

Recurrent Neural Networks

Why Sequence Models?: Understanding the importance of sequence models in tasks involving time series, language processing, and other sequential data.

Notation: Defining key mathematical symbols and notations used in describing recurrent neural networks (RNNs).

Recurrent Neural Network Model: A type of neural network designed for sequential data, where past information is used to inform future predictions.

Backpropagation Through Time: An extension of backpropagation for training RNNs by computing gradients through unfolded time steps.

Different Types of RNNs: Various architectures of RNNs, including simple RNNs, LSTMs, GRUs, and bidirectional RNNs.

Language Model and Sequence Generation: Using RNNs to generate text sequences and model natural language patterns.

Sampling Novel Sequences: Generating new sequences by sampling from a trained RNN-based model.

Vanishing Gradients with RNNs: A common problem in training deep RNNs where gradients shrink exponentially, making learning difficult.

Gated Recurrent Unit (GRU): A type of RNN that improves upon traditional RNNs by using gating mechanisms to manage long-term dependencies.

Long Short Term Memory (LSTM): An advanced RNN variant designed to retain long-term dependencies using special gating mechanisms.

Bidirectional RNN: An RNN architecture that processes sequences in both forward and backward directions for improved context understanding.

Deep RNNs: Stacking multiple RNN layers to capture more complex hierarchical structures in sequential data.

Introduction to Word Embeddings

Word Representation: A method of representing words as numerical vectors to capture their semantic meaning and relationships.

Using Word Embeddings: Applying pre-trained word embeddings in natural language processing tasks to improve model performance.

Properties of Word Embeddings: Key characteristics of word embeddings, such as similarity, analogy, and vector arithmetic.

Embedding Matrix: A matrix containing word embeddings, where each row corresponds to a word's numerical representation.

Learning Word Embeddings: Word2vec & GloVe

Learning Word Embeddings: Training word embeddings from large text corpora to capture meaningful word relationships.

Word2Vec: A neural network-based model that learns word embeddings using continuous bag-of-words (CBOW) and skip-gram approaches.

Negative Sampling: A technique used in Word2Vec to optimize training by updating a subset of word pairs rather than the entire vocabulary.

GloVe Word Vectors: A model that generates word embeddings by factorizing a word co-occurrence matrix to capture global statistical information.

Applications Using Word Embeddings

Sentiment Classification: Using word embeddings to classify text into sentiment categories such as positive, negative, or neutral.

Debiasing Word Embeddings: Techniques to remove biases from word embeddings to ensure fairness and reduce unintended associations in NLP models.

Various Sequence To Sequence Architectures

Basic Models: Fundamental sequence-to-sequence architectures used in machine translation, speech recognition, and text summarization.

Picking the Most Likely Sentence: Techniques for selecting the best output sequence based on probability scores in sequence models.

Beam Search: A decoding algorithm that explores multiple possible output sequences to find the most likely result.

Refinements to Beam Search: Improvements to beam search, such as length normalization and coverage penalties, to enhance translation quality.

Error Analysis in Beam Search: Methods for evaluating and diagnosing errors in beam search-based sequence generation.

Attention Model Intuition: An introduction to attention mechanisms that help models focus on relevant input parts during sequence generation.

Attention Model: A neural network architecture that improves sequence-to-sequence tasks by dynamically weighting different input elements.

Speech Recognition: Converting spoken language into text using deep learning models trained on audio data.

Trigger Word Detection: A technique for detecting specific words or phrases in audio streams, commonly used in voice assistants.

Transformers

Transformer Network Intuition: An overview of how transformer networks work and their advantages over traditional sequence models.

Self-Attention: A mechanism in transformers that allows the model to weigh different words in a sequence when making predictions.

Multi-Head Attention: An extension of self-attention that enables the model to focus on multiple aspects of the input sequence simultaneously.

Transformer Network: A deep learning architecture that relies entirely on self-attention mechanisms to process sequential data efficiently.