```
## Rice forecasting and prediction:
# Data Loading
from google.colab import drive
import pandas as pd
drive.mount('/content/drive')
file_path = '/content/drive/My Drive/Rice.csv'
df = pd.read_csv(file_path)
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

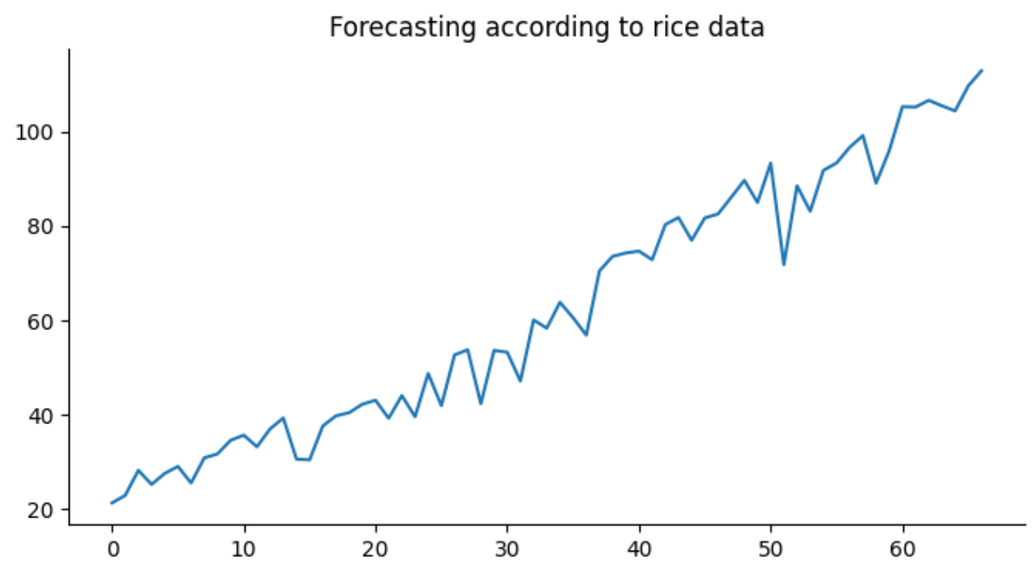
```
df.head()
df
```

| | Year | Area | Production | Yield | Area under Irrigation(%) |
|---|---|---|---|---|---|
| **0** | 1951-52 | 29.83 | 21.30 | 714 | 31.71 |
| **1** | 1952-53 | 29.97 | 22.90 | 764 | 32.3 |
| **2** | 1953-54 | 31.29 | 28.21 | 902 | 33.59 |
| **3** | 1954-55 | 30.77 | 25.22 | 820 | 34.41 |
| **4** | 1955-56 | 31.52 | 27.56 | 874 | 34.88 |
| **...** | ... | ... | ... | ... | ... |
| **62** | 2013-14 | 44.14 | 106.65 | 2416 | 59.65 |
| **63** | 2014-15 | 44.11 | 105.48 | 2391 | 60.09 |
| **64** | 2015-16 | 43.50 | 104.41 | 2400 | - |
| **65** | 2016-17 | 43.99 | 109.70 | 2494 | - |
| **66** | 2017-18* | 43.79 | 112.91 | 2578 | - |

67 rows × 5 columns

Next steps: Generate code with `df` View recommended plots

```
# Production

from matplotlib import pyplot as plt
df['Production'].plot(kind='line', figsize=(8, 4), title='Forecasting according to rice data')
plt.gca().spines[['top', 'right']].set_visible(False)
```




```
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler
from keras.models import Sequential
from keras.layers import LSTM, Dense
import numpy as np
```

```
# Keep only production column
df = df[['Production']]
```

```
# Convert to float
df['Production'] = df['Production'].astype(float)
```

```
<ipython-input-134-9cb8324ec63d>:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['Production'] = df['Production'].astype(float)
```

```
# Scale the data
scaler = MinMaxScaler()
df['Production'] = scaler.fit_transform(df[['Production']])
```

```
<ipython-input-135-7e51136ee59a>:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['Production'] = scaler.fit_transform(df[['Production']])
```

```
# Split data into train and test
train = df.loc[:'2010-11']
test = df.loc['2011-12':]
```

```
# Reshape for LSTM
X_train = train.values.reshape(-1,1)
X_test = test.values.reshape(-1,1)
```

