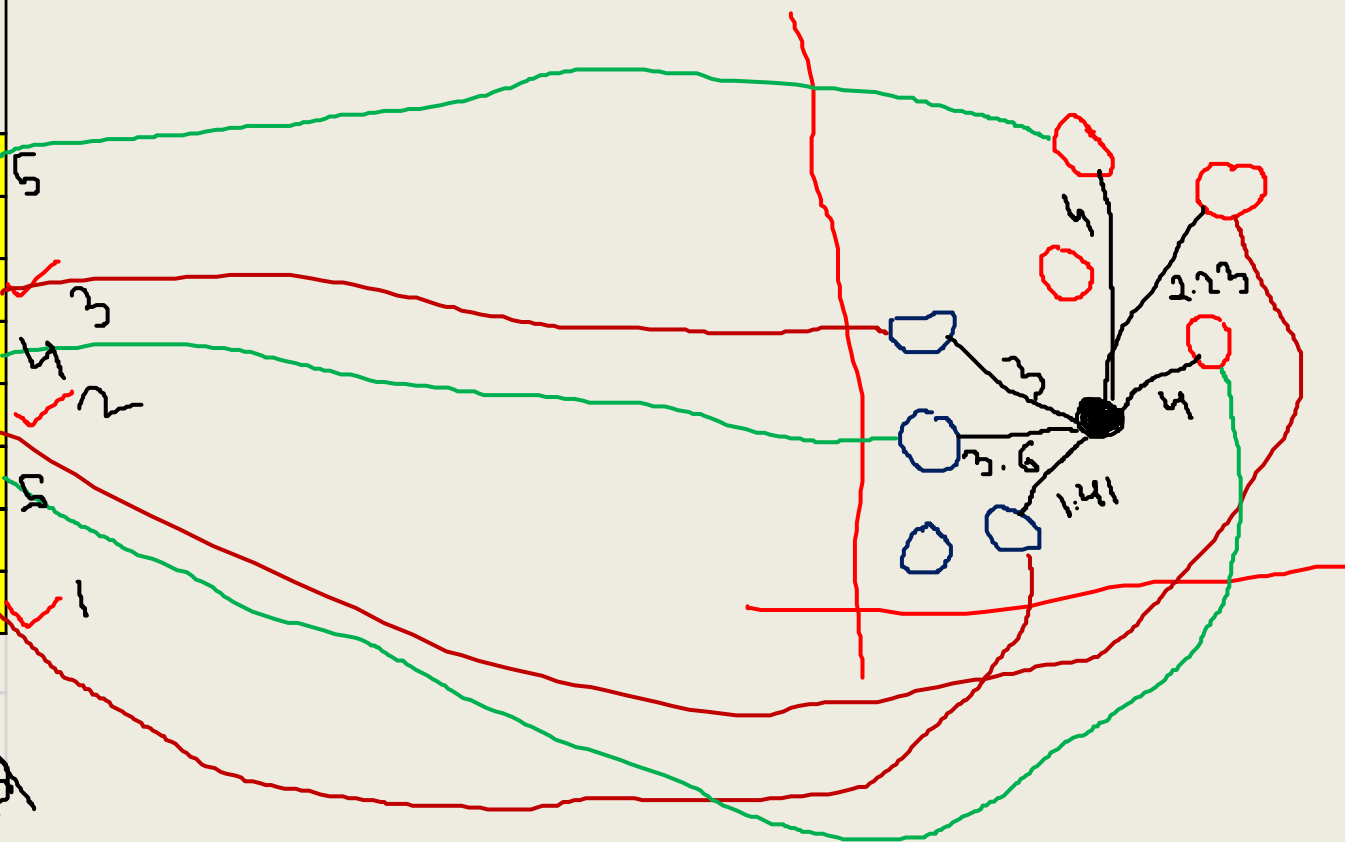
K=5

Good = 3  
Bad = 3

| X1<br>(Acid Durability)<br>Seconds | X2<br>(Strength)<br>Sq/meter | Y    | Euclidean<br>Distance |
|------------------------------------|------------------------------|------|-----------------------|
| 7                                  | 7                            | Bad  | 4                     |
| 7                                  | 4                            | Bad  | 5                     |
| 3                                  | 4                            | Good | 3                     |
| 1                                  | 4                            | Good | 3.6055513             |
| 4                                  | 5                            | Bad  | 2.236068              |
| 7                                  | 7                            | Bad  | 4                     |
| 8                                  | 2                            | Good | 7.0710678             |
| 2                                  | 6                            | Good | 1.4142136             |

|   |   |   |
|---|---|---|
| 3 | 7 | ? |
|---|---|---|

good or Bad



| X1<br>(Acid Durability)<br>Seconds | X2<br>(Strength)<br>Sq/meter | Y    | Euclidean<br>Distance | Rank |
|------------------------------------|------------------------------|------|-----------------------|------|
| 7                                  | 7                            | Bad  | 4                     | 5    |
| 7                                  | 4                            | Bad  | 5                     |      |
| 3                                  | 4                            | Good | 3                     | 3    |
| 1                                  | 4                            | Good | 3.6055513             | 4    |
| 4                                  | 5                            | Bad  | 2.236068              | 2    |
| 7                                  | 7                            | Bad  | 4                     | 5    |
| 8                                  | 2                            | Good | 7.0710678             |      |
| 2                                  | 6                            | Good | 1.4142136             | 1    |
|                                    |                              |      |                       |      |
| 3                                  | 7                            | ?    |                       |      |
|                                    |                              | Mean | 3.042638803           |      |
|                                    |                              | Mode | 4                     |      |

4 < 5 < 6  
K=5  
→ 4.5





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