



RNN-Redes Neurais Recorrentes

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A decorative graphic on the left side of the slide consisting of overlapping geometric shapes. A blue parallelogram is partially covered by a light green parallelogram, which is in turn partially covered by a darker blue parallelogram. The background of the entire slide is a dark navy blue with faint, lighter blue diagonal stripes.

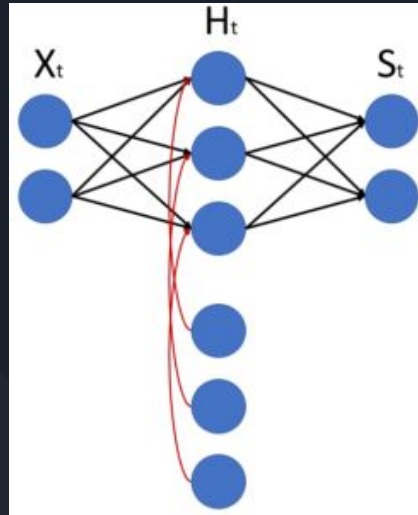
O que é a RNN?
Arquitetura
Treinamento
Aplicações
Limitações



O que é a RNN?

- Recurrent Neural Network
- Modelo de aprendizado profundo (deep learning)
- Converte uma entrada de dados sequencial em uma saída de dados específica

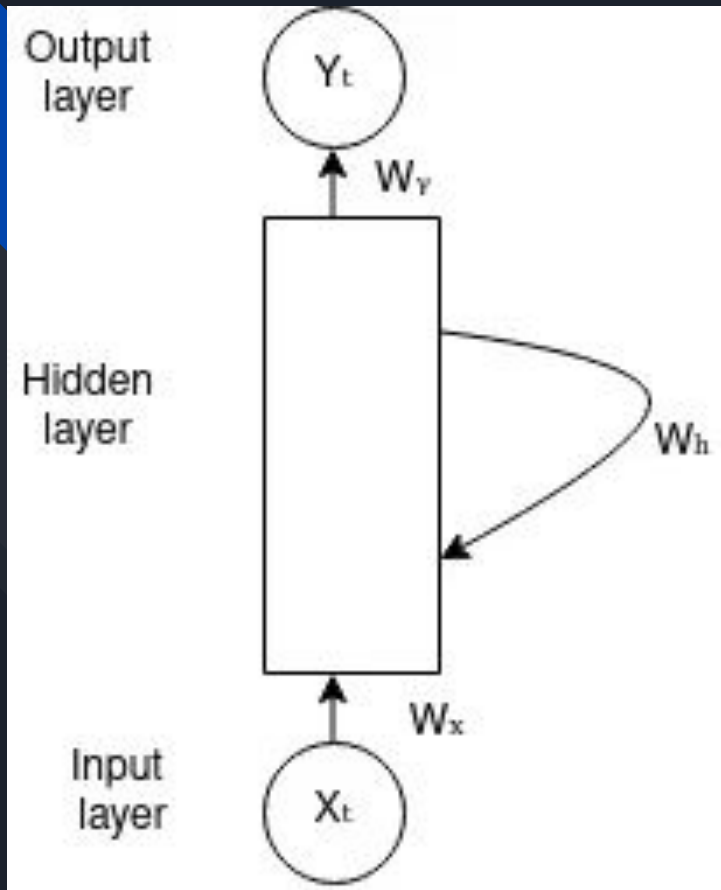
Como funciona?



Neurônios de entrada (X), de saída (S), a camada oculta (H) e a camada de memória (M)

