Question Paper - Computer vision 8 (5 Mark) questions (Difficulty: 3) (Difficulty 3)

1. Okay, here are 5 exam-style questions on Computer Vision, each worth 5 marks and designed with a difficulty level of 3 (where 1 is easy and 5 is very difficult):

2. \*\*Question 1: Image Segmentation and its Evaluation\*\*

3. a) Describe the concept of semantic image segmentation. Explain the difference between semantic segmentation and instance segmentation, providing a concrete example to illustrate the difference. (3 marks)

4. b) Discuss two different metrics commonly used to evaluate the performance of image segmentation algorithms. Explain the strengths and weaknesses of each metric in the context of imbalanced class distributions. (2 marks)

5. \*\*Question 2: Object Detection and Bounding Box Regression\*\*

6. a) Explain the role of bounding box regression in modern object detection frameworks like Faster R-CNN or YOLO. Why is it necessary, and what problems does it address? (3 marks)

7. b) Describe the loss function commonly used for bounding box regression. Explain how the loss function penalizes errors in the predicted bounding box coordinates (e.g., center coordinates, width, height). (2 marks)

8. \*\*Question 3: Deep Learning Architectures for Image Recognition\*\*

9. a) Explain the concept of "skip connections" as used in ResNet architectures. Why were they introduced, and what problem do they aim to solve in deep convolutional neural networks? (3 marks)

10. b) Compare and contrast the advantages and disadvantages of using a pre-trained Convolutional Neural Network (CNN) for a computer vision task versus training a CNN from scratch. Consider factors like dataset size, computational resources, and expected performance. (2 marks)

11. \*\*Question 4: Visual Tracking\*\*

12. a) Describe the key challenges in visual tracking, such as occlusion, illumination changes, and scale variations. (3 marks)

13. b) Explain the working principle of a correlation filter-based tracking algorithm (e.g., MOSSE or KCF). How does it adapt to changes in the appearance of the tracked object over time? (2 marks)

14. \*\*Question 5: 3D Vision and Structure from Motion\*\*

15. a) Explain the concept of epipolar geometry in the context of stereo vision. Define the epipolar line and epipole, and explain their significance in establishing correspondences between images. (3 marks)

16. b) Describe the basic steps involved in a Structure from Motion (SfM) pipeline. What are the inputs and outputs of each step, and how does SfM reconstruct a 3D scene from a set of 2D images? (2 marks)

17. \*\*Explanation of Difficulty Level 3:\*\*

18. These questions require more than just memorization. They require:

19. \* \*\*Understanding of Concepts:\*\* Students need to understand the underlying principles behind the algorithms and techniques.

20. \* \*\*Application of Knowledge:\*\* Students need to be able to apply their knowledge to explain the reasoning behind design choices or to compare and contrast different approaches.

21. \* \*\*Problem-Solving:\*\* Some questions might require students to think critically about the limitations of certain methods and how they might be addressed.

22. Good luck to your students! Let me know if you would like more questions or want to adjust the difficulty.