

RNNs and LSTM Quiz

Multiple Choice Questions

- Q1. What is the primary benefit of stacking multiple RNN layers (i.e., stacked RNNs)?**
- A. Faster training
 - B. Lower memory usage
 - C. Better learning of hierarchical features
 - D. Simpler architecture
- Q2. Which of the following is the main reason RNNs struggle with long-term dependencies?**
- A. Overfitting
 - B. Vanishing gradients
 - C. Lack of non-linearity
 - D. Insufficient data
- Q3. What differentiates an LSTM cell from a standard RNN cell?**
- A. It uses ReLU instead of tanh
 - B. It introduces gates to control the flow of information
 - C. It has fewer parameters
 - D. It is a convolutional architecture
- Q4. In a standard LSTM, which gate is responsible for deciding how much of the past memory to keep?**
- A. Output gate

- B. Forget gate
- C. Input gate
- D. Update gate

Descriptive Questions

Q5. Why is the forget gate bias in LSTMs often initialized to a high value (e.g., 2 or 3)? Explain its effect on long-term dependency learning.

Q6. Bidirectional RNNs are often used for POS tagging but not machine translation. Explain why, considering input-output alignment and context flow.

Q7. Designing an RNN model for variable-length legal documents with long dependencies:

- (a) Choose between vanilla RNN or LSTM.
- (b) Stack layers or keep it shallow?
- (c) Make it bidirectional?

Justify each choice based on model behavior and task needs.

Q8. Consider a vanilla RNN with recurrent weight matrix W_h and sequence length 50. Analyze gradient behavior:

- (a) If $\|W_h\|_{\infty} = 0.9$, will gradients vanish or explode? Justify.
- (b) If $\|W_h\|_{\infty} = 1.2$, will gradients vanish or explode? Justify. Suggest an easy fix and explain how it helps.

Hint: Consider eigenvalue effects on gradient propagation over time.