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Course: *ML&CV - prof.Heba*

Assignemnt No.: *8*

QUESTIONS

1) **What is the main issue with vanilla RNNs when dealing with long-term dependencies in sequences?**

ans: Vanilla RNNs struggle with long-term dependencies because vanishing gradients during backpropagation prevent them from remembering distant information. Newer architectures like LSTMs overcome this limitation.

2) **explain the purpose of the attention mechanism in neural networks. How does it enhance the model's ability to process sequential or spatial data?**

ans: Attention spotlights relevant parts of data (words, pixels) for enhanced processing: - Sequences: remembers distant words by dynamically weighting their importance. - Spatial data: focuses on key regions and ignores background noise.

3) **In a sequence-to-sequence model with attention, if the encoder processes a sequence of length 10 and the decoder generates a sequence of length 8, how many alignment scores need to be computed in total?**

ans: 80 alignment scores are computed

4) **Break down the four components of a Long Short-Term Memory (LSTM) cell. How does each component contribute to addressing the challenges of learning long-term dependencies?**

ans:

- Cell State & Forget Gate: Together, they filter and preserve long-term dependencies, like remembering the main plot points of a story, even after reading for hours.
- Input & Output Gates: These regulate the flow of information, ensuring only relevant updates enter and crucial insights leave, preventing distractions and focusing on what matters.

5) **If you were to visualize attention weights in a sequence-to-sequence model, what would high attention weights indicate? How does attention help the model focus on relevant parts of the input sequence during decoding?**

ans: High attention weights in a sequence-to-sequence model light up the most relevant parts of the input sequence, like a spotlight guiding the model's focus during decoding.

This selective focus improves accuracy and context-awareness in tasks like translation and text summarization.

6) **Describe the role of Region Proposal Networks (RPNs) in object detection frameworks like Faster R-CNN?**

ans:

RPNs act as treasure hunters in Faster R-CNN, scanning images for promising object locations with "objectness scores" and suggesting bounding boxes for closer inspection.

7) **How does semantic segmentation differ from object detection?**

ans: Semantic segmentation meticulously paints each pixel with its class, while object detection draws rough outlines around distinct objects.

8) **Describe the idea behind using fully convolutional networks for semantic segmentation. How do these networks differ from traditional convolutional networks in handling segmentation tasks?**

ans: FCNs ditch final fully-connected layers for convolutions, letting them process any size image and maintain pixel-level detail. This unlocks tasks like street scene labeling where each pixel gets its own "color" (semantic category). Think of it as coloring a detailed map instead of the whole thing with one color. Bye-bye fixed input sizes, hello detailed pixel-wise segmentation!
