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CS 415

Mini Project 3

Q1.

Similarities:

- Both algorithms are used to extract information from an image by clustering together pixels that are similar in some way.

Differences:

- Mean-shift automatically determines the amount of clusters needed while k-means you must specify beforehand
- Mean-shift is not affected by outliers in the data while in k-means the impact is quite significant
- The complexity of k-means is much better than mean-shift

Q2.

Q2. Data = {0, 1, 2, 3, 4} Centroid 1 = 3 Centroid 2 = 4

1st Iteration:

C_1 = Cluster 1 = {3}

C_2 = Cluster 2 = {4}

Data	D_1	D_2	Cluster
0	3	4	C_1
1	2	3	C_1
2	1	2	C_1
3	0	1	C_1
4	1	0	C_2

$C_1 = \{0, 1, 2, 3\}$

$C_2 = \{4\}$

New Centroid 1 = $\frac{0+1+2+3}{4} = 1.5$

New Centroid 2 = $\frac{4}{1} = 4$

Iteration 2:

Data	D_1	D_2	Cluster
0	1.5	4	C_1
1	0.5	3	C_1
2	0.5	2	C_1
3	1.5	1	C_2
4	2.5	0	C_2

$C_1 = \{0, 1, 2\}$

$C_2 = \{3, 4\}$

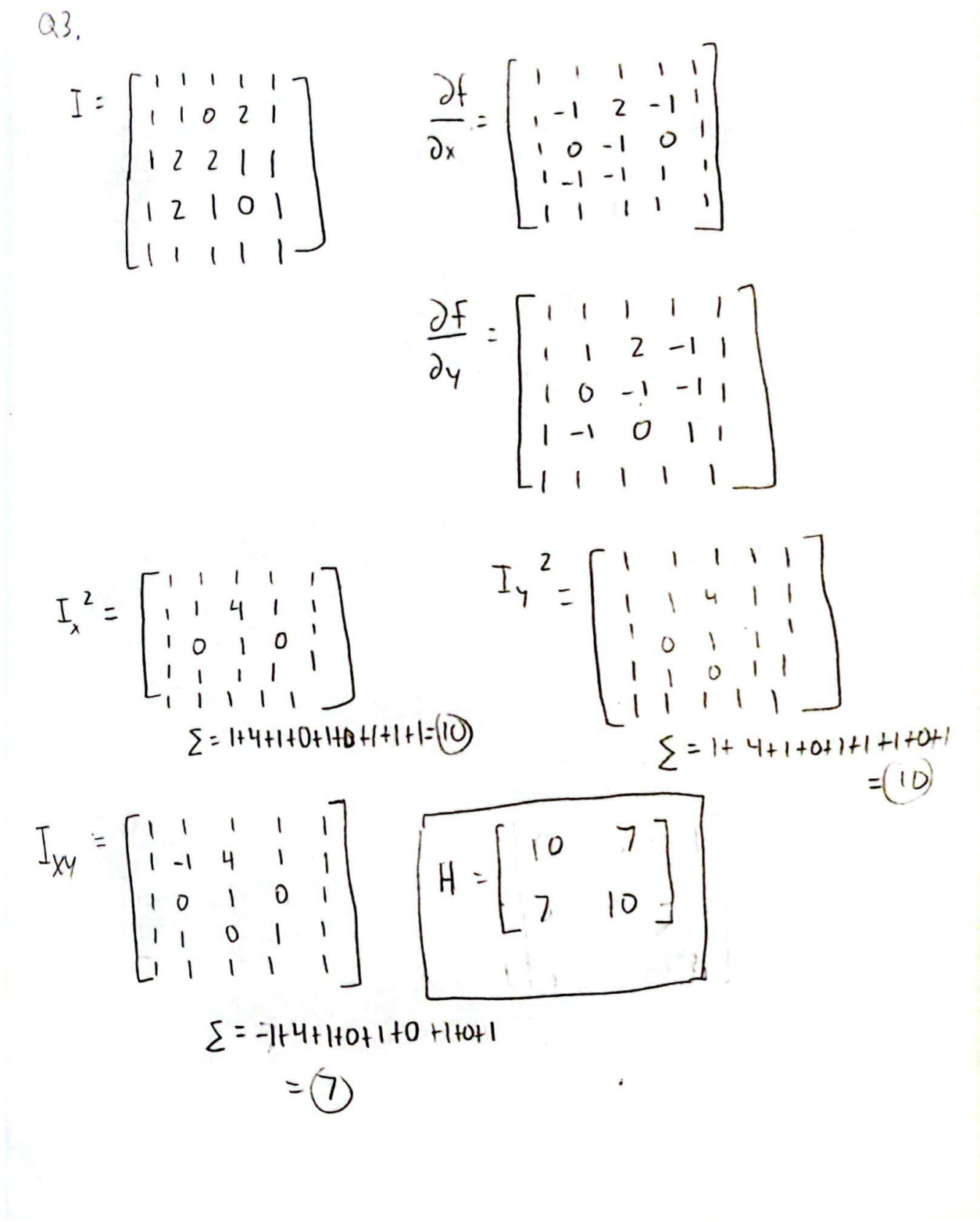
New Centroid 1 = $\frac{0+1+2}{3} = 1$

New Centroid 2 = $\frac{3+4}{2} = 3.5$

* D_1 = Distance to Centroid 1

D_2 = Distance to Centroid 2.

Q3.


Q3.
$I = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 2 & 1 \\ 1 & 2 & 2 & 1 & 1 \\ 1 & 2 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$
$\frac{\partial f}{\partial x} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & -1 & 2 & -1 & 1 \\ 1 & 0 & -1 & 0 & 1 \\ 1 & -1 & -1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$
$\frac{\partial f}{\partial y} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 2 & -1 & 1 \\ 1 & 0 & -1 & -1 & 1 \\ 1 & -1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$
$I_x^2 = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 4 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$
$\Sigma = 1+4+1+0+1+1+1+1+1 = 10$
$I_y^2 = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 4 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$
$\Sigma = 1+4+1+0+1+1+1+0+1 = 10$
$I_{xy} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & -1 & 4 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$
$H = \begin{bmatrix} 10 & 7 \\ 7 & 10 \end{bmatrix}$
$\Sigma = 1+4+1+0+1+0+1+1+1 = 7$