No. Abdelrahman Adel
Date 1701296 Sheet 5

(1) 1 → B
2 → E
3 → A #
4 → C
5 → D

(2) a) 1. Keypoint Localization using a scale-space extrema based on (DoG) method

2. Orientation Assignment for each point by considering the local gradient directions within the keypoint's neighborhood.

3. Descriptor Computation using grid of orientation histograms in the keypoint's local region

b) Rotation, Scale, Affine Transformations

c) It's achieved by assigning an orientation to each keypoint based on local gradient directions

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3)
$$\begin{bmatrix} 1&1&1&1 \\ 1&2&2&2 \\ 1&2&4&4 \\ 1&2&4&8 \end{bmatrix} \times \begin{bmatrix} 0.4 & 0.45 & 0.45 & 0.5 \\ 0.5 & 0.5 & 0.5 & 0.55 \\ 0.5 & 0.55 & 0.65 & 0.9 \\ 0.55 & 0.9 & 0.9 & 0.55 \end{bmatrix} = \begin{bmatrix} 1.95 & 2.4 & 2.4 & 2.5 \\ 3.5 & 4.35 & 4.35 & 4.5 \\ 5.6 & 7.25 & 7.35 & 7.4 \\ 7.8 & 10.85 & 10.85 & 9.6 \end{bmatrix}$$

$$\begin{bmatrix} 1&2&4&8 \\ 1&2&4&4 \\ 1&2&2&2 \\ 1&1&1&1 \end{bmatrix} \times \begin{bmatrix} 0.95 & 0.5 & 0.55 & 0.5 \\ 0.5 & 0.45 & 0.45 & 0.35 \\ 0.4 & 0.4 & 0.4 & 0.3 \\ 0.45 & 0.45 & 0.3 & 0.35 \end{bmatrix} = \begin{bmatrix} 7.15 & 6.6 & 5.45 & 5.2 \\ 5.35 & 4.8 & 4.25 & 3.8 \\ 3.65 & 3.1 & 2.85 & 2.5 \\ 2.3 & 1.8 & 1.7 & 1.5 \end{bmatrix}$$

$$\begin{bmatrix} 1&1&1&1 \\ 2&2&2&1 \\ 4&4&2&1 \\ 8&4&2&1 \end{bmatrix} \times \begin{bmatrix} 0.5 & 0.5 & 0.4 & 0.45 \\ 0.55 & 0.5 & 0.45 & 0.4 \\ 0.8 & 0.75 & 0.5 & 0.5 \\ 0.55 & 0.55 & 0.9 & 0.95 \end{bmatrix} = \begin{bmatrix} 2.4 & 2.3 & 2.25 & 2.3 \\ 4.25 & 4.05 & 3.6 & 3.65 \\ 6.35 & 6.05 & 5.3 & 5.35 \\ 8.35 & 8.05 & 6.9 & 7.15 \end{bmatrix}$$

$$\begin{bmatrix} 8&4&2&1 \\ 4&4&2&1 \\ 2&2&2&1 \\ 1&1&1&1 \end{bmatrix} \times \begin{bmatrix} 0.5 & 0.55 & 0.95 & 0.9 \\ 0.35 & 0.35 & 0.33 & 0.5 \\ 0.3 & 0.3 & 0.55 & 0.5 \\ 0.35 & 0.3 & 0.5 & 0.55 \end{bmatrix} = \begin{bmatrix} 6.35 & 6.7 & 10.52 & 10.75 \\ 4.35 & 4.5 & 6.72 & 7.15 \\ 2.65 & 2.7 & 4.16 & 4.35 \\ 1.5 & 1.5 & 2.33 & 2.45 \end{bmatrix}$$

↘ = 1.95+3.5+5.6+10.85+2.33+2.45 = 26.68

↓ = 7.8+7.15+5.35+3.1+1.8+2.4+4.35+7.25+4.25+5.45+2.5+1.5+4.25+7.15+4.35 = 63.25

↙ = 2.4+2.3+4.05+6.05+8.05 = 22.85

← = 6.35+8.35+6.35+7.25+3.6+5.3+6.9 = 39.1

↖ = 4.35+7.25+6.6+5.2 = 23.4

↑ = 3.65+2.3+2.4+10.85+4.8+2.85+1.7+2.5+4.5+7.4+9.6+3.8+4.35+2.65+4.5+6.7 = 74.35

↗ = 2.3+3.65+5.35+7.15 = 18.45

→ = 1.5+1.5+2.7+10.52+6.72+4.16+10.75 = 37.85

DAOM