Load Packages

In [142…

```
# packages used in this tutorial
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.dates as mdates
import seaborn as sns
import joblib
```

Load CSVs

In [143…

```
ny = pd.read_csv(f'CSVafterClean2/ny_12.csv')
fl = pd.read_csv(f'CSVafterClean3/_12.csv')
```

Precipitation vs Time

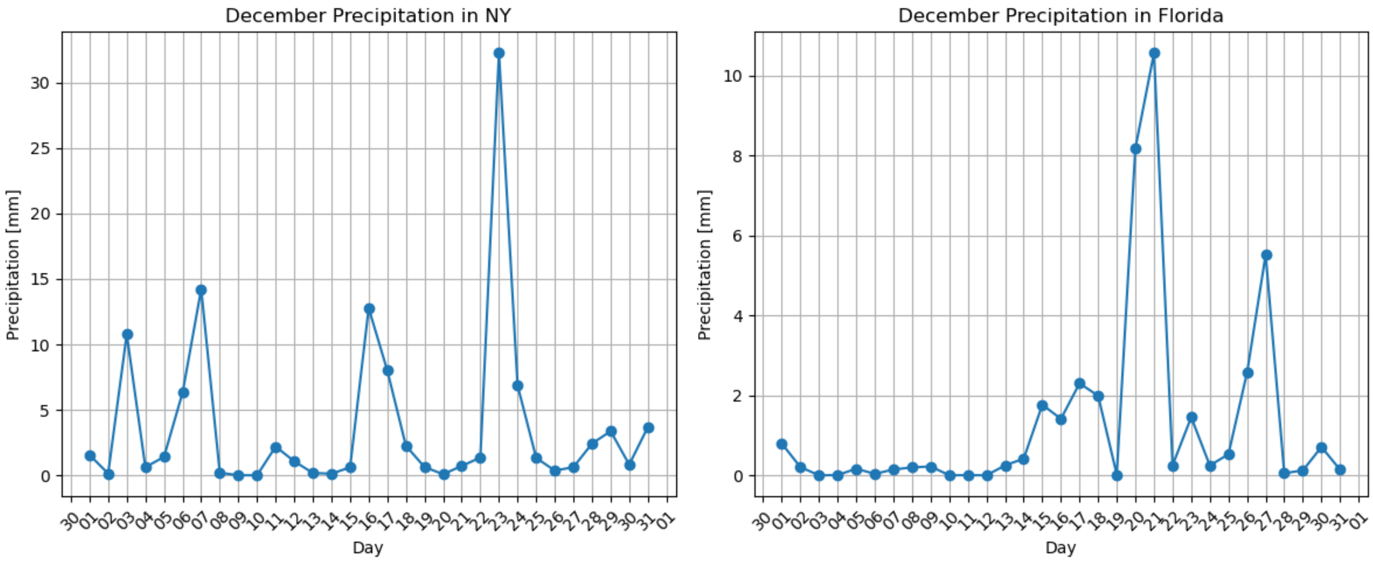
In [144…

```
#initialize dfs
ny_snip = ny
fl_snip = fl

# Convert 'time' column to datetime
ny_snip['time'] = pd.to_datetime(ny_snip['time'])
fl_snip['time'] = pd.to_datetime(fl_snip['time'])

# Group by date and calculate the average precipitation for each day
ny_snip = ny_snip.groupby(ny_snip['time'].dt.date)['prcp_total'].mean().reset_index()  #c
fl_snip = fl_snip.groupby(fl_snip['time'].dt.date)['prcp_total'].mean().reset_index()

#print('New York',ny_snip)
#print('Florida',fl_snip)
```

In [145…

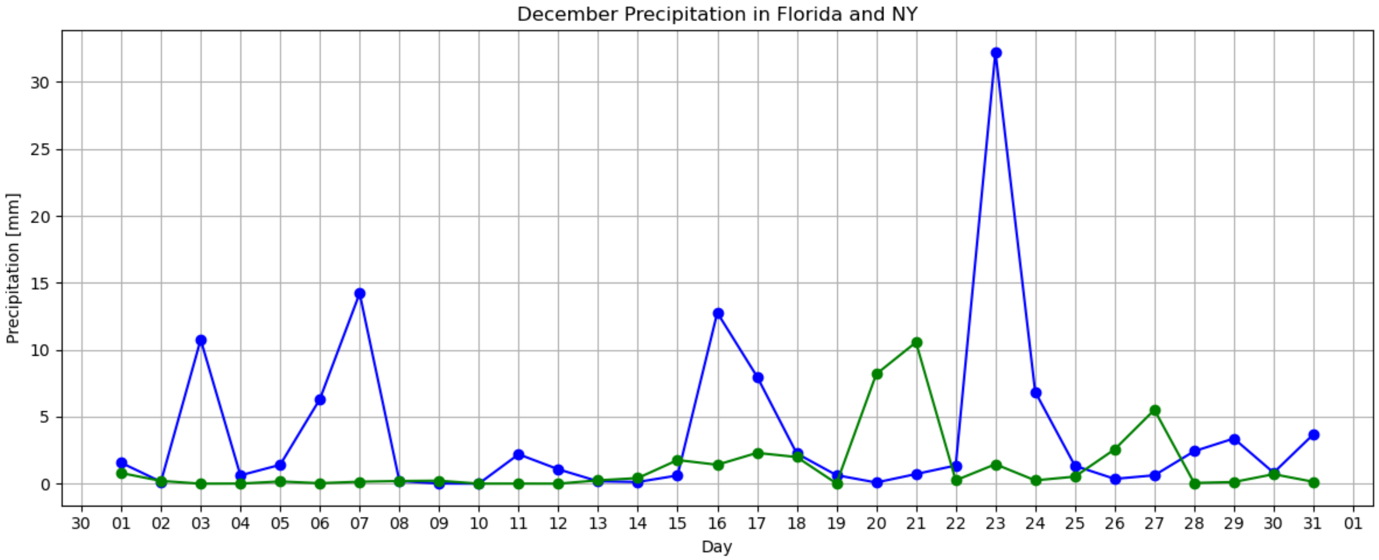
```
# Create subplots with two line graphs
plt.figure(figsize=(12, 5))  # Adjust the figure size as needed

plt.subplot(1, 2, 1)  # 1 row, 2 columns, subplot 1
plt.plot(ny_snip['time'], ny_snip['prcp_total'], marker='o', linestyle='-')
plt.xlabel('Day')
plt.ylabel('Precipitation [mm]')
plt.title('December Precipitation in NY')
plt.grid(True)

# Format the x-axis ticks to show one label per day
plt.xticks(rotation=45)  # Rotate x-axis labels for better visibility
# Format the x-axis ticks to show one label per month
plt.gca().xaxis.set_major_formatter(mdates.DateFormatter('%d'))
plt.gca().xaxis.set_major_locator(mdates.DayLocator(interval=1))  # Set tick interval to

plt.subplot(1, 2, 2)  # 1 row, 2 columns, subplot 2
plt.plot(fl_snip['time'], fl_snip['prcp_total'], marker='o', linestyle='-')
plt.xlabel('Day')
plt.ylabel('Precipitation [mm]')
plt.title('December Precipitation in Florida')
plt.grid(True)

# Format the x-axis ticks to show one label per day
plt.xticks(rotation=45)  # Rotate x-axis labels for better visibility
# Format the x-axis ticks to show one label per month
```

```
plt.gca().xaxis.set_major_formatter(mdates.DateFormatter('%d'))
plt.gca().xaxis.set_major_locator(mdates.DayLocator(interval=1))  # Set tick interval to

plt.tight_layout()  # Adjust spacing between subplots
plt.show()
```



In [146…

```
# Create subplots with two line graphs
plt.figure(figsize=(12, 5))  # Adjust the figure size as needed

plt.plot(ny_snip['time'], ny_snip['prcp_total'], color = 'b', marker='o', linestyle='-')
plt.xlabel('Day')
plt.ylabel('Precipitation [mm]')
plt.title('December Precipitation in NY')
plt.grid(True)

# Format the x-axis ticks to show one label per month
plt.gca().xaxis.set_major_formatter(mdates.DateFormatter('%d'))
plt.gca().xaxis.set_major_locator(mdates.DayLocator(interval=1))  # Set tick interval to

plt.plot(fl_snip['time'], fl_snip['prcp_total'], color = 'g', marker='o', linestyle='-')
plt.xlabel('Day')
plt.ylabel('Precipitation [mm]')
plt.title('December Precipitation in Florida and NY')
plt.grid(True)

# Format the x-axis ticks to show one label per month
plt.gca().xaxis.set_major_formatter(mdates.DateFormatter('%d'))
plt.gca().xaxis.set_major_locator(mdates.DayLocator(interval=1))  # Set tick interval to

plt.tight_layout()  # Adjust spacing between subplots
plt.show()
```

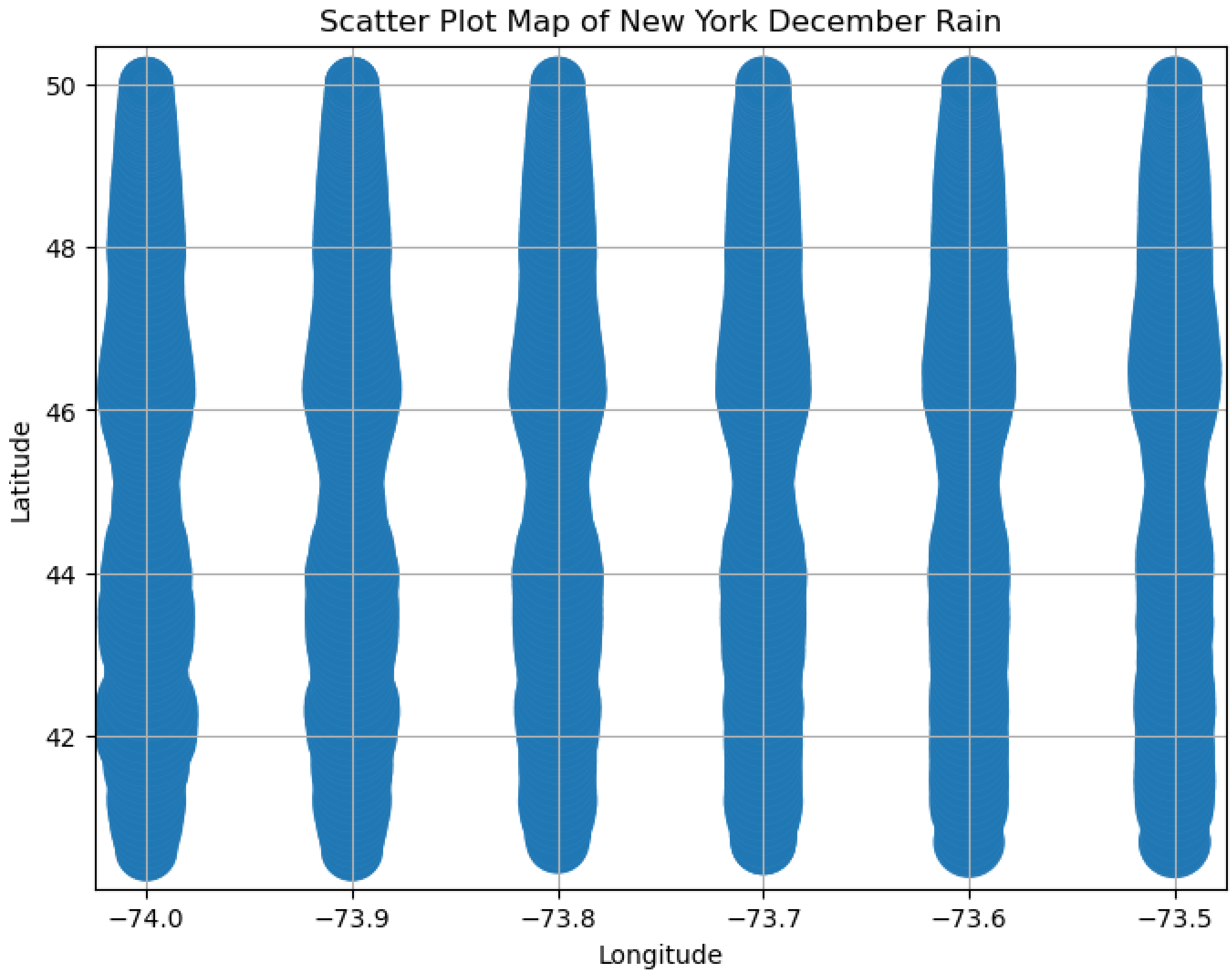


Spatial Distribution

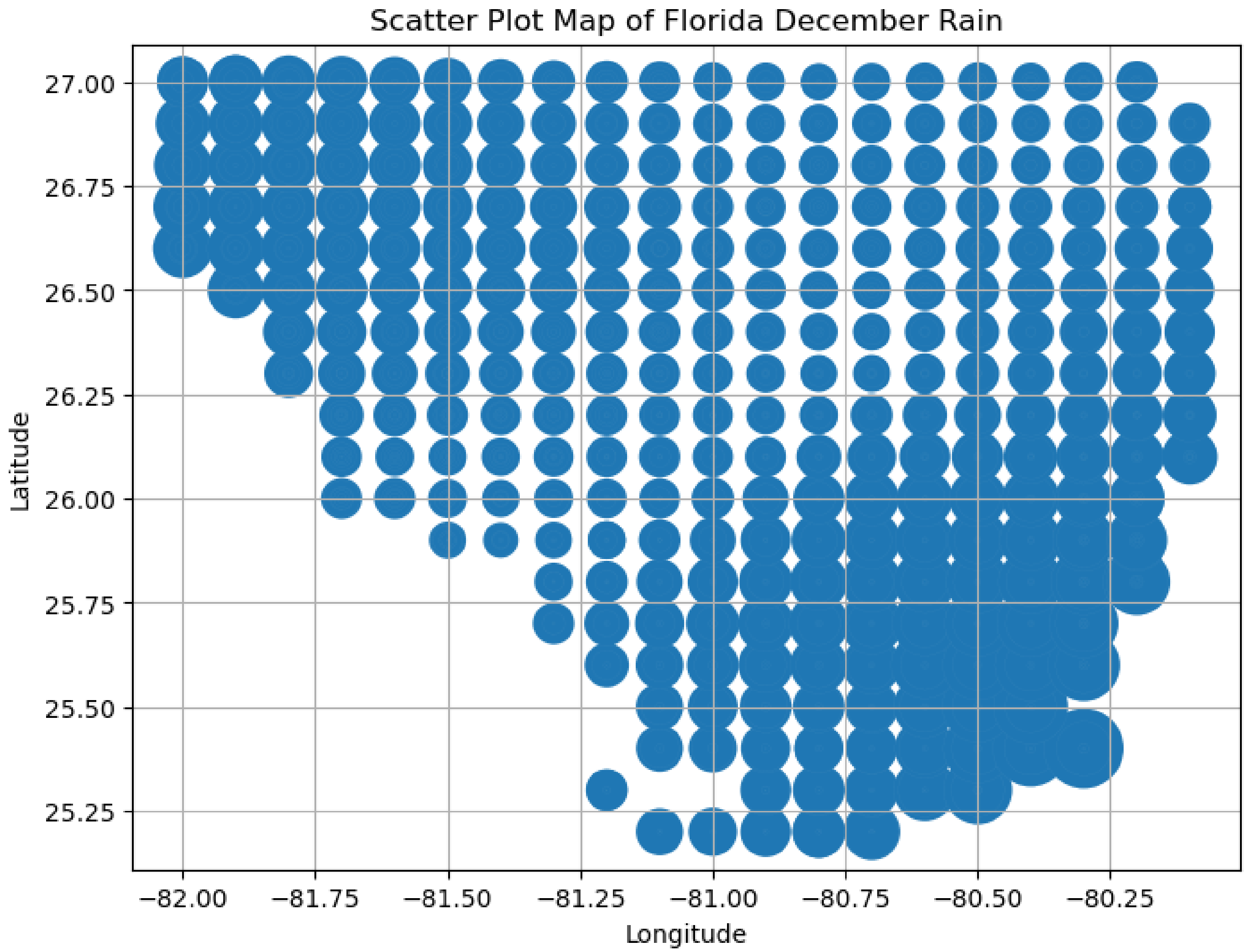
In [147…

```
locations = {'New York': ny, 'Florida': fl}

for location, df in locations.items():
    plt.figure(figsize=(8, 6))
    sns.scatterplot(x='lon', y='lat', data=df, marker='o', s=df['prcp_total']*30)
    plt.title(f"Scatter Plot Map of {location} December Rain")
    plt.xlabel("Longitude")
    plt.ylabel("Latitude")
    plt.grid(True)
    # Save the plot to a file (optional)
    # plt.savefig(f"CSVafterClean/map_prpc_{location}.png", dpi=300, bbox_inches='tight'
    # Show the plot (optional)
    plt.show()
```

```
C:\Users\yepesim\Anaconda3\envs\PakiMod\lib\site-packages\matplotlib\collections.py:981:
RuntimeWarning: invalid value encountered in sqrt
  scale = np.sqrt(self._sizes) * dpi / 72.0 * self._factor
C:\Users\yepesim\Anaconda3\envs\PakiMod\lib\site-packages\matplotlib\collections.py:981:
RuntimeWarning: invalid value encountered in sqrt
  scale = np.sqrt(self._sizes) * dpi / 72.0 * self._factor
```



```
C:\Users\yepesim\Anaconda3\envs\PakiMod\lib\site-packages\matplotlib\collections.py:981:
RuntimeWarning: invalid value encountered in sqrt
  scale = np.sqrt(self._sizes) * dpi / 72.0 * self._factor
C:\Users\yepesim\Anaconda3\envs\PakiMod\lib\site-packages\matplotlib\collections.py:981:
RuntimeWarning: invalid value encountered in sqrt
  scale = np.sqrt(self._sizes) * dpi / 72.0 * self._factor
```



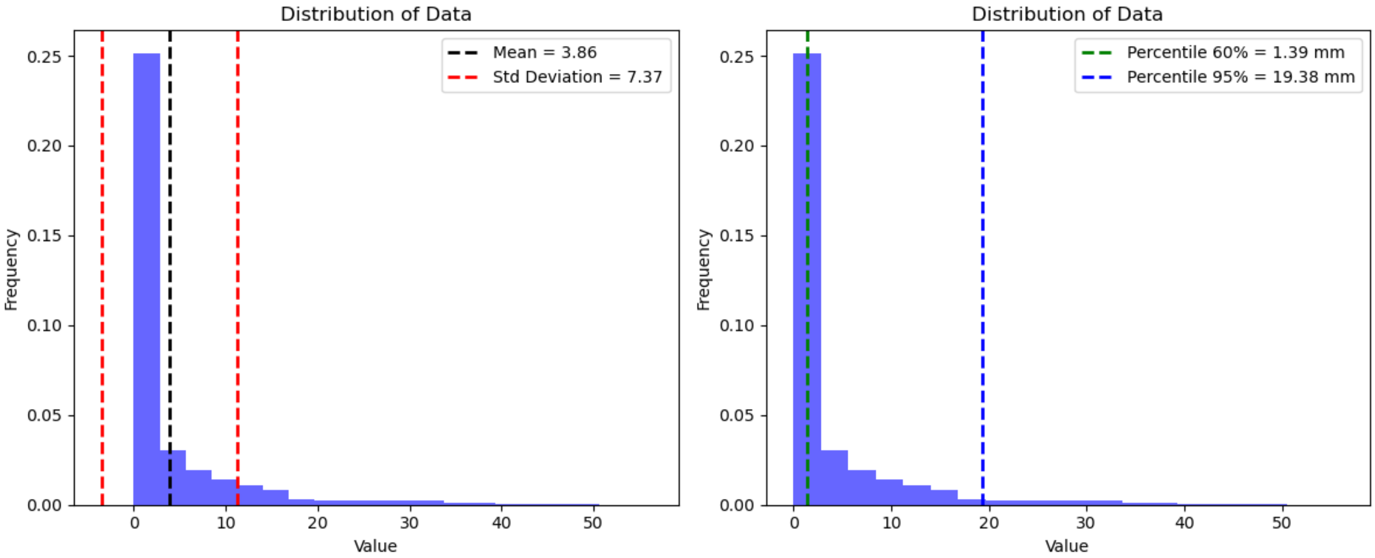
Group Categorically

In [148…

```
def catAn(df):
    df = df['next_day_prcp_total']
    # Calculate statistics
    mean = np.mean(df)
    std_dev = np.std(df)
    # Calculate the percentiles
    a = 0.6
    b = 0.95
    percentile_a = df.quantile(a)
    percentile_b = df.quantile(b)
    # Count data points within the percentile ranges
    count_below_a = np.sum(df < percentile_a)
    count_a_to_b = np.sum((df >= percentile_a) & (df <= percentile_b))
    count_above_b = np.sum(df > percentile_b)

    # Create subplots with two histograms
    plt.figure(figsize=(12, 5))   # Adjust the figure size as needed

    plt.subplot(1, 2, 1)   # 1 row, 2 columns, subplot 1
    plt.hist(df, bins=20, density=True, alpha=0.6, color='b')
    plt.axvline(mean, color='k', linestyle='dashed', linewidth=2, label=f"Mean = {mean:.
    plt.axvline(mean + std_dev, color='r', linestyle='dashed', linewidth=2, label=f"Std
    plt.axvline(mean - std_dev, color='r', linestyle='dashed', linewidth=2)
    plt.legend()
    plt.title("Distribution of Data")
    plt.xlabel("Value")
    plt.ylabel("Frequency")
    plt.subplot(1, 2, 2)  # 1 row, 2 columns, subplot 2
    plt.hist(df, bins=20, density=True, alpha=0.6, color='b')
    plt.axvline(percentile_a, color='g', linestyle='dashed', linewidth=2, label=f"Percen
    plt.axvline(percentile_b, color='b', linestyle='dashed', linewidth=2, label=f"Percen
    plt.legend()
    plt.title("Distribution of Data")
    plt.xlabel("Value")
    plt.ylabel("Frequency")

    plt.tight_layout()  # Adjust spacing between subplots
    plt.show()

    print('Category 0 is from 0 to ' + str(round(percentile_a, 3)) + ' mm of rain')
    print(f"Number of data points below the {a*100}% percentile: {count_below_a}")
    print('Category 1 is from ' + str(round(percentile_a, 3)) + ' mm of rain to ' + str(
    print(f"Number of data points in the {a*100}% to {b*100}% range: {count_a_to_b}")
    print('Category 2 is from ' + str(round(percentile_b, 3)) + ' mm of rain to the maxi
    print(f"Number of data points above the {b*100}% percentile: {count_above_b}")

    # Create categorical labels based on percentiles
    dfCol = pd.cut(
        df,
        bins=[float('-inf'), percentile_a, percentile_b, float('inf')],
        labels=['0', '1', '2']
    )

    return dfCol
```

In [149…

