

NAME- RISHI KUMAR
CWID- 20015656
HOME WORK #8

Part 1: Prepare a 1-page slide/poster to review/summarize the concept of RNN

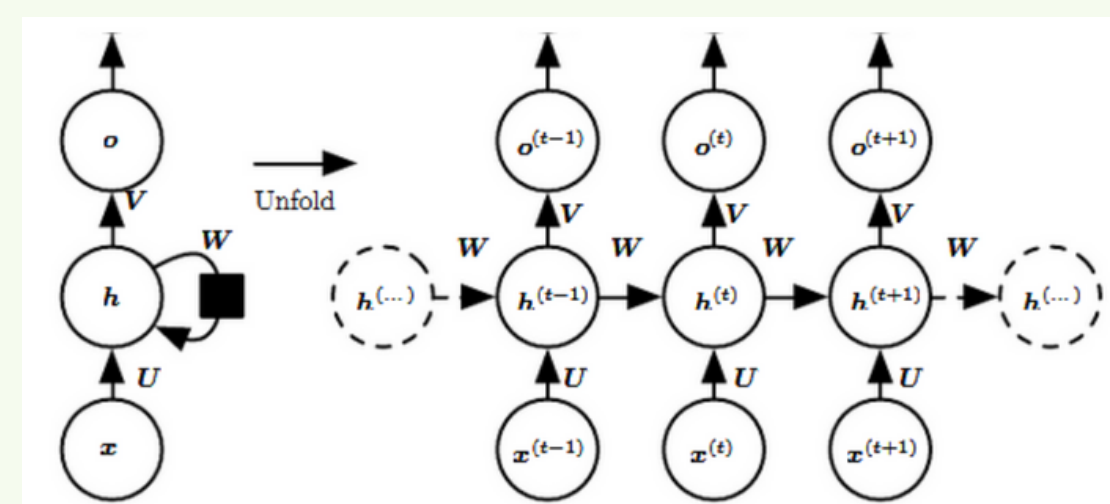
Recurrent Neural Networks

What is a Recurrent neural network?

- A recurrent neural network (RNN) is a type of artificial neural network which uses sequential data or time series data.
- These deep learning algorithms are commonly used for ordinal or temporal problems, such as language translation, natural language processing (NLP), speech recognition, and image captioning.
- While traditional deep neural networks assume that inputs and outputs are independent of each other, the output of recurrent neural networks depends on the prior elements within the sequence.
- RNNs have a “memory” which remembers all information about what has been calculated. It uses the same parameters for each input as it performs the same task on all the inputs or hidden layers to produce the output. This reduces the complexity of parameters, unlike other neural networks.

RNN Architecture:

- Input: $x(t)$ is taken as the input to the network at time step t .
- Hidden state: $h(t)$ represents a hidden state at time t and acts as “memory” of the network
- Weights: The RNN has input to hidden connections parameterized by a weight matrix U , hidden-to-hidden recurrent connections parameterized by a weight matrix W , and hidden-to-output connections parameterized by a weight matrix V and all these weights (U , V , W) are shared across time.
- Output: $o(t)$ illustrates the output of the network.



Advantages:

- An RNN remembers each and every piece of information through time. It is useful in time series prediction only because of the feature to remember previous inputs as well. This is called Long Short Term Memory.
- Recurrent neural networks are even used with convolutional layers to extend the effective pixel neighborhood.

Disadvantages:

- Gradient vanishing and exploding problems.
- Training an RNN is a very difficult task.
- It cannot process very long sequences if using tanh or relu as an activation function.

Applications:

- they are incorporated into popular applications such as Siri, voice search, and Google Translate.

references:

1. <https://www.geeksforgeeks.org/introduction-to-recurrent-neural-network/>
2. <https://www.ibm.com/cloud/learn/recurrent-neural-networks>