Chashma Prediction

Predicting using ANN, LSTM and Fuzzy Method

1: First, we need to preprocess the data.

Importing Required Libraries

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler, RobustScaler
from sklearn.model_selection import *
from sklearn.model_selection import train_test_split
from tensorflow.keras.models import Sequential
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, LSTM, Dropout
from tensorflow.keras.regularizers import l2
from tensorflow.keras.optimizers import Adam
%matplotlib inline
from sklearn import metrics as mtr
from sklearn.metrics import *
from scipy.stats import pearsonr
from sklearn.ensemble import *
import pickle
from joblib import Parallel, delayed
from tensorflow.keras.callbacks import EarlyStopping, ModelCheckpoint
from scipy.interpolate import make_interp_spline
from scipy.ndimage import gaussian_filter1d
```

Read the Excel file

```
df = pd.read_excel('C:/Grdc-Chashma Prediction/Sample Data sheet.xlsx')
df.head()
```

Out[2]:

	year	June (Temp)	July (Temp)	Aug (Temp)	Sep (Temp)	June (Precipitation)	July (Precipitation)	Aug (Precipitation)	Sep (Precipitation)	June (Pressure)	July (Pressure)	Aug (Pressure)	Sep (Pressure)	June (Discharge)	July (Discharge)	Aug (Discharge)	Sep (Discharge)
0	1961	37.24	36.60	34.75	31.87	0.23	0.45	2.55	1.60	2.57	2.56	2.57	2.13	17500	24428	33000	21000
1	1962	36.00	35.00	34.00	32.00	0.50	1.00	2.00	1.50	2.00	2.00	2.00	2.00	17500	22000	33000	21000
2	1963	35.00	34.01	33.00	31.00	0.50	1.00	1.50	1.00	2.00	2.00	2.00	2.00	17500	22000	33000	20000
3	1964	35.01	35.00	35.02	30.00	0.25	2.50	1.50	1.77	1.50	2.07	1.50	2.34	17500	21000	33000	17500
4	1965	37.00	35.00	33.00	30.00	0.00	3.00	2.00	1.00	2.00	2.00	2.00	2.00	17500	21000	17500	21000

Select the Relevant Columns

```
input_columns = df.iloc[:, 1:13]
output_column = df.iloc[:, 13:17]
X = input_columns
Y = output_column
Years = [1961,1962,1963,1964,1965,1966,1967,1968,1969,1970,1971,1972,1973,1974,1975]
X
```

Out[3]:

	June (Temp)	July (Temp)	Aug (Temp)	Sep (Temp)	June (Precipitation)	July (Precipitation)	Aug (Precipitation)	Sep (Precipitation)	June (Pressure)	July (Pressure)	Aug (Pressure)	Sep (Pressure)
0	37.24	36.60	34.75	31.87	0.23	0.45	2.55	1.60	2.57	2.56	2.57	2.13
1	36.00	35.00	34.00	32.00	0.50	1.00	2.00	1.50	2.00	2.00	2.00	2.00
2	35.00	34.01	33.00	31.00	0.50	1.00	1.50	1.00	2.00	2.00	2.00	2.00
3	35.01	35.00	35.02	30.00	0.25	2.50	1.50	1.77	1.50	2.07	1.50	2.34
4	37.00	35.00	33.00	30.00	0.00	3.00	2.00	1.00	2.00	2.00	2.00	2.00
...	...	...	...	...	...	...	...	...	...	...	...	...
58	36.40	36.40	36.20	34.00	1.40	1.32	3.25	3.04	3.04	3.04	3.60	4.24
59	37.00	37.00	35.00	33.70	0.65	3.02	3.34	3.04	4.00	4.07	4.04	3.47
60	36.21	36.21	36.21	36.00	3.02	3.02	3.47	3.34	4.07	4.21	3.60	3.60
61	35.92	35.92	35.05	35.00	1.05	1.05	3.05	3.25	3.34	3.34	3.96	3.77
62	37.00	37.00	36.07	35.00	1.04	3.01	3.12	3.02	4.16	4.07	4.00	3.34

63 rows × 12 columns

Remove Outliers

```
Q1 = X.quantile(.25)
Q3 = X.quantile(.75)
IQR = Q3 - Q1
X = X[~((X < (Q1 - 1.5 * IQR)) | (X > (Q3 + 1.5 * IQR)).any(axis=1))]
X.shape
```

Scale the Data

```
scaler_x = RobustScaler()
X_scaled = scaler_x.fit_transform(X)

scaler_y = MinMaxScaler()
y_scaled = scaler_y.fit_transform(Y)
```

Split data into Training and Testing Sets

```
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y_scaled, test_size=0.2, random_state=42)
```

2: ANN Model

ANN Model

```
def create_ann_model():
    model = Sequential()
    model.add(Dense(256, input_dim=12, activation='relu', kernel_regularizer=l2(0.001)))
    model.add(Dense(128, activation='relu', kernel_regularizer=l2(0.001)))
    model.add(Dense(64, activation='relu', kernel_regularizer=l2(0.001)))
    model.add(Dense(4, activation='relu', kernel_regularizer=l2(0.001)))
    adam = Adam(learning_rate=0.01)
    model.compile(loss='mse', optimizer=adam,learning_rate=0.001, metrics=['accuracy'])
    return model
```

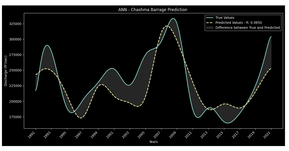
Create Models

```
ann_model = create_ann_model()
```

Train ANN Model

```
ann_model.fit(X_train, y_train, epochs=700, batch_size=8, verbose=1)
```

```
Epoch 1/700
8/8 [==============================] - 7s 13ms/step - loss: 0.4401 - accuracy: 0.2295
Epoch 2/700
8/8 [==============================] - 0s 5ms/step - loss: 0.3763 - accuracy: 0.1803
Epoch 3/700
8/8 [==============================] - 0s 5ms/step - loss: 0.3444 - accuracy: 0.0982
Epoch 4/700
8/8 [==============================] - 0s 5ms/step - loss: 0.3187 - accuracy: 0.6230
Epoch 5/700
8/8 [==============================] - 0s 5ms/step - loss: 0.2979 - accuracy: 0.6967
Epoch 6/700
8/8 [==============================] - 0s 5ms/step - loss: 0.2779 - accuracy: 0.6721
Epoch 7/700
8/8 [==============================] - 0s 7ms/step - loss: 0.2606 - accuracy: 0.6991
Epoch 8/700
8/8 [==============================] - 0s 27ms/step - loss: 0.2437 - accuracy: 0.7049
Epoch 9/700
8/8 [==============================] - 0s 5ms/step - loss: 0.2311 - accuracy: 0.6885
Epoch 10/700
8/8 [==============================] - 0s 7ms/step - loss: 0.2181 - accuracy: 0.7377
Epoch 11/700
8/8 [==============================] - 0s 5ms/step - loss: 0.2053 - accuracy: 0.7049
Epoch 12/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1934 - accuracy: 0.7705
Epoch 13/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1826 - accuracy: 0.7541
Epoch 14/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1750 - accuracy: 0.8197
Epoch 15/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1667 - accuracy: 0.8033
Epoch 16/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1582 - accuracy: 0.7869
Epoch 17/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1504 - accuracy: 0.8361
Epoch 18/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1447 - accuracy: 0.8197
Epoch 19/700
8/8 [==============================] - 0s 7ms/step - loss: 0.1371 - accuracy: 0.8361
Epoch 20/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1314 - accuracy: 0.8525
Epoch 21/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1261 - accuracy: 0.8689
Epoch 22/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1206 - accuracy: 0.8525
Epoch 23/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1157 - accuracy: 0.8689
Epoch 24/700
8/8 [==============================] - 0s 13ms/step - loss: 0.1110 - accuracy: 0.8689
Epoch 25/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1077 - accuracy: 0.8361
Epoch 26/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1044 - accuracy: 0.8361
Epoch 27/700
8/8 [==============================] - 0s 5ms/step - loss: 0.1003 - accuracy: 0.8525
Epoch 28/700
8/8 [==============================] - 0s 17ms/step - loss: 0.0968 - accuracy: 0.8525
Epoch 29/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0929 - accuracy: 0.8525
Epoch 30/700
8/8 [==============================] - 0s 47ms/step - loss: 0.0901 - accuracy: 0.8689
Epoch 31/700
8/8 [==============================] - 0s 15ms/step - loss: 0.0866 - accuracy: 0.8525
Epoch 32/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0842 - accuracy: 0.8689
Epoch 33/700
8/8 [==============================] - 0s 15ms/step - loss: 0.0823 - accuracy: 0.8525
Epoch 34/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0800 - accuracy: 0.8689
Epoch 35/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0777 - accuracy: 0.8689
Epoch 36/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0752 - accuracy: 0.8689
Epoch 37/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0739 - accuracy: 0.8361
Epoch 38/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0717 - accuracy: 0.8689
Epoch 39/700
8/8 [==============================] - 0s 13ms/step - loss: 0.0696 - accuracy: 0.8689
Epoch 40/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0675 - accuracy: 0.8689
Epoch 41/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0657 - accuracy: 0.8689
Epoch 42/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0638 - accuracy: 0.8689
Epoch 43/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0623 - accuracy: 0.8689
Epoch 44/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0604 - accuracy: 0.8689
Epoch 45/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0586 - accuracy: 0.8852
Epoch 46/700
8/8 [==============================] - 0s 13ms/step - loss: 0.0565 - accuracy: 0.8689
Epoch 47/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0576 - accuracy: 0.8852
Epoch 48/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0557 - accuracy: 0.8689
Epoch 49/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0550 - accuracy: 0.8689
Epoch 50/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0541 - accuracy: 0.8689
Epoch 51/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0526 - accuracy: 0.8689
Epoch 52/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0515 - accuracy: 0.8525
Epoch 53/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0513 - accuracy: 0.8852
Epoch 54/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0503 - accuracy: 0.8689
Epoch 55/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0489 - accuracy: 0.8852
Epoch 56/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0486 - accuracy: 0.8852
Epoch 57/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0482 - accuracy: 0.8689
Epoch 58/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0473 - accuracy: 0.8197
Epoch 59/700
8/8 [==============================] - 0s 17ms/step - loss: 0.0468 - accuracy: 0.8689
Epoch 60/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0460 - accuracy: 0.8689
Epoch 61/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0449 - accuracy: 0.8852
Epoch 62/700
8/8 [==============================] - 0s 17ms/step - loss: 0.0439 - accuracy: 0.8852
Epoch 63/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0435 - accuracy: 0.8525
Epoch 64/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0426 - accuracy: 0.8852
Epoch 65/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0426 - accuracy: 0.8852
Epoch 66/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0417 - accuracy: 0.8852
Epoch 67/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0408 - accuracy: 0.8852
Epoch 68/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0398 - accuracy: 0.8852
Epoch 69/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0396 - accuracy: 0.8852
Epoch 70/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0386 - accuracy: 0.8852