```
# Build LSTM model
model = Sequential()
model.add(LSTM(80, activation='relu', input_shape=(1, 1)))
model.add(Dense(1))
model.compile(loss='mean_squared_error', optimizer='adam')
```

```
# Train model
model.fit(X_train, X_train, epochs=800, batch_size=1, verbose=0)
```

```
<keras.src.callbacks.History at 0x7d81623aee90>
```

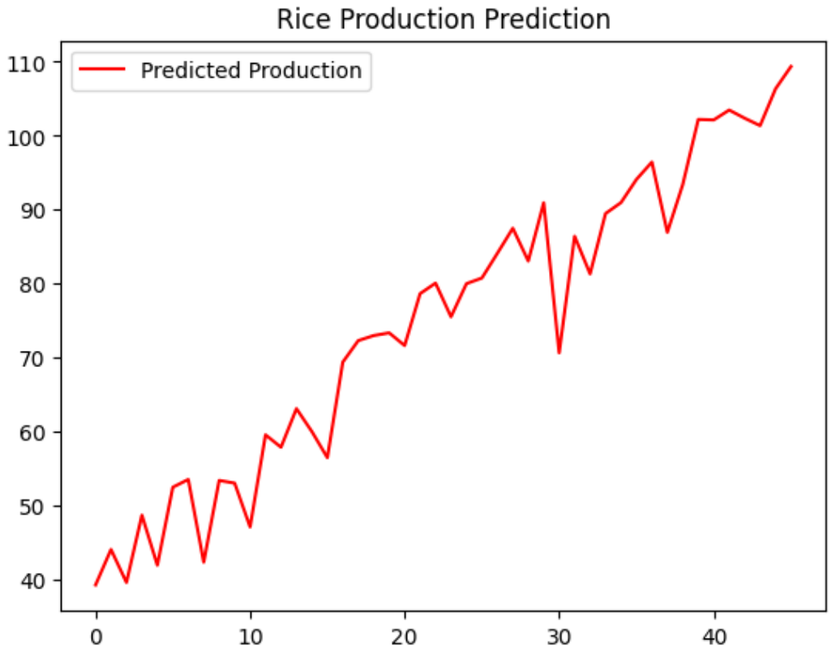
```
# Predict on test
pred = model.predict(X_test)
pred = scaler.inverse_transform(pred)
```

```
WARNING:tensorflow:5 out of the last 12 calls to <function Model.make_predict_function.<locals>.predict_function at 0x7d815f538ee0> triggered tf.function retracing. Tracing is expen
2/2 [==============================] - 0s 8ms/step
```

```
# Evaluate model
mae = mean_absolute_error(test, pred)
print("MAE:", mae)
```

```
MAE: 73.9452603438371
```

```
# Plot results
plt.plot(pred, color='red', label='Predicted Production')
plt.title('Rice Production Prediction')
plt.legend()
plt.show()
```




```
# Predict next 30 years
X_new = test.values[-30:].reshape(-1,1)
next_30_years = model.predict(X_new)
next_30_years = scaler.inverse_transform(next_30_years)
print(next_30_years)
```

```
1/1 [==============================] - 0s 22ms/step
[[ 69.37769 ]
 [ 72.285515]
 [ 72.964935]
 [ 73.332954]
 [ 71.61552 ]
 [ 78.635635]
 [ 80.0602  ]
 [ 75.503204]
 [ 79.98473 ]
 [ 80.74888 ]
 [ 84.08826 ]
 [ 87.4838  ]
 [ 83.05064 ]
 [ 90.93328 ]
 [ 70.63356 ]
 [ 86.399155]
 [ 81.30548 ]
 [ 89.47279 ]
 [ 90.952126]
 [ 94.08955 ]
 [ 96.435295]
 [ 86.92732 ]
 [ 93.42064 ]
 [102.19982 ]
 [102.13389 ]
 [103.47123 ]
 [102.36935 ]
 [101.361595]
 [106.34341 ]
 [109.36589 ]]
```

```
# Fit curve
x = np.arange(0, len(df))
y = df['Production'].values
p = np.polyfit(x, y, 4)
f = np.poly1d(p)
```

```
print(f) # Print equation
```

$$-1.148e{-}08\,x^4 - 1.014e{-}06\,x^3 + 0.0002617\,x^2 + 0.004356\,x + 0.04133$$

