**CVI620/DPS920 Worksheet 9 – Object Detection**

1. While tracking, five keypoints where detected in a frame and described in the following descriptor list:

In the next frame, only one keypoint was detected with the following descriptor:

Which of the five keypoints in the previous frame does this keypoint match to, if using:

1. L1 norm distance; i.e.
2. Hamming distance; i.e.
3. Given a dictionary of 4 objects:

Given the following features detected in an image, which of the four objects is detected using an Euclidean distance (L2 norm):

1. Given the following binary image and template of a C-shape:

Binary image Template

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 1 | 1 | 1 | 0 |  | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 1 |  | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 0 |  | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | 0 |  |  |  |  |
| 0 | 1 | 0 | 0 | 1 | 0 |  |  |  |  |

Calculate the matching space using the sum of squared differences and use it to find the center (row, column) of the best match. Mark it on the image.

1. Use the Chamfer Matching method to find the match in the following binary (edge) image, the template shown. Use Euclidean distance to calculate the Chamfer Image.

Binary image Template

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |  | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |  | 1 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |  | 1 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |  | 1 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |  | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |  |  |  |  |  |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |  |  |  |  |  |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |