

Question 1 [30 Marks]

An image is stored as a matrix of 0s and 1s. We can change the value of these bits by applying a filter over the image. Given a 6 x 6 image matrix, you have to iterate over the image using a 2 x 2 filter matrix.

Consider the following rule for applying the filter:

- Place the filter matrix over the image matrix.
- If all the elements of the filter matrix match the image matrix, change the value of the index that overlaps the (0,0) index of the filter matrix to 1, otherwise change the value to 0.

Note: This rule will not apply to the last row and last column (both will be zero).

For example:

Filter Matrix:

1 1

1 1

Image Matrix:

1 1 0 1 1 0

1 1 0 1 1 0

1 1 0 1 1 0

1 0 1 1 0 0

1 1 0 1 1 0

1 1 0 1 1 0

Applying the filter over the image. All the elements are matching, change the value of the index that overlaps (0,0) index of the filter matrix to 1.

Filter Matrix:

1 1

1 1

Image Matrix:

1 1 0 1 1 0

1 1 0 1 1 0

1 1 0 1 1 0

1 0 1 1 0 0

1 1 0 1 1 0

1 1 0 1 1 0

Output after one element operation:

1 1 0 1 1 0

1 1 0 1 1 0

1 1 0 1 1 0

1 0 1 1 0 0

1 1 0 1 1 0

1 1 0 1 1 0

Applying filter over image: All the elements are not matching, change the value of the index that overlaps (0,0) index of the filter matrix to 0.

Filter Matrix:

1 1

1 1

Image Matrix:

1 1 0 1 1 0

1 1 0 1 1 0

1 1 0 1 1 0

1 0 1 1 0 0

1 1 0 1 1 0

1 1 0 1 1 0

Output of second element operation:

1 0 0 1 1 0

1 1 0 1 1 0

1 1 0 1 1 0

1 0 1 1 0 0

1 1 0 1 1 0

1 1 0 1 1 0

Replaced value with 0 because pattern does not match

Final output matrix:

1 0 0 1 1 0

1 0 0 1 1 0

1 0 0 1 1 0

1 0 0 1 1 0

0 0 0 0 0 0

0 0 0 0 0 0

Note: You should do all the tasks using functions.