```
# Define the polynomial coefficients
a = -1.148e-08
b = - 1.014e-06
c = 0.0002617
d = 0.004356
e = 0.04133
# Profit calculation:
C= 1000     # for eg. taking cost price per production

# Evaluate the polynomial at certain value of x
x_val = 82.07022
polynomial_value = a * pow(x_val,4) + b * pow(x_val,3) + c * pow(x_val,2) + d * x_val + e
print("Polynomial value at x =", x_val, "is", polynomial_value)
print(C*polynomial_value) # profit eg
```

```
Polynomial value at x = 82.07022 is 1.0801730830662053
1080.1730830662052
```

```
# Data Loading
from google.colab import drive
import pandas as pd
drive.mount('/content/drive')
file_path = '/content/drive/My Drive/Wheat.csv'
df = pd.read_csv(file_path)
```

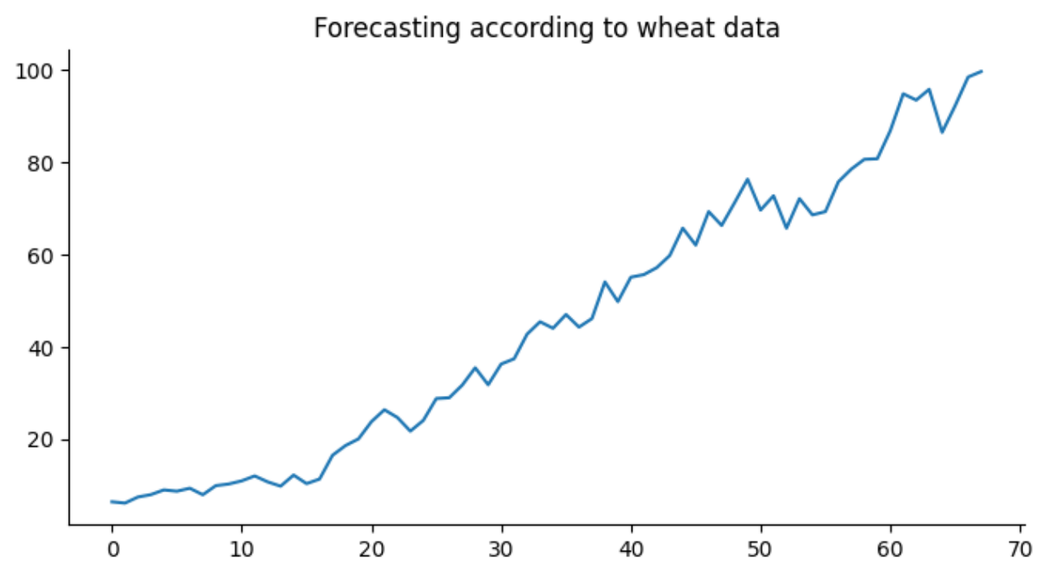
```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler
from sklearn.metrics import mean_absolute_error
from keras.models import Sequential
from keras.layers import LSTM, Dense
```

```
# Keep production column
df = df[['Production']]

# Convert to float
df['Production'] = df['Production'].astype(float)
```

```
<ipython-input-151-6252ce2f56da>:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df['Production'] = df['Production'].astype(float)
```

```
# Production

from matplotlib import pyplot as plt
df['Production'].plot(kind='line', figsize=(8, 4), title='Forecasting according to wheat data')
plt.gca().spines[['top', 'right']].set_visible(False)
```




```
# Scale data
scaler = MinMaxScaler()
scaled = scaler.fit_transform(df)
```

```
# Split data into train and test
train = df.loc[:'2010-11']
test = df.loc['2011-12':]
```

```
# Reshape for LSTM
X_train = train.values.reshape(-1,1)
X_test = test.values.reshape(-1,1)
```

```
# Build LSTM
model = Sequential()
model.add(LSTM(50, activation='relu', input_shape=(1, 1)))
model.add(Dense(1))
model.compile(loss='mse', optimizer='adam')
```

```
# Train model
model.fit(X_train, X_train, epochs=200, batch_size=1, verbose=0)
```