Epoch 71/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0380 - accuracy: 0.8852
Epoch 72/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0375 - accuracy: 0.8852
Epoch 73/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0368 - accuracy: 0.8852
Epoch 74/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0360 - accuracy: 0.8852
Epoch 75/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0352 - accuracy: 0.8689
Epoch 76/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0375 - accuracy: 0.8852
Epoch 77/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0371 - accuracy: 0.8689
Epoch 78/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0358 - accuracy: 0.8852
Epoch 79/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0344 - accuracy: 0.8852
Epoch 80/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0342 - accuracy: 0.8852
Epoch 81/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0363 - accuracy: 0.8852
Epoch 82/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0348 - accuracy: 0.8852
Epoch 83/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0329 - accuracy: 0.8689
Epoch 84/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0350 - accuracy: 0.8852
Epoch 85/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0339 - accuracy: 0.8852
Epoch 86/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0337 - accuracy: 0.8689
Epoch 87/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0326 - accuracy: 0.8689
Epoch 88/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0326 - accuracy: 0.8525
Epoch 89/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0315 - accuracy: 0.8689
Epoch 90/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0320 - accuracy: 0.8689
Epoch 91/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0314 - accuracy: 0.8525
Epoch 92/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0309 - accuracy: 0.8689
Epoch 93/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0307 - accuracy: 0.8689
Epoch 94/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0299 - accuracy: 0.8689
Epoch 95/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0318 - accuracy: 0.8361
Epoch 96/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0317 - accuracy: 0.8689
Epoch 97/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0310 - accuracy: 0.8852
Epoch 98/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0326 - accuracy: 0.8689
Epoch 99/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0317 - accuracy: 0.8361
Epoch 100/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0310 - accuracy: 0.8525
Epoch 101/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0310 - accuracy: 0.8689
Epoch 102/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0302 - accuracy: 0.8525
Epoch 103/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0296 - accuracy: 0.8689
Epoch 104/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0290 - accuracy: 0.8689
Epoch 105/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0287 - accuracy: 0.8852
Epoch 106/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0297 - accuracy: 0.8689
Epoch 107/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0289 - accuracy: 0.8852
Epoch 108/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0286 - accuracy: 0.8689
Epoch 109/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0276 - accuracy: 0.8689
Epoch 110/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0280 - accuracy: 0.8689
Epoch 111/700
8/8 [==============================] - 0s 7ms/step - loss: 0.0276 - accuracy: 0.8689
Epoch 112/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0276 - accuracy: 0.8689
Epoch 113/700
8/8 [==============================] - 0s 7ms/step - loss: 0.0282 - accuracy: 0.8852
Epoch 114/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0287 - accuracy: 0.8689
Epoch 115/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0288 - accuracy: 0.8852
Epoch 116/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0281 - accuracy: 0.8852
Epoch 117/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0281 - accuracy: 0.8852
Epoch 118/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0287 - accuracy: 0.8852
Epoch 119/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0288 - accuracy: 0.8689
Epoch 120/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0274 - accuracy: 0.8689
Epoch 121/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0284 - accuracy: 0.7869
Epoch 122/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0278 - accuracy: 0.8689
Epoch 123/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0281 - accuracy: 0.8689
Epoch 124/700
8/8 [==============================] - 0s 13ms/step - loss: 0.0268 - accuracy: 0.8852
Epoch 125/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0262 - accuracy: 0.8689
Epoch 126/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0268 - accuracy: 0.8689
Epoch 127/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0263 - accuracy: 0.8689
Epoch 128/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0259 - accuracy: 0.8689
Epoch 129/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0257 - accuracy: 0.8689
Epoch 130/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0257 - accuracy: 0.8689
Epoch 131/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0256 - accuracy: 0.8689
Epoch 132/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0256 - accuracy: 0.8689
Epoch 133/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0255 - accuracy: 0.8689
Epoch 134/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0253 - accuracy: 0.8689
Epoch 135/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0257 - accuracy: 0.8852
Epoch 136/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0255 - accuracy: 0.8852
Epoch 137/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0253 - accuracy: 0.8689
Epoch 138/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0252 - accuracy: 0.8852
Epoch 139/700
8/8 [==============================] - 0s 7ms/step - loss: 0.0251 - accuracy: 0.8689
Epoch 140/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0250 - accuracy: 0.8689
Epoch 141/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0254 - accuracy: 0.8689
Epoch 142/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0254 - accuracy: 0.8689
Epoch 143/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0254 - accuracy: 0.8689
Epoch 144/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0254 - accuracy: 0.8689
Epoch 145/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0254 - accuracy: 0.8689
Epoch 146/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0252 - accuracy: 0.8689
Epoch 147/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0251 - accuracy: 0.8525
Epoch 148/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0255 - accuracy: 0.8852
Epoch 149/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0252 - accuracy: 0.8689
Epoch 150/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0248 - accuracy: 0.8689
Epoch 151/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0255 - accuracy: 0.8852
