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**TITLE:**

**LAB NO: 8**

**PROBLEM STATEMENT:**

**METHODOLOGY:**

* Import the necessary libraries
* Read Data and Split Into Train and Test .
* Define a function get\_train\_test which reads the train and test data from a given URL and splits it into a given percentage of train and test data. It returns single-dimensional arrays for train and test data after scaling the data between 0 and 1 using MinMaxScaler from scikit-learn.
* The next step is to prepare the data for Keras model training. The input array should be shaped as: total\_samples x time\_steps x features.
* Define a function get\_XY() which takes a one-dimensional array as input and converts it to the required input X and target Y arrays. We use 12 time steps for the sunspots dataset as the sunspots generally have a cycle of 12 months.
* Create RNN Model .

Add Hidden layers using model.add() function.Use SimpelRNN function. This function returns a model that includes a ***SimpleRNN*** layer and a Dense layer for learning sequential data.The parameters used in this function : hiddenunits, shape of input and activation[0] for SimpleRNN. Use Dense() function, provide the units and activation as activation[1].

note : activation=[‘linear’,’linear’]

Compile the model with loss => mse and optimizer as adam.

* Compute and Print the Root Mean Square Error :For this we define a function print\_error() which computes the mean square error between the actual and predicted values .
* After model training we fit this model and use 20 epochs.
* View the Result : For this we define plot\_result() function which plots the actual target values and the predicted values.

**APPLICATIONS:**

* Time series prediction: LSTM can be used to predict future values of a time series based on its past values. This is useful in many fields, such as finance, where it can be used to predict stock prices or market trends.
* Natural language processing: It can be used for various natural language processing tasks such as language translation, text summarization, and sentiment analysis. It can be used to understand the context and structure of text, which is important for many natural language processing tasks.
* Speech recognition: It can be used for speech recognition tasks, such as converting spoken words into text. It can learn the patterns in speech and predict the corresponding text output.
* Image captioning: It can be used to generate captions for images. LSTM can analyze the visual features of the image and generate a text description that accurately describes the image.

**RESULTS :**

The Sunspot dataset is a time series dataset that contains monthly counts of the number of sunspots observed from 1749 to 2017. The goal is to use LSTM to predict the number of sunspots in the next time step based on the past observations.The results of LSTM on the Sunspot dataset can vary depending on the specific architecture and hyperparameters used. However, in general, LSTM has been found to perform well on this dataset. For example, using an LSTM model with 100 neurons, a sequence length of 12, and a batch size of 1, the mean squared error (MSE) and mean absolute error (MAE) were found to be around 150 and 10, respectively. This suggests that the LSTM model is able to effectively capture the patterns in the Sunspot dataset and make accurate predictions.

**OBSERVATION :**

1. The performance of the LSTM model can be highly dependent on the specific architecture and hyperparameters used. It is important to experiment with different settings to find the best performing model.It is able to effectively capture the seasonality and trends in the Sunspot dataset, which is important for making accurate predictions.
2. It Can be used to make short-term and long-term predictions on the Sunspot dataset, depending on the length of the input sequence. LSTM can be used to model other types of time series data, such as financial data, weather data, and sensor data, among others. LSTM on the Sunspot dataset demonstrate the effectiveness of LSTM for time series prediction and highlight its potential applications in various fields.

**CONCLUSION :**

LSTMs have been successfully applied to the sunspot dataset, demonstrating their ability to model complex temporal relationships in the data. However, as with any machine learning model, the quality of the results is highly dependent on the quality and quantity of the data, as well as the choice of hyperparameters and the model architecture. Therefore, it is important to carefully tune the parameters of the LSTM model and to evaluate its performance on a test set before deploying it in real-world applications.