Model and Results

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A comparison of 4 models, MLP, CNN, LSTM and Bi-LSTM were done. Same amount of dataset with the same preprocessing was used for each model. The models were trained for 100 epochs each and the results were compared as shown below.

Metrics used for comparison are Mean Squared Error (MSE), Mean Absolute Error (MAE), Coefficient of Determination (R2) and Root mean squared error (RMSE). The comparison of results for each of these models are given in Table.1

Metrics	MLP	CNN	LSTM	Bi-LSTM
MSE	31.515	**0.257**	57.025	88.336
R2	0.801	**0.890**	0.512	-0.589

Tabel.1 Comparison of different models

From Table.1, we can clearly see that the **CNN model has substantially low MSE value and good Coefficient of Determination (R2).** The figures 1, 2 shows the training and validation plots of different metrics.
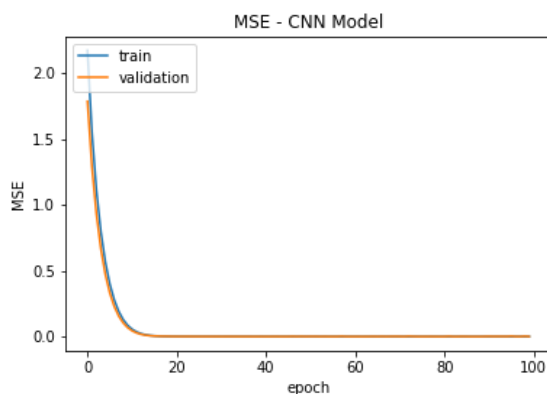

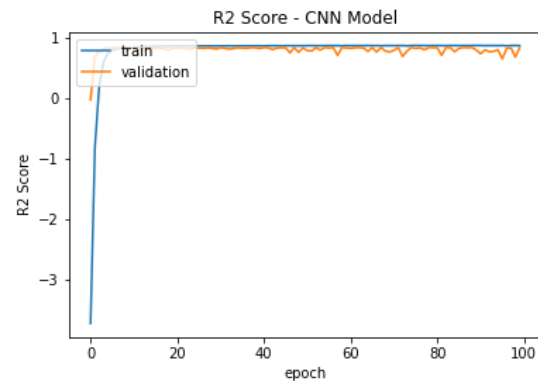Fig.1 Training and Validation MSE of CNN

Fig.2 Training and Validation R2 Score of CNN

The model was selected after the comparison to forecast the yearly rainfall with a step size of 365. In order to make the model better, hyper parameter tuning was performed, with the number of filters and the activation function. The goal was to minimize the MSE. Hence the results showed that a number of 126 kernels and activation function of tanh gave the least MSE. The architecture of CNN model is given in Fig.3
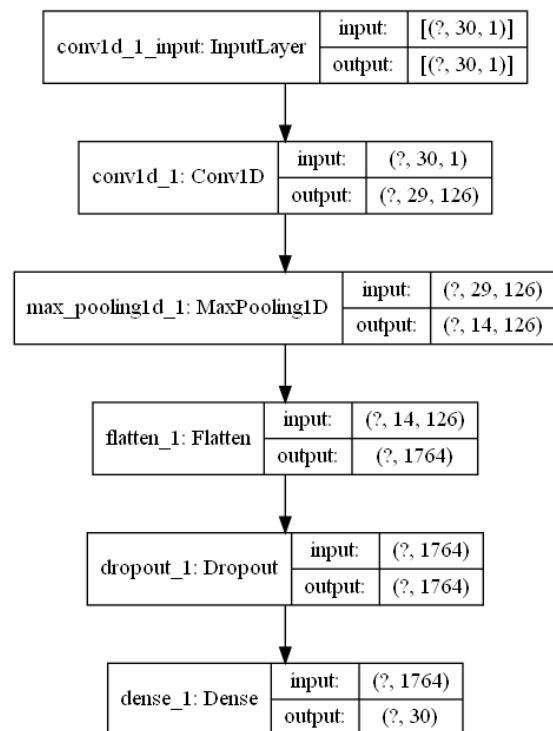

Fig.3 CNN Architecture

Comparing the training and validation of the other 3 models to the CNN model shows significant overfitting and validation loss variations.

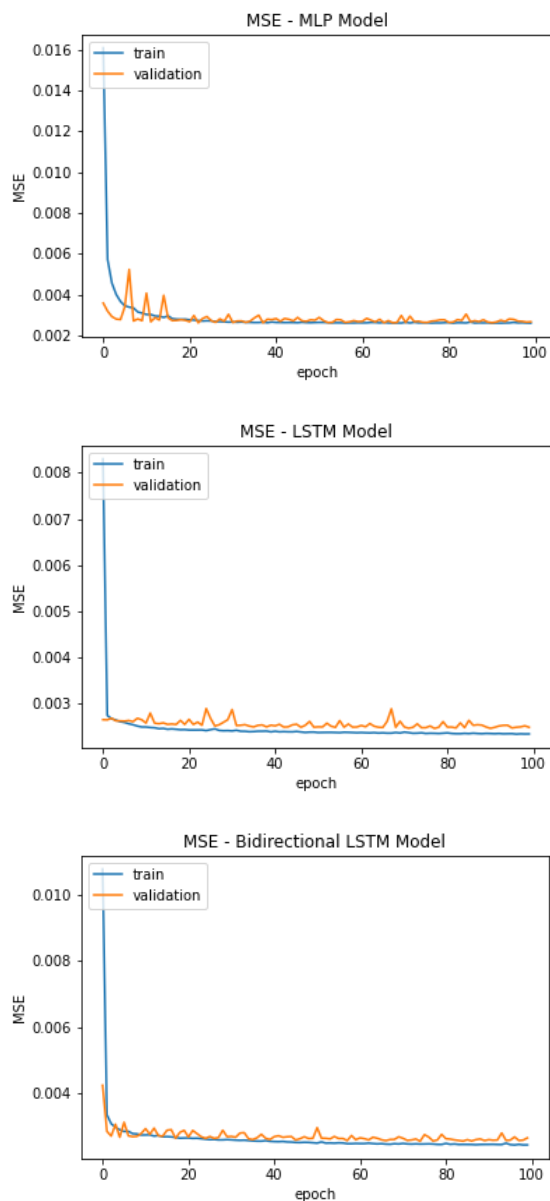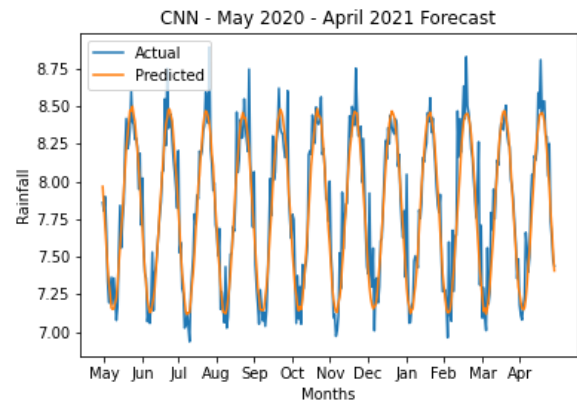
Fig. 5 Yearly Rainfall forecast with CNN

Fig.4 Comparison of MSE

Thus the CNN model was better performing during training, validation and testing. Also no overfitting was observed in the CNN model.

The yearly forecast, done with 365 time steps, on the CNN model gives the following result shown in fig 5. The Prediction in this case, gave an MSE of 29.278 and an R2 Score of 0.8597. The predicted rainfall if from May 2020 - April 2021.