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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021**

COURSE NAME : VISION SYSTEM
COURSE CODE : BEH 41902 / BEJ34202
PROGRAMME CODE : BEJ
EXAMINATION DATE : JULY 2021
DURATION : 2 HOURS AND 30 MINUTES
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **THREE (3) PAGES**

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Part A (Objective)

Q0 Answer all the questions from the following link:

bit.ly/BEH41902_FE

(50 marks)

Part B (Subjective)

Q1 You have been given a task to segment out objects of interests from image *A* and image *B* with a resolution of 8x5 pixels as shown in **Figure Q1**. For the segmentation, the global method shall be executed using OTSU between class variance while local method using mean-C with 3x3 kernel and $C=140$.

(a) Investigate the suitable method of segmentation to separate between foreground and background of image *A* and Image *B* respectively. (Please use illustration and provide clear explanation).

(4 marks)

(b) Analyze the optimal threshold value of image *A*.

(16 marks)

(c) From the threshold value obtained in **Q1(b)**, construct an edge map of image *A* by using Prewit operator given by:

$$dx = \begin{bmatrix} -1 & -1 & -1 \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}, dy = \begin{bmatrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{bmatrix}$$

(5 marks)

Q2 By referring to Convolutional Neural Network (CNN) code in **Figure Q2**:

(a) Illustrate the model structure with details of layer label.

(3 marks)

(b) Analyze image output shape and its total trainable parameters for each stack of the CNN layer.

(20 marks)

(c) Illustrate the new model structure if VGG pre-trained model is to be integrated to the existing CNN structure.

(2 marks)

- END OF QUESTION -

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100	100	100	100	100	100	100	100
110	110	150	150	170	110	110	100
110	130	130	130	170	170	170	110
110	110	150	150	170	170	120	110
110	170	170	170	170	120	120	120

Image A

110	110	110	110	100	100	120	120
110	120	120	130	150	170	150	130
110	100	130	120	150	170	170	130
100	100	130	130	170	170	170	120
100	100	150	100	170	170	170	150

Image B

Figure Q1

```

cnn_model = models.Sequential()
cnn_model.add(layers.Conv2D(16,(11,11), activation='relu', input_shape=(256,256,3)))
cnn_model.add(layers.MaxPooling2D((2,2)))
cnn_model.add(layers.Conv2D(32,(7,7),activation='relu'))
cnn_model.add(layers.MaxPooling2D((2,2)))
cnn_model.add(layers.Conv2D(64,(1,1),activation='relu'))
cnn_model.add(layers.Conv2D(128,(5,5),activation='relu'))
cnn_model.add(layers.MaxPooling2D((2,2)))
cnn_model.add(layers.Conv2D(256,(3,3),activation='relu'))
cnn_model.add(layers.MaxPooling2D((2,2)))
cnn_model.add(layers.Conv2D(512,(3,3),activation='relu'))
cnn_model.add(layers.Flatten())
cnn_model.add(layers.Dense(512, activation='relu'))
cnn_model.add(layers.Dense(1,activation='sigmoid'))
    
```

Figure Q2

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