Epoch 152/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0245 - accuracy: 0.8689
Epoch 153/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0248 - accuracy: 0.8689
Epoch 154/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0246 - accuracy: 0.8689
Epoch 155/700
8/8 [==============================] - 0s 7ms/step - loss: 0.0247 - accuracy: 0.8689
Epoch 156/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0246 - accuracy: 0.8689
Epoch 157/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0247 - accuracy: 0.8689
Epoch 158/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0246 - accuracy: 0.8689
Epoch 159/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0247 - accuracy: 0.8689
Epoch 160/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0246 - accuracy: 0.8689
Epoch 161/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 162/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 163/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0243 - accuracy: 0.8689
Epoch 164/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 165/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0243 - accuracy: 0.8689
Epoch 166/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 167/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0243 - accuracy: 0.8689
Epoch 168/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 169/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 170/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 171/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 172/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 173/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 174/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 175/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 176/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 177/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 178/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 179/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 180/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 181/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 182/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 183/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 184/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 185/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 186/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 187/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 188/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 189/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 190/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 191/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 192/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 193/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 194/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 195/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 196/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 197/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 198/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 199/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 200/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 201/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 202/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 203/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 204/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 205/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 206/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 207/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 208/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 209/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 210/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 211/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 212/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 213/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 214/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 215/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 216/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 217/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 218/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 219/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 220/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 221/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 222/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 223/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 224/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 225/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 226/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 227/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 228/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 229/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 230/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 231/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 232/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 233/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 234/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 235/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 236/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 237/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 238/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 239/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 240/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 241/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 242/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 243/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 244/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 245/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 246/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 247/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 248/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 249/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 250/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 251/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 252/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 253/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 254/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 255/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 256/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 257/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 258/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 259/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 260/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 261/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 262/700
8/8 [==============================] - 0s 5ms/step - loss: 0.0244 - accuracy: 0.8689
Epoch 263/700
8/8 [==
```


ANN - Chashma Barrage Prediction
Discharge (Cusec)
325000
300000
275000
250000
225000
200000
175000
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Date
True Values
Predicted Values - R: 0.9893
Difference Between True and Predicted