Arquitetura

- Hidden Layers & States

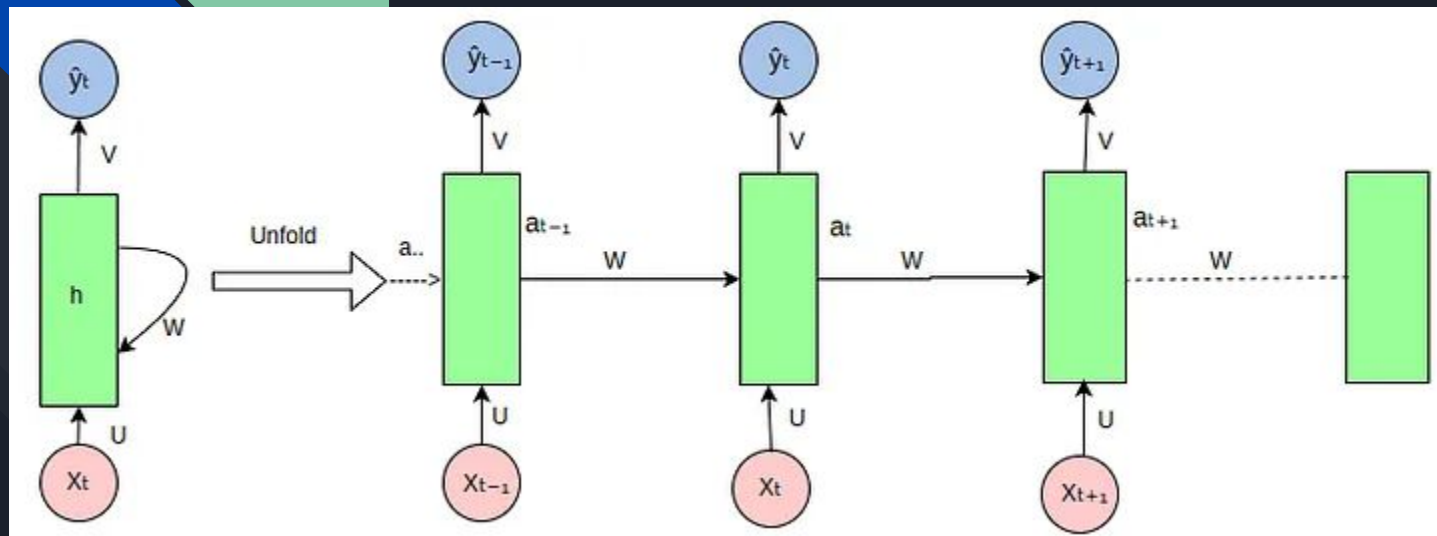


Atualização do Hidden State

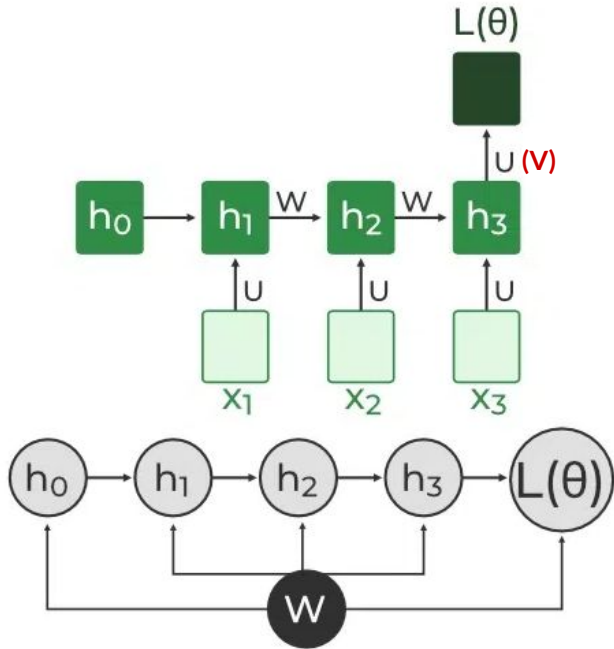
- Formula: $a_t = f(U \cdot x_t + W \cdot a_{t-1} + b)$

Computação do Resultado

- Formula: $\hat{y}_t = f(V \cdot a_t + c)$



Treinamento



Backpropagation Through Time (BPTT) In RNN

- BPTT (Backpropagation Through Time)
- Perda $L(0)$
- $W = U = V$
- Refinamento/Ajuste de pesos



Aplicações

- Principais Aplicações:
 - Processamento de Linguagem Natural (NLP)
 - Reconhecimento de Fala
 - Geração de Áudio
 - Visão Computacional
 - Análise de Séries Temporais
 - Controle de Sistemas
 - Diagnósticos

Limitações

Principais limitações:

- Problema Do Gradiente Desaparecido e Explosivo
 - Dependência de longo prazo
 - Treinamento ineficiente
 - Explosão de Softmax
 - Limitações de capacidade
 - Overfitting
-
- Alternativas de melhorias:
 - LSTM e GRU
 - Transformers

Referências

- [https://aws.amazon.com/pt/what-is/recurrent-neural-network/#:~:text=Uma%20Recurrent%20Neural%20Network%20\(RNN,sa%C3%ADda%20de%20dados%20sequencial%20espec%C3%ADfica.](https://aws.amazon.com/pt/what-is/recurrent-neural-network/#:~:text=Uma%20Recurrent%20Neural%20Network%20(RNN,sa%C3%ADda%20de%20dados%20sequencial%20espec%C3%ADfica.)
- [https://dl.acm.org/An application of recurrent neural networks to discriminative keyword spotting](https://dl.acm.org/An%20application%20of%20recurrent%20neural%20networks%20to%20discriminative%20keyword%20spotting)
- [https://www.sciencedirect.com/science/article/Time series forecasting using artificial neural networks methodologies: A systematic review](https://www.sciencedirect.com/science/article/Time%20series%20forecasting%20using%20artificial%20neural%20networks%20methodologies%20A%20systematic%20review)
- <https://medium.com/@poudelsushmita878/recurrent-neural-network-rnn-architecture-explained-1d69560541ef#:~:text=Architecture%20Of%20RNN&text=The%20RNN%20takes%20an%20input,parameters%20across%20all%20time%20steps.>