

# Digital Talent Scholarship 2022

## Time Series 3

Lead a sprint through the Machine Learning Track

# Agenda

- Recurrent Neural Network for Time Series
- Real World time series data

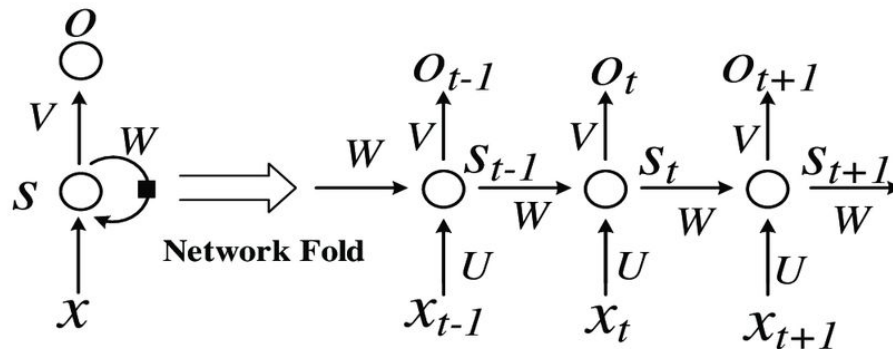
# Are your students ML-ready?

# Recap

# Recurrent Neural Networks

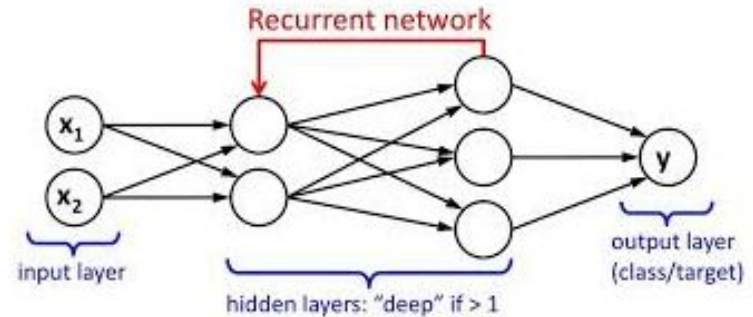
# Recurrent Neural Networks

- Jaringan saraf berulang (RNNs) adalah model Deep Learning, biasanya digunakan untuk menyelesaikan masalah dengan data input berurutan seperti Time Series
- Serangkaian neural network feed-forward dimana node tersembunyi terhubung secara seri.
- RNN memiliki prediksi beberapa seri, tidak seperti CNN.



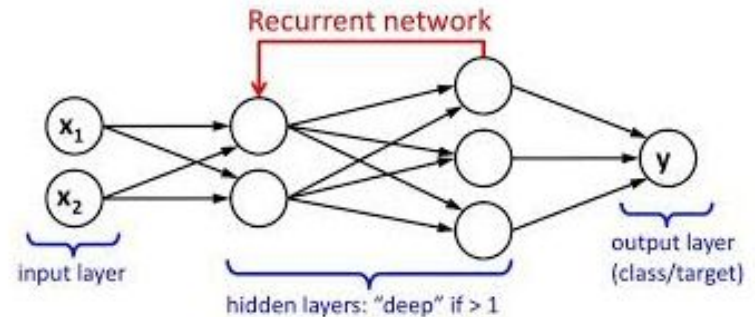
# Recurrent Neural Networks

- RNN memiliki lapisan input, lapisan tersembunyi, dan lapisan output.
- Lapisan input mengambil input, fungsi aktivasi diterapkan ke lapisan tersembunyi, dan akhirnya, RNN menerima output.
- Dalam deep neural network ada beberapa lapisan tersembunyi.
- Setiap lapisan tersembunyi diketahui bobot dan biasnya.



# Recurrent Neural Networks

- Bobot dan bias dari lapisan tersembunyi ini berbeda.
- Ini dikarenakan masing-masing lapisan ini berperilaku berbeda / independen sehingga kami tidak dapat menggabungkannya bersama-sama.
- Oleh karena itu, kita harus memiliki bobot dan bias yang sama untuk lapisan tersembunyi ini mengikat lapisan tersembunyi lain.