```
<keras.src.callbacks.History at 0x7d8160cd4ac0>
```

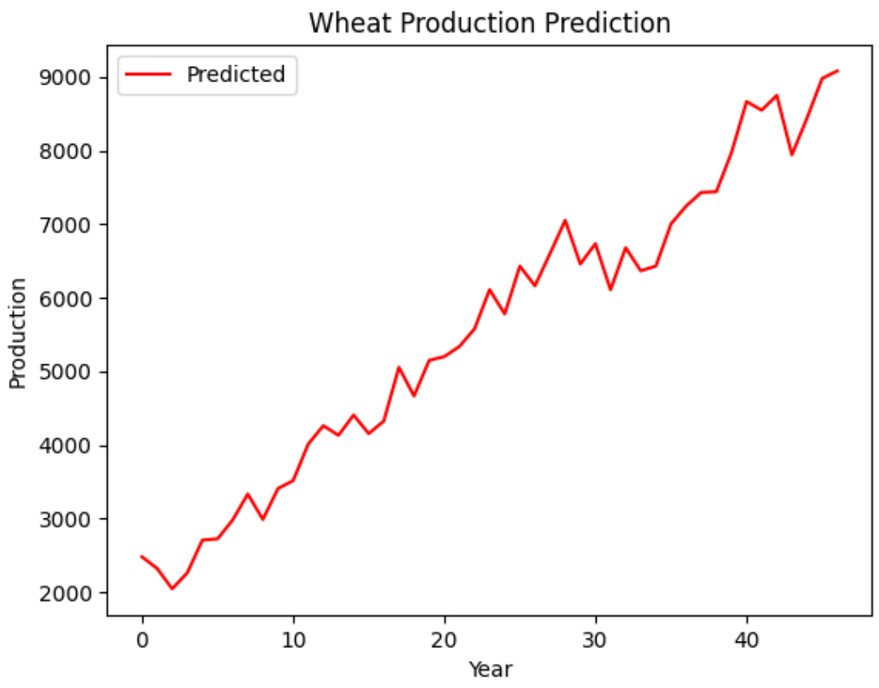
```
# Predict and rescale
pred = model.predict(X_test)
pred = scaler.inverse_transform(pred)
```

```
WARNING:tensorflow:5 out of the last 12 calls to <function Model.make_predict_function.<locals>.predict_function at 0x7d8160c92170> triggered tf.function retracing. Tracing is expen
2/2 [==============================] - 0s 5ms/step
```

```
# Evaluate model
mae = mean_absolute_error(test, pred)
print("MAE:", mae)
```

```
MAE: 5501.4996839677515
```

```
# Plot results
plt.plot(pred, color='red', label='Predicted')
plt.title('Wheat Production Prediction')
plt.xlabel('Year')
plt.ylabel('Production')
plt.legend()
plt.show()
```




```
# Prediction on 2024-2051 time frame
X_future = np.arange(2024,2051).reshape(-1,1)
X_future_poly = poly.fit_transform(X_future)
future_pred = model.predict(X_future_poly)
print(future_pred)
```

```
1/1 [==============================] - 0s 189ms/step
[[1.5649093e+13]
 [1.5680043e+13]
 [1.5711037e+13]
 [1.5742078e+13]
 [1.5773165e+13]
 [1.5804295e+13]
 [1.5835473e+13]
 [1.5866699e+13]
 [1.5897968e+13]
 [1.5929285e+13]
 [1.5960648e+13]
 [1.5992058e+13]
 [1.6023513e+13]
 [1.6055015e+13]
 [1.6086563e+13]
 [1.6118159e+13]
 [1.6149800e+13]
 [1.6181486e+13]
 [1.6213219e+13]
 [1.6245003e+13]
 [1.6276831e+13]
 [1.6308706e+13]
 [1.6340627e+13]
 [1.6372596e+13]
 [1.6404610e+13]
 [1.6436672e+13]
 [1.6468781e+13]]
```

```
# Fit curve
x = np.arange(0, len(df))
y = df['Production'].values
p = np.polyfit(x, y, 2)
f = np.poly1d(p)
```

```
print(f) # Print equation
```

```
             2
0.007956 x + 0.9395 x + 1.586
```

```
# Define the polynomial coefficients
a = 0.007956
b = 0.9395
c = 1.586
# Profit calculation:
C= 1000     # for eg. taking cost price per production

# Evaluate the polynomial at certain value of x
x_val = 1.9178593e+13
polynomial_value = a * pow(x_val,2) + b * x_val + c
print("Polynomial value at x =", x_val, "is", polynomial_value)
print(C*polynomial_value) # profit eg
```

```
Polynomial value at x = 19178593000000.0 is 2.9263634247989856e+24
2.926363424798986e+27
```