**Aim**

To predict future temperature trends in Williamtown using the NeuralProphet model.

**Objective**

- To preprocess historical weather data for Williamtown.
- To train a NeuralProphet model on the preprocessed data.
- To forecast future temperatures and visualize the predictions.

**Summary**

This project utilizes the NeuralProphet library to forecast temperatures based on historical weather data for Williamtown, Australia. The project involves data preprocessing, model training, and making future predictions. The results are visualized to assess the model's performance and the accuracy of the forecasts.

**Tools and Libraries Used**

- Google Colab
- Python
- pandas
- NeuralProphet
- Matplotlib
- pickle

**Procedure**

1. **Install and Import Libraries:**

CODE:

```
!pip install neuralprophet

import pandas as pd

from neuralprophet import NeuralProphet

from matplotlib import pyplot as plt

import pickle
```

2. **Load and Inspect Data:**

CODE:

```
df = pd.read_csv("/content/drive/MyDrive/weather daaset/weatherAUS.csv")

df.head()
```

```
df.Location.unique()
df.columns
```

3. **Filter Data for Williamtown:**

CODE:

```
melb = df[df['Location']=='Williamtown']
melb['Date'] = pd.to_datetime(melb['Date'])
melb.head()
plt.plot(melb['Date'], melb['Temp3pm'])
plt.show()
```

4. **Preprocess Data:**

CODE:

```
melb['Year'] = melb['Date'].apply(lambda x: x.year)
melb = melb[melb['Year']<=2015]
plt.plot(melb['Date'], melb['Temp3pm'])
plt.show()
data = melb[['Date', 'Temp3pm']]
data.dropna(inplace=True)
data.columns = ['ds', 'y']
data.head()
```

5. **Train the Model:**

CODE:

```
m = NeuralProphet()
model = m.fit(data, freq='D', epochs=1000)
```

6. **Make Future Predictions:**

CODE:

```
future = m.make_future_dataframe(data, periods=1200)
forecast = m.predict(future)
forecast.head()
plot1 = m.plot(forecast)
```

```
plt2 = m.plot_components(forecast)
```

7. **Save and Load Model:**

CODE:

```
with open('saved_model.pkl', "wb") as f:
  pickle.dump(m, f)
with open('saved_model.pkl', "rb") as f:
  m = pickle.load(f)
```

8. **Further Predictions:**

CODE:

```
future = m.make_future_dataframe(data, periods=900)
forecast = m.predict(future)
forecast.head()
plt.plot(forecast)
plt.show()
```

**Highlights**

- **NeuralProphet:** A powerful tool for time-series forecasting that extends Prophet with neural network components.
- **Data Preprocessing:** Ensuring data is clean and in the correct format (date as ds, target variable as y).
- **Model Training:** Fitting the NeuralProphet model with a substantial number of epochs (1000) to capture trends and seasonality.
- **Visualization:** Comprehensive plots to visualize the actual data, forecast, and components of the forecast.
- **Model Persistence:** Saving and loading the model using pickle for future use and further predictions.

**Conclusion**

The project successfully demonstrates the application of the NeuralProphet model to predict future temperature trends in Williamtown. By leveraging historical data, the model can make accurate forecasts, which are visualized for better understanding and assessment. The ability to save and load the model enhances its usability for continuous or repeated forecasting tasks.