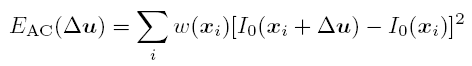
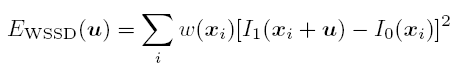
Question 1:

1. What is auto-correlation function? What is the difference between auto-correlation function and weighted summed square difference?





1. Please calculate the auto-correlation function of the following three patches (the patches only contain the center and its eight neighbors) and fill out the auto-correlation function table. Explain which center of the patch is most likely to be a feature point. The numbers represent grayscale intensity.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 7 | 7 | 8 | 9 | 9 |  | 7 | 7 | 7 | 7 | 8 |  | 3 | 2 | 2 | 3 | 2 |
| 8 | 7 | 6 | 7 | 9 |  | 6 | 6 | 6 | 3 | 2 |  | 2 | 3 | 4 | 4 | 5 |
| 8 | 6 | 2 | 8 | 8 |  | 2 | 2 | 2 | 2 | 2 |  | 6 | 3 | 2 | 2 | 3 |
| 8 | 7 | 7 | 7 | 8 |  | 3 | 3 | 7 | 7 | 8 |  | 2 | 4 | 5 | 3 | 3 |
| 9 | 9 | 8 | 8 | 9 |  | 8 | 8 | 8 | 8 | 8 |  | 3 | 2 | 4 | 3 | 6 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 62 | 53 |  |  |  | 102 | 95 |  | 23 | 25 | 33 |
| 60 |  | 59 |  | 25 | 0 | 27 |  | 21 | 0 | 9 |
| 65 | 51 | 62 |  | 87 | 111 |  |  | 39 |  | 25 |

Answer 1:

1. Auto-correlation function: a function which can determine the proper feature points in one image by the image itself.

Auto-correlation function can find the proper feature points by the image itself, and weighted summed square difference is usually used to compare the difference between two images or patches.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 62 | 53 | **67** |  | **117** | 102 | 95 |  | 23 | 25 | 33 |
| 60 | **0** | 59 |  | 25 | 0 | 27 |  | 21 | 0 | 9 |
| 65 | 51 | 62 |  | 87 | 111 | **146** |  | 39 | **24** | 25 |

The leftmost one is the proper feature point, because there are much difference between the center and its eight neighbors.

Question 2:

Please describe three matching strategies and its methods respectively.

Answer 2:

1. Matching with fixed threshold: every feature point will be matched with any feature point which has distance not farther than the threshold. This method may have higher false positive rate.
2. Nearest neighbor: every feature point will be matched with the feature point which is the nearest feature point among all feature points.
3. Nearest neighbor distance ratio: for every feature point we compute the ratio of the distances between the first and second nearest feature points. And then only take into account the smaller ratio ones. It means we only match the obvious feature point pairs and not to match ambiguous ones.