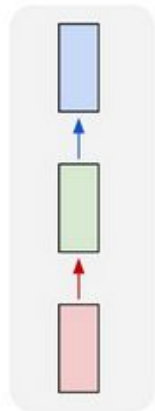
# Jenis RNN

- 1. One to One: This is also called Vanilla Neural Network. It is used in such machine learning problems where it has a single input and single output
- 2. One to Many: It has a single input and multiple outputs. An example is Music Generation

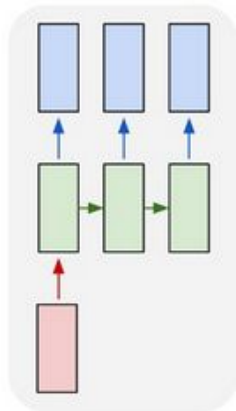
# Jenis RNN

- 3. Many to One: RNN takes a sequence of inputs and produces a single output. The examples are Sentiment classification, prediction of the next word.
- 4. Many to Many: RNN takes a sequence of inputs and produces a sequence of outputs. For example, Language Translation.

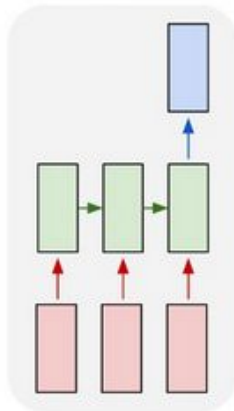
one to one



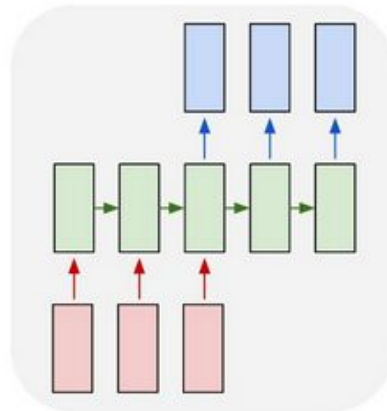
one to many



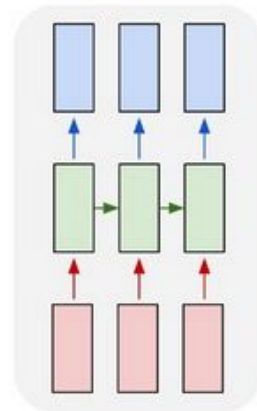
many to one



many to many



many to many



# Improvements to RNN

- RNNs have a problem called vanishing gradient descent
- Hence there are two improvements over it
  - 1.Gated Recurrent Unit (GRU)
  - 2.Long Short Term Memory (LSTM))
- Among these more popular is LSTM more often used in time series forecasting also

# Vanishing Gradient Problem

The Vanishing Gradient Problem was discovered by Sepp Hochreiter, who is a German computer scientist who also had a role in the development of Recurrent Neural Networks in deep learning.

As its name says, the vanishing gradient problem is related to deep learning gradient descent algorithms. The gradient descent algorithm is then combined with a backpropagation algorithm to update the weights throughout the Neural Network. Recurrent neural network behaves a little differently due to the hidden layer of one observation is used to train the hidden layer of the next observation.

This vanishing gradient problem occurs when the backpropagation algorithm moves back through all the neurons of the neural network to update their weights.

# Bagaimana cara solve the Vanishing Gradient Problem

Initialization of weights is one of the techniques that can be used to solve the Vanishing Gradient Problem. That is creating an initial value for weights in a neural network to prevent the backpropagation algorithm from assigning weights that are small.

# Applications(Some of) of RNN

- Speech Recognition: Anyone speaking with a particular language, gets translated into different languages. And also voice is recognized by the machine.
- Language Translation: Using RNN, Text mining and Sentiment analysis can be carried out for Natural Language Processing (NLP).
- Image Recognition and its characterization: RNNs are used to capture an image by analyzing the present activities.
- Time Series Forecasting: Any time series forecasting problem, such as predicting the prices of stocks in a particular month/year, can be solved using an RNN.

# DEMO - Time Series Forecasting using LSTM



Q n A



Terimakasih