Neural Prophet

September 10, 2022

1 0. Install and Import Dependencies

[1]:
```
!pip install neuralprophet
```

```
Requirement already satisfied: neuralprophet in /opt/conda/lib/python3.9/site-
packages (0.3.2)
Requirement already satisfied: torch-lr-finder>=0.2.1 in
/opt/conda/lib/python3.9/site-packages (from neuralprophet) (0.2.1)
Requirement already satisfied: numpy>=1.15.4 in /opt/conda/lib/python3.9/site-
packages (from neuralprophet) (1.23.3)
Requirement already satisfied: ipywidgets>=7.5.1 in
/opt/conda/lib/python3.9/site-packages (from neuralprophet) (7.6.3)
Requirement already satisfied: convertdate>=2.1.2 in
/opt/conda/lib/python3.9/site-packages (from neuralprophet) (2.4.0)
Requirement already satisfied: torch>=1.4.0 in /opt/conda/lib/python3.9/site-
packages (from neuralprophet) (1.12.1)
Requirement already satisfied: matplotlib>=2.0.0 in
/opt/conda/lib/python3.9/site-packages (from neuralprophet) (3.4.2)
Requirement already satisfied: tqdm>=4.50.2 in /opt/conda/lib/python3.9/site-
packages (from neuralprophet) (4.61.0)
Requirement already satisfied: dataclasses>=0.6 in
/opt/conda/lib/python3.9/site-packages (from neuralprophet) (0.6)
Requirement already satisfied: pandas>=1.0.4 in /opt/conda/lib/python3.9/site-
packages (from neuralprophet) (1.2.4)
Requirement already satisfied: python-dateutil>=2.8.0 in
/opt/conda/lib/python3.9/site-packages (from neuralprophet) (2.8.1)
Requirement already satisfied: LunarCalendar>=0.0.9 in
/opt/conda/lib/python3.9/site-packages (from neuralprophet) (0.0.9)
Requirement already satisfied: holidays>=0.11.3.1 in
/opt/conda/lib/python3.9/site-packages (from neuralprophet) (0.15)
Requirement already satisfied: pymeeus<=1,>=0.3.13 in
/opt/conda/lib/python3.9/site-packages (from convertdate>=2.1.2->neuralprophet)
(0.5.11)
Requirement already satisfied: korean-lunar-calendar in
/opt/conda/lib/python3.9/site-packages (from holidays>=0.11.3.1->neuralprophet)
(0.2.1)
Requirement already satisfied: hijri-converter in /opt/conda/lib/python3.9/site-
packages (from holidays>=0.11.3.1->neuralprophet) (2.2.4)
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Requirement already satisfied: ipykernel>=4.5.1 in
/opt/conda/lib/python3.9/site-packages (from ipywidgets>=7.5.1->neuralprophet)
(5.5.5)
Requirement already satisfied: jupyterlab-widgets>=1.0.0 in
/opt/conda/lib/python3.9/site-packages (from ipywidgets>=7.5.1->neuralprophet)
(1.0.0)
Requirement already satisfied: widgetsnbextension~=3.5.0 in
/opt/conda/lib/python3.9/site-packages (from ipywidgets>=7.5.1->neuralprophet)
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Requirement already satisfied: ipython>=4.0.0 in /opt/conda/lib/python3.9/site-
packages (from ipywidgets>=7.5.1->neuralprophet) (7.24.0)
Requirement already satisfied: traitlets>=4.3.1 in
/opt/conda/lib/python3.9/site-packages (from ipywidgets>=7.5.1->neuralprophet)
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Requirement already satisfied: nbformat>=4.2.0 in /opt/conda/lib/python3.9/site-
packages (from ipywidgets>=7.5.1->neuralprophet) (5.1.3)
Requirement already satisfied: jupyter-client in /opt/conda/lib/python3.9/site-
packages (from ipykernel>=4.5.1->ipywidgets>=7.5.1->neuralprophet) (6.1.12)
Requirement already satisfied: tornado>=4.2 in /opt/conda/lib/python3.9/site-
packages (from ipykernel>=4.5.1->ipywidgets>=7.5.1->neuralprophet) (6.1)
Requirement already satisfied: pickleshare in /opt/conda/lib/python3.9/site-
packages (from ipython>=4.0.0->ipywidgets>=7.5.1->neuralprophet) (0.7.5)
Requirement already satisfied: backcall in /opt/conda/lib/python3.9/site-
packages (from ipython>=4.0.0->ipywidgets>=7.5.1->neuralprophet) (0.2.0)
Requirement already satisfied: matplotlib-inline in
/opt/conda/lib/python3.9/site-packages (from
ipython>=4.0.0->ipywidgets>=7.5.1->neuralprophet) (0.1.2)
Requirement already satisfied: setuptools>=18.5 in
/opt/conda/lib/python3.9/site-packages (from
ipython>=4.0.0->ipywidgets>=7.5.1->neuralprophet) (49.6.0.post20210108)
Requirement already satisfied: pygments in /opt/conda/lib/python3.9/site-
packages (from ipython>=4.0.0->ipywidgets>=7.5.1->neuralprophet) (2.9.0)
Requirement already satisfied: prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0 in
/opt/conda/lib/python3.9/site-packages (from
ipython>=4.0.0->ipywidgets>=7.5.1->neuralprophet) (3.0.18)
Requirement already satisfied: pexpect>4.3 in /opt/conda/lib/python3.9/site-
packages (from ipython>=4.0.0->ipywidgets>=7.5.1->neuralprophet) (4.8.0)
Requirement already satisfied: jedi>=0.16 in /opt/conda/lib/python3.9/site-
packages (from ipython>=4.0.0->ipywidgets>=7.5.1->neuralprophet) (0.18.0)
Requirement already satisfied: decorator in /opt/conda/lib/python3.9/site-
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Requirement already satisfied: parso<0.9.0,>=0.8.0 in
/opt/conda/lib/python3.9/site-packages (from
jedi>=0.16->ipython>=4.0.0->ipywidgets>=7.5.1->neuralprophet) (0.8.2)
Requirement already satisfied: pytz in /opt/conda/lib/python3.9/site-packages
(from LunarCalendar>=0.0.9->neuralprophet) (2021.1)
Requirement already satisfied: ephem>=3.7.5.3 in /opt/conda/lib/python3.9/site-
packages (from LunarCalendar>=0.0.9->neuralprophet) (4.1.3)
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Requirement already satisfied: pyparsing>=2.2.1 in
/opt/conda/lib/python3.9/site-packages (from matplotlib>=2.0.0->neuralprophet)
(2.4.7)
Requirement already satisfied: cycler>=0.10 in /opt/conda/lib/python3.9/site-
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Requirement already satisfied: pillow>=6.2.0 in /opt/conda/lib/python3.9/site-
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Requirement already satisfied: kiwisolver>=1.0.1 in
/opt/conda/lib/python3.9/site-packages (from matplotlib>=2.0.0->neuralprophet)
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Requirement already satisfied: six in /opt/conda/lib/python3.9/site-packages
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Requirement already satisfied: ipython-genutils in
/opt/conda/lib/python3.9/site-packages (from
nbformat>=4.2.0->ipywidgets>=7.5.1->neuralprophet) (0.2.0)
Requirement already satisfied: jsonschema!=2.5.0,>=2.4 in
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nbformat>=4.2.0->ipywidgets>=7.5.1->neuralprophet) (3.2.0)
Requirement already satisfied: jupyter-core in /opt/conda/lib/python3.9/site-
packages (from nbformat>=4.2.0->ipywidgets>=7.5.1->neuralprophet) (4.7.1)
Requirement already satisfied: attrs>=17.4.0 in /opt/conda/lib/python3.9/site-
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jsonschema!=2.5.0,>=2.4->nbformat>=4.2.0->ipywidgets>=7.5.1->neuralprophet)
(21.2.0)
Requirement already satisfied: pyrsistent>=0.14.0 in
/opt/conda/lib/python3.9/site-packages (from
jsonschema!=2.5.0,>=2.4->nbformat>=4.2.0->ipywidgets>=7.5.1->neuralprophet)
(0.17.3)
Requirement already satisfied: ptyprocess>=0.5 in /opt/conda/lib/python3.9/site-
packages (from pexpect>4.3->ipython>=4.0.0->ipywidgets>=7.5.1->neuralprophet)
(0.7.0)
Requirement already satisfied: wcwidth in /opt/conda/lib/python3.9/site-packages
(from prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0->ipython>=4.0.0->ipywidgets>=
7.5.1->neuralprophet) (0.2.5)
Requirement already satisfied: typing-extensions in
/opt/conda/lib/python3.9/site-packages (from torch>=1.4.0->neuralprophet)
(4.3.0)
Requirement already satisfied: packaging in /opt/conda/lib/python3.9/site-
packages (from torch-lr-finder>=0.2.1->neuralprophet) (21.3)
Requirement already satisfied: notebook>=4.4.1 in /opt/conda/lib/python3.9/site-
packages (from widgetsnbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet)
(6.4.0)
Requirement already satisfied: pyzmq>=17 in /opt/conda/lib/python3.9/site-
packages (from
notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet)
(22.1.0)
Requirement already satisfied: argon2-cffi in /opt/conda/lib/python3.9/site-
packages (from
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notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet)
(20.1.0)
Requirement already satisfied: nbconvert in /opt/conda/lib/python3.9/site-
packages (from
notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet)
(6.0.7)
Requirement already satisfied: terminado>=0.8.3 in
/opt/conda/lib/python3.9/site-packages (from
notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet)
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Requirement already satisfied: jinja2 in /opt/conda/lib/python3.9/site-packages
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(3.0.1)
Requirement already satisfied: Send2Trash>=1.5.0 in
/opt/conda/lib/python3.9/site-packages (from
notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet)
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Requirement already satisfied: prometheus-client in
/opt/conda/lib/python3.9/site-packages (from
notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet)
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Requirement already satisfied: cffi>=1.0.0 in /opt/conda/lib/python3.9/site-
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ts>=7.5.1->neuralprophet) (1.14.5)
Requirement already satisfied: pycparser in /opt/conda/lib/python3.9/site-
packages (from cffi>=1.0.0->argon2-cffi->notebook>=4.4.1->widgetsnbextension~=3.
5.0->ipywidgets>=7.5.1->neuralprophet) (2.20)
Requirement already satisfied: MarkupSafe>=2.0 in /opt/conda/lib/python3.9/site-
packages (from jinja2->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7
.5.1->neuralprophet) (2.1.1)
Requirement already satisfied: entrypoints>=0.2.2 in
/opt/conda/lib/python3.9/site-packages (from nbconvert->notebook>=4.4.1->widgets
nbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet) (0.3)
Requirement already satisfied: pandocfilters>=1.4.1 in
/opt/conda/lib/python3.9/site-packages (from nbconvert->notebook>=4.4.1->widgets
nbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet) (1.4.2)
Requirement already satisfied: jupyterlab-pygments in
/opt/conda/lib/python3.9/site-packages (from nbconvert->notebook>=4.4.1->widgets
nbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet) (0.1.2)
Requirement already satisfied: bleach in /opt/conda/lib/python3.9/site-packages
(from nbconvert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets>=7.5.1->
neuralprophet) (3.3.0)
Requirement already satisfied: nbclient<0.6.0,>=0.5.0 in
/opt/conda/lib/python3.9/site-packages (from nbconvert->notebook>=4.4.1->widgets
nbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet) (0.5.3)
Requirement already satisfied: testpath in /opt/conda/lib/python3.9/site-
packages (from nbconvert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets
```

```
>=7.5.1->neuralprophet) (0.5.0)
Requirement already satisfied: defusedxml in /opt/conda/lib/python3.9/site-
packages (from nbconvert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets
>=7.5.1->neuralprophet) (0.7.1)
Requirement already satisfied: mistune<2,>=0.8.1 in
/opt/conda/lib/python3.9/site-packages (from nbconvert->notebook>=4.4.1->widgets
nbextension~=3.5.0->ipywidgets>=7.5.1->neuralprophet) (0.8.4)
Requirement already satisfied: nest-asyncio in /opt/conda/lib/python3.9/site-
packages (from nbclient<0.6.0,>=0.5.0->nbconvert->notebook>=4.4.1->widgetsnbexte
nsion~=3.5.0->ipywidgets>=7.5.1->neuralprophet) (1.5.1)
Requirement already satisfied: async-generator in /opt/conda/lib/python3.9/site-
packages (from nbclient<0.6.0,>=0.5.0->nbconvert->notebook>=4.4.1->widgetsnbexte
nsion~=3.5.0->ipywidgets>=7.5.1->neuralprophet) (1.10)
Requirement already satisfied: webencodings in /opt/conda/lib/python3.9/site-
packages (from bleach->nbconvert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ip
ywidgets>=7.5.1->neuralprophet) (0.5.1)
```

[2]:
```
# https://www.kaggle.com/jsphyg/weather-dataset-rattle-package
```

[3]:
```
import pandas as pd
from neuralprophet import NeuralProphet
from matplotlib import pyplot as plt
import pickle
```

2 1. Read in Data and Process Dates

[4]:
```
df = pd.read_csv('weatherAUS.csv')
df.head()
```

[4]:

	Date	Location	MinTemp	MaxTemp	Rainfall	Evaporation	Sunshine	\
0	2008-12-01	Albury	13.4	22.9	0.6	NaN	NaN	
1	2008-12-02	Albury	7.4	25.1	0.0	NaN	NaN	
2	2008-12-03	Albury	12.9	25.7	0.0	NaN	NaN	
3	2008-12-04	Albury	9.2	28.0	0.0	NaN	NaN	
4	2008-12-05	Albury	17.5	32.3	1.0	NaN	NaN	

	WindGustDir	WindGustSpeed	WindDir9am	…	Humidity9am	Humidity3pm	\
0	W	44.0	W	…	71.0	22.0	
1	WNW	44.0	NNW	…	44.0	25.0	
2	WSW	46.0	W	…	38.0	30.0	
3	NE	24.0	SE	…	45.0	16.0	
4	W	41.0	ENE	…	82.0	33.0	

	Pressure9am	Pressure3pm	Cloud9am	Cloud3pm	Temp9am	Temp3pm	RainToday	\
0	1007.7	1007.1	8.0	NaN	16.9	21.8	No	
1	1010.6	1007.8	NaN	NaN	17.2	24.3	No	

```
2       1007.6       1008.7       NaN       2.0      21.0      23.2          No
3       1017.6       1012.8       NaN       NaN      18.1      26.5          No
4       1010.8       1006.0       7.0       8.0      17.8      29.7          No

   RainTomorrow
0            No
1            No
2            No
3            No
4            No

[5 rows x 23 columns]
```

[5]:
```
df.Location.unique()
```

[5]:
```
array(['Albury', 'BadgerysCreek', 'Cobar', 'CoffsHarbour', 'Moree',
       'Newcastle', 'NorahHead', 'NorfolkIsland', 'Penrith', 'Richmond',
       'Sydney', 'SydneyAirport', 'WaggaWagga', 'Williamtown',
       'Wollongong', 'Canberra', 'Tuggeranong', 'MountGinini', 'Ballarat',
       'Bendigo', 'Sale', 'MelbourneAirport', 'Melbourne', 'Mildura',
       'Nhil', 'Portland', 'Watsonia', 'Dartmoor', 'Brisbane', 'Cairns',
       'GoldCoast', 'Townsville', 'Adelaide', 'MountGambier', 'Nuriootpa',
       'Woomera', 'Albany', 'Witchcliffe', 'PearceRAAF', 'PerthAirport',
       'Perth', 'SalmonGums', 'Walpole', 'Hobart', 'Launceston',
       'AliceSprings', 'Darwin', 'Katherine', 'Uluru'], dtype=object)
```

[6]:
```
df.columns
```

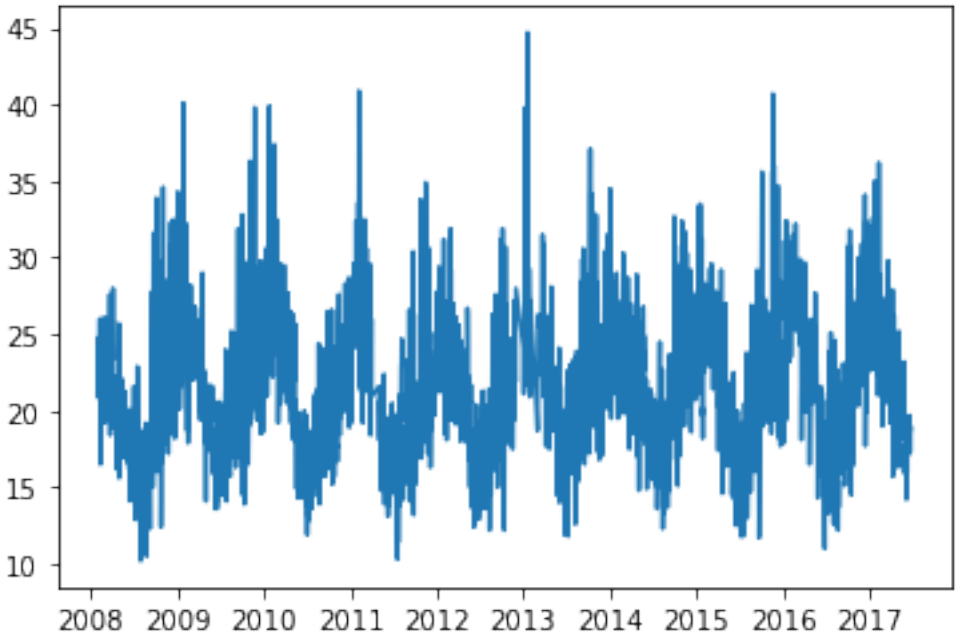
[6]:
```
Index(['Date', 'Location', 'MinTemp', 'MaxTemp', 'Rainfall', 'Evaporation',
       'Sunshine', 'WindGustDir', 'WindGustSpeed', 'WindDir9am', 'WindDir3pm',
       'WindSpeed9am', 'WindSpeed3pm', 'Humidity9am', 'Humidity3pm',
       'Pressure9am', 'Pressure3pm', 'Cloud9am', 'Cloud3pm', 'Temp9am',
       'Temp3pm', 'RainToday', 'RainTomorrow'],
      dtype='object')
```

[7]:
```
syd = df[df['Location']=='Sydney']
syd['Date'] = pd.to_datetime(syd['Date'])
syd.head()
```

```
WARNING - (py.warnings._showwarnmsg) - <ipython-input-7-1a4ae1fbd3d1>: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
  syd['Date'] = pd.to_datetime(syd['Date'])
```

