Enrollment No......................................

Faculty of Engineering / Science
End Sem Examination May-2024
CS3EL22 / BC3EA06 Computer Vision

Programme: B.Tech. / B.Sc.   Branch/Specialisation: All /
Computer Science

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1   i.   What is the primary purpose of the convolution operation in a   **1**
             Convolutional Neural Network (CNN)?
             (a) To extract low-level features
             (b) To reduce the number of parameters
             (c) To introduce non-linearity
             (d) All of these

      ii.   What is the role of the ReLU (Rectified Linear Unit) activation   **1**
             function in a CNN?
             (a) To introduce non-linearity   (b) To normalize the output
             (c) To perform max-pooling   (d) To flatten the feature maps

     iii.   Which clustering algorithm is commonly used for image   **1**
             segmentation?
             (a) K-means   (b) Hierarchical   (c) Spectral   (d) All of these

      iv.   What is the purpose of the softmax function in a CNN-based   **1**
             classifier?
             (a) To normalize the output probabilities
             (b) To perform max-pooling
             (c) To calculate the loss function
             (d) To flatten the feature maps

       v.   What is the key difference between a standard CNN and a ResNet   **1**
             (Residual Network)?
             (a) ResNet has fewer layers
             (b) ResNet uses skip connections
             (c) ResNet has a different activation function
             (d) ResNet has a different pooling strategy

P.T.O.

vi. What is the main purpose of using attention mechanisms in image **1** captioning models?
(a) To focus on relevant regions of the image
(b) To generate more fluent captions
(c) To improve the efficiency of the model
(d) All of the above

vii. What is the main advantage of transfer learning in computer vision **1** tasks?
(a) Reduced training time
(b) Improved accuracy
(c) Reduced computational requirements
(d) All of these

viii. What is the primary goal of image captioning? **1**
(a) To identify object in image
(b) To generate a textual description for an image
(c) To classify image into categories
(d) To enhance image resolution

ix. What is the role of non-max suppression in the Single Shot Detector **1** (SSD) object detection algorithm?
(a) To remove duplicate detections
(b) To improve the accuracy of the model
(c) To handle the problem of scale
(d) To generate bounding boxes

x. What is the purpose of the intersection over union (IoU) metric in **1** object detection?
(a) To measure the overlap between predicted and ground truth bounding boxes
(b) To evaluate the performance of the object detector
(c) To perform non-max suppression
(d) Both (a) and (b)

Q.2 i. Explain the intuition behind Convolutional Neural Networks (CNNs) **2** and discuss the purpose of the different layers (convolution, pooling, fully connected) in a CNN.

ii. Describe the steps involved in building a CNN, including the process **3** of training, evaluating, and tuning the model.

iii. Discuss the advantages and limitations of CNN-based models **5** compared to traditional image processing techniques.

OR iv. Explain how CNNs can be applied to real-world computer vision **5** tasks, such as image classification and object detection.

Q.3 i. Describe the K-means clustering algorithm and its application in **2** image segmentation.

ii. Explain the concept of content-based image retrieval and discuss the **8** role of visual words and indexing techniques in this process.

OR iii. Compare and contrast the Bayes classifier and Support Vector **8** Machine (SVM) for image classification tasks, highlighting their strengths and weaknesses.

Q.4 i. Discuss the key architectural features of the ResNet (Residual **3** Network) and how it differs from a standard CNN.

ii. Explain the concept of transfer learning. How it can be applied to **7** improve the performance of ResNet-based models?

OR iii. Describe the benefits of using ResNet-based models for computer **7** vision tasks and discuss their applications in real-world scenarios.

Q.5 i. Explain the process of generating image captions using a **4** combination of Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs).

ii. Discuss the role of attention mechanisms in improving the **6** performance of image captioning models and describe how they work.

OR iii. Describe the challenges involved in developing effective image **6** captioning systems and discuss potential future advancements in this field.

Q.6 Attempt any two:
i. Discuss the advantages and limitations of the Single Shot Detector **5** (SSD) algorithm for object detection and compare it to other popular object detection methods.

ii. Explain the concept of intersection over union (IoU) and its **5** importance in evaluating the performance of object detection models.

iii. Describe the potential future applications of computer vision **5** technology in various domains, such as healthcare, agriculture, and surveillance, and discuss the ethical considerations involved.

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Marking Scheme
Computer Vision-BC3EA06(T)

Q.1
i)	D		1
ii)	A		1
iii)	D		1
iv)	A		1
v)	B		1
vi)	D		1
vii)	A		1
viii)	D		1
ix)	D		1
x)	D		1

Q.2 i. Thorough explanation of the intuition behind CNNs and the purpose of different layers, demonstrating strong understanding **2**

ii. Detailed description of the steps involved in building a CNN, including the training, evaluation, and tuning process **3**

iii. Comprehensive discussion of the advantages and limitations of CNN-based models, with clear examples and comparisons to traditional techniques **5**

OR iv. Detailed explanation of how CNNs can be applied to real-world computer vision tasks, with relevant examples and use cases **5**

Q.3 i. Clear description of the K-means clustering algorithm and its relevance to image segmentation **2**

ii. Thorough explanation of content-based image retrieval, with a detailed discussion of visual words and indexing techniques **8**

OR iii. Comprehensive comparison and contrast of the Bayes classifier and SVM for image classification, with specific examples and a balanced analysis of their strengths and weaknesses **8**

Q.4 i. Thorough discussion of the key architectural features of ResNet and a clear comparison to a standard CNN **3**

ii. Detailed explanation of the concept of transfer learning and how it can be applied to enhance the performance of ResNet-based models **7**

OR iii. Comprehensive description of the benefits of using ResNet-based models, with relevant examples and discussion of their real-world applications **7**

Q.5 i. Clear and detailed explanation of the process of generating image **4**

captions using CNNs and RNNs

ii. Thorough discussion of the role of attention mechanisms in image captioning models, including a comprehensive explanation of how they work **6**

OR iii. Comprehensive description of the challenges in developing effective image captioning systems, with a thoughtful discussion of potential future advancements in this field **6**

Q.6

i. Thorough discussion of the advantages and limitations of the SSD algorithm, with a well-reasoned comparison to other object detection methods **5**

ii. Clear explanation of the concept of IoU and its significance in evaluating the performance of object detection models **5**

iii. Comprehensive description of the potential future applications of computer vision technology, with a thoughtful discussion of the ethical considerations involved **5**

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