The goal of sequence prediction is to predict future values of the variable of interest given past values of that variable. More precisely, at time $t$, we want to predict the values of $\langle x_{t+d}, x_{t+d+1}, ..., x_{t+d+p-1} \rangle$ given $\langle x_{t-b}, x_{t-b+1}, ..., x_{t-1} \rangle$, where $d, b$ and $p$ are positive constants, $d$ is the delay (indicating how far into the future our predictions start), $b$ is the lookback (indicating how far into the past an instance starts), and $p$ is the length of the prediction window.

Your task is to write programs for sequence prediction. Specifically, you will use the solar dataset $xrp.npy$, which contains solar x-ray (first two columns) and proton fluxes (last six columns) measured every five minutes for a period of several years.

For our experiments, we will use a lookback of 144, corresponding to 12 hours, a delay of 36, corresponding to 3 hours, and a prediction window of 12, corresponding to 1 hour. Instead of predicting all the values in the prediction window, we will predict the mean of these values. Thus the first row in our data array would be $x[:144]$ and the first target value would be $\text{np.mean}(x[180:192])$; the second row in our data array would be $x[1:145]$ and the first target value would be $\text{np.mean}(x[181:193])$, and so on.

Implement and compare the following prediction algorithms. Use the first 1,300,000 examples as training and the rest as testing.

- A baseline, consisting of predicting the mean value of a row as the target value (that is, $\text{predict}(x[i]) = \text{np.mean}(x[i])$).
- LSTM using Keras
- CONV1D in Keras
- Any regressor from sklearn

As usual, write a report describing your work. For each of the 8 columns in the dataset, compare the performance of the algorithms with the baseline and comment about their relative performances.