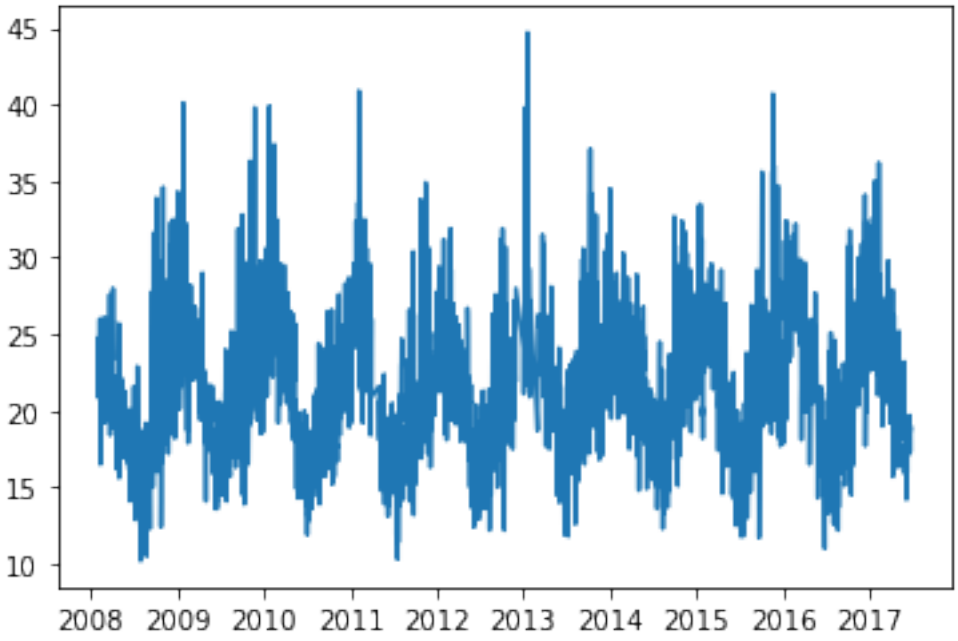
[7]:
```
            Date Location  MinTemp  MaxTemp  Rainfall  Evaporation  Sunshine  \
30176 2008-02-01   Sydney     19.5     22.4      15.6          6.2       0.0
30177 2008-02-02   Sydney     19.5     25.6       6.0          3.4       2.7
30178 2008-02-03   Sydney     21.6     24.5       6.6          2.4       0.1
30179 2008-02-04   Sydney     20.2     22.8      18.8          2.2       0.0
30180 2008-02-05   Sydney     19.7     25.7      77.4          NaN       0.0

      WindGustDir  WindGustSpeed WindDir9am  … Humidity9am  Humidity3pm  \
30176         NaN            NaN          S  …        92.0         84.0
30177         NaN            NaN          W  …        83.0         73.0
30178         NaN            NaN        ESE  …        88.0         86.0
30179         NaN            NaN        NNE  …        83.0         90.0
30180         NaN            NaN        NNE  …        88.0         74.0

       Pressure9am  Pressure3pm  Cloud9am  Cloud3pm  Temp9am  Temp3pm  \
30176       1017.6       1017.4       8.0       8.0     20.7     20.9
30177       1017.9       1016.4       7.0       7.0     22.4     24.8
30178       1016.7       1015.6       7.0       8.0     23.5     23.0
30179       1014.2       1011.8       8.0       8.0     21.4     20.9
30180       1008.3       1004.8       8.0       8.0     22.5     25.5

       RainToday  RainTomorrow
30176        Yes           Yes
30177        Yes           Yes
30178        Yes           Yes
30179        Yes           Yes
30180        Yes           Yes

[5 rows x 23 columns]
```

[8]:
```
plt.plot(syd['Date'], syd['Temp3pm'])
plt.show()
```



[9]:
```
syd['Year'] = syd['Date'].apply(lambda x: x.year)
syd = syd[syd['Year']<=2018]
plt.plot(syd['Date'], syd['Temp3pm'])
plt.show()
```

```
WARNING - (py.warnings._showwarnmsg) - <ipython-input-9-71b453e3ed51>:1:
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
  syd['Year'] = syd['Date'].apply(lambda x: x.year)
```



[10]:
```
data = syd[['Date', 'Temp3pm']]
data.dropna(inplace=True)
data.columns = ['ds', 'y']
data.head()
```

```
WARNING - (py.warnings._showwarnmsg) - <ipython-input-10-74b34f345573>:2:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data.dropna(inplace=True)
```

[10]:

	ds	y
30176	2008-02-01	20.9
30177	2008-02-02	24.8
30178	2008-02-03	23.0
30179	2008-02-04	20.9
30180	2008-02-05	25.5

[11]:
```
data
```

[11]:

	ds	y
30176	2008-02-01	20.9
30177	2008-02-02	24.8

```
30178 2008-02-03  23.0
30179 2008-02-04  20.9
30180 2008-02-05  25.5
…           …    …
33515 2017-06-21  17.9
33516 2017-06-22  18.7
33517 2017-06-23  17.3
33518 2017-06-24  19.0
33519 2017-06-25  18.8

[3340 rows x 2 columns]
```

3 2. Train Model

[12]:
```
m = NeuralProphet()
```

[13]:
```
?m.fit
```

```
Signature: m.fit(df, freq='auto', validation_df=None, progress='bar',␣
 ↪minimal=False)
Docstring:
Train, and potentially evaluate model.

Parameters
----------
    df : pd.DataFrame, dict
        containing column ``ds``, ``y`` with all data
    freq : str
        Data step sizes. Frequency of data recording,

        Note
        ----
        Any valid frequency for pd.date_range, such as ``5min``, ``D``, ``MS``␣
 ↪or ``auto`` (default) to automatically set frequency.
    validation_df : pd.DataFrame, dict
        if provided, model with performance  will be evaluated after each␣
 ↪training epoch over this data.
    epochs : int
        number of epochs to train (overrides default setting).
        default: if not specified, uses self.epochs
    progress : str
        Method of progress display

        Options
            * (default) ``bar`` display updating progress bar (tqdm)
            * ``print`` print out progress (fallback option)
```

```
            * ``plot`` plot a live updating graph of the training loss, requires␣
↪[live] install or livelossplot package installed.
            * ``plot-all`` extended to all recorded metrics.
    minimal : bool
        whether to train without any printouts or metrics collection

Returns
-------
    pd.DataFrame
        metrics with training and potentially evaluation metrics
File:       /opt/conda/lib/python3.9/site-packages/neuralprophet/forecaster.py
Type:       method
```

[14]:
```
model = m.fit(data, freq='D')

#, epochs=1000 -- throwing error
```

```
INFO - (NP.df_utils._infer_frequency) - Major frequency D corresponds to 99.76%
of the data.
INFO - (NP.df_utils._infer_frequency) - Defined frequency is equal to major
frequency - D
INFO - (NP.config.init_data_params) - Setting normalization to global as only
one dataframe provided for training.
INFO - (NP.utils.set_auto_seasonalities) - Disabling daily seasonality. Run
NeuralProphet with daily_seasonality=True to override this.
INFO - (NP.config.set_auto_batch_epoch) - Auto-set batch_size to 32
INFO - (NP.config.set_auto_batch_epoch) - Auto-set epochs to 137
  0%|          | 0/138 [00:00<?, ?it/s]
INFO - (NP.utils_torch.lr_range_test) - lr-range-test results: steep: 8.17E-02,
min: 1.07E+00
  0%|          | 0/138 [00:00<?, ?it/s]
INFO - (NP.utils_torch.lr_range_test) - lr-range-test results: steep: 8.17E-02,
min: 1.45E+00
INFO - (NP.forecaster._init_train_loader) - lr-range-test selected learning
rate: 8.74E-02
Epoch[137/137]: 100%|      | 137/137 [00:26<00:00,  5.22it/s,
SmoothL1Loss=0.0135, MAE=2.18, RMSE=2.94, RegLoss=0]
```

4 3. Forecast Away

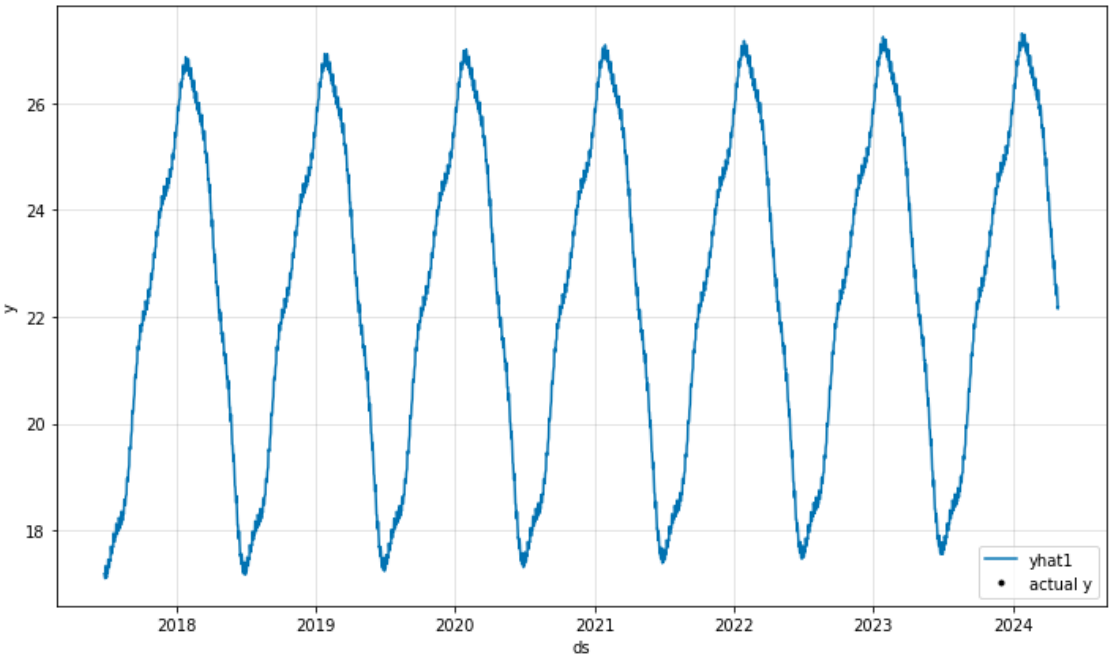
[15]:
```
future = m.make_future_dataframe(data, periods=2500)
forecast = m.predict(future)
forecast.head()
```

```
INFO - (NP.df_utils._infer_frequency) - Major frequency D corresponds to 99.76%
of the data.
INFO - (NP.df_utils._infer_frequency) - Defined frequency is equal to major
frequency - D
INFO - (NP.df_utils._infer_frequency) - Major frequency D corresponds to 99.96%
of the data.
INFO - (NP.df_utils._infer_frequency) - Defined frequency is equal to major
frequency - D
INFO - (NP.df_utils._infer_frequency) - Major frequency D corresponds to 99.96%
of the data.
INFO - (NP.df_utils._infer_frequency) - Defined frequency is equal to major
frequency - D
```

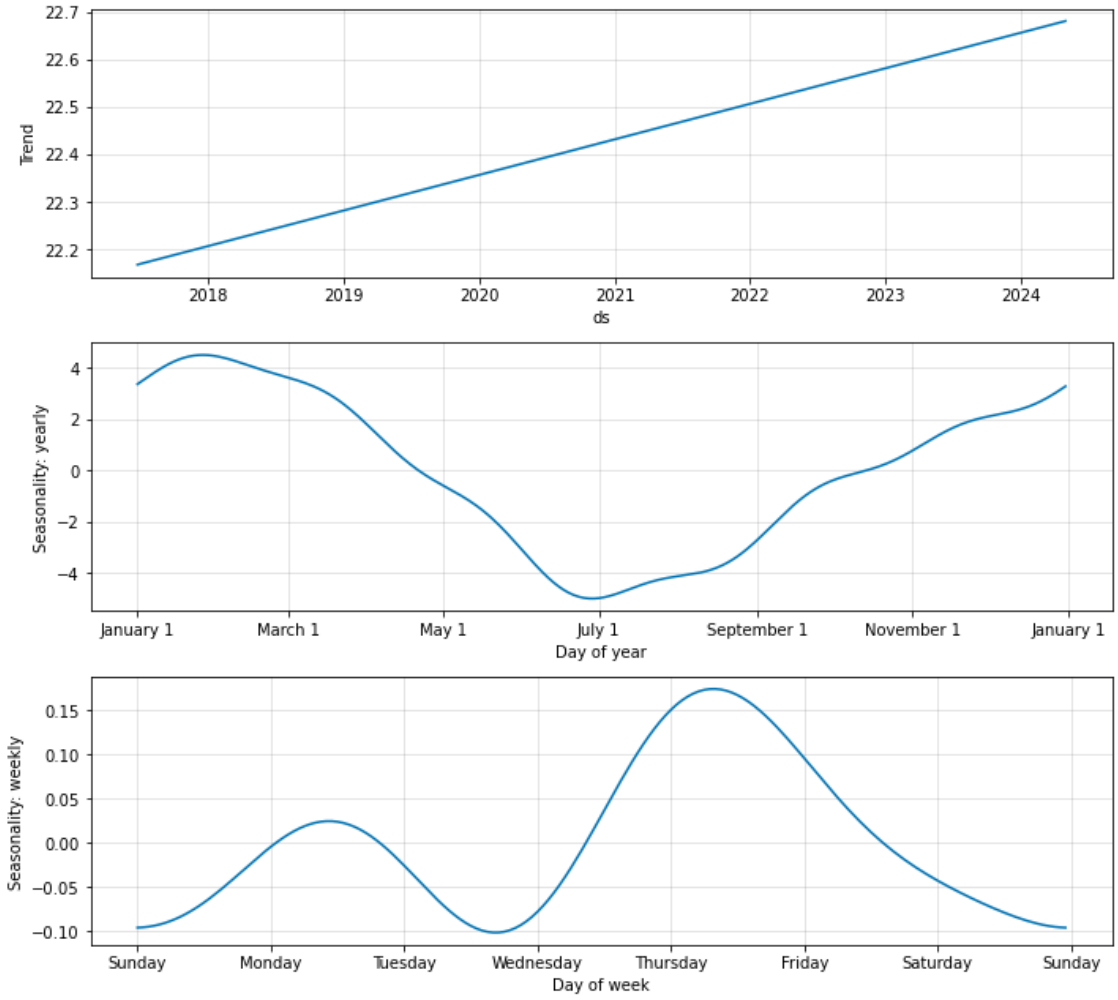
[15]:

	ds	y	yhat1	residual1	trend	season_yearly	season_weekly
0	2017-06-26	None	17.185152	NaN	22.167822	-4.978289	-0.004382
1	2017-06-27	None	17.154835	NaN	22.168026	-4.987507	-0.025686
2	2017-06-28	None	17.098808	NaN	22.168232	-4.991504	-0.077919
3	2017-06-29	None	17.328777	NaN	22.168438	-4.990499	0.150838
4	2017-06-30	None	17.279785	NaN	22.168642	-4.984741	0.095884

[16]:
```
plot1 = m.plot(forecast)
```



[17]:
```
plt2 = m.plot_components(forecast)
```



5 4. Save Model

[18]:
```
with open('saved_model.pkl', "wb") as f:
    pickle.dump(m, f)
```

[19]:
```
del m
```

[20]:
```
with open('saved_model.pkl', "rb") as f:
    m = pickle.load(f)
```

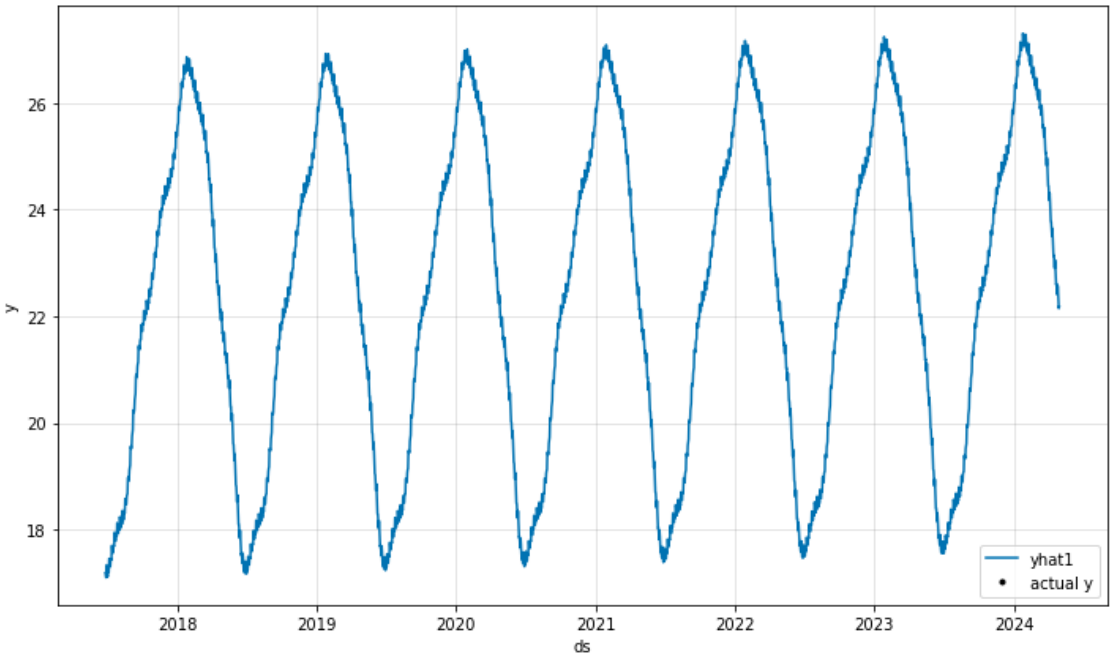
[21]:
```
future = m.make_future_dataframe(data, periods=2500)
forecast = m.predict(future)
forecast.head()
```

```
INFO - (NP.df_utils._infer_frequency) - Major frequency D corresponds to 99.76%
of the data.
INFO - (NP.df_utils._infer_frequency) - Defined frequency is equal to major
frequency - D
INFO - (NP.df_utils._infer_frequency) - Major frequency D corresponds to 99.96%
of the data.
INFO - (NP.df_utils._infer_frequency) - Defined frequency is equal to major
frequency - D
INFO - (NP.df_utils._infer_frequency) - Major frequency D corresponds to 99.96%
of the data.
INFO - (NP.df_utils._infer_frequency) - Defined frequency is equal to major
frequency - D
```

[21]:

	ds	y	yhat1	residual1	trend	season_yearly	season_weekly
0	2017-06-26	None	17.185152	NaN	22.167822	-4.978289	-0.004382
1	2017-06-27	None	17.154835	NaN	22.168026	-4.987507	-0.025686
2	2017-06-28	None	17.098808	NaN	22.168232	-4.991504	-0.077919
3	2017-06-29	None	17.328777	NaN	22.168438	-4.990499	0.150838
4	2017-06-30	None	17.279785	NaN	22.168642	-4.984741	0.095884

[22]:
```
plot1 = m.plot(forecast)
```



[23]:
```
forecast.to_csv("forecast.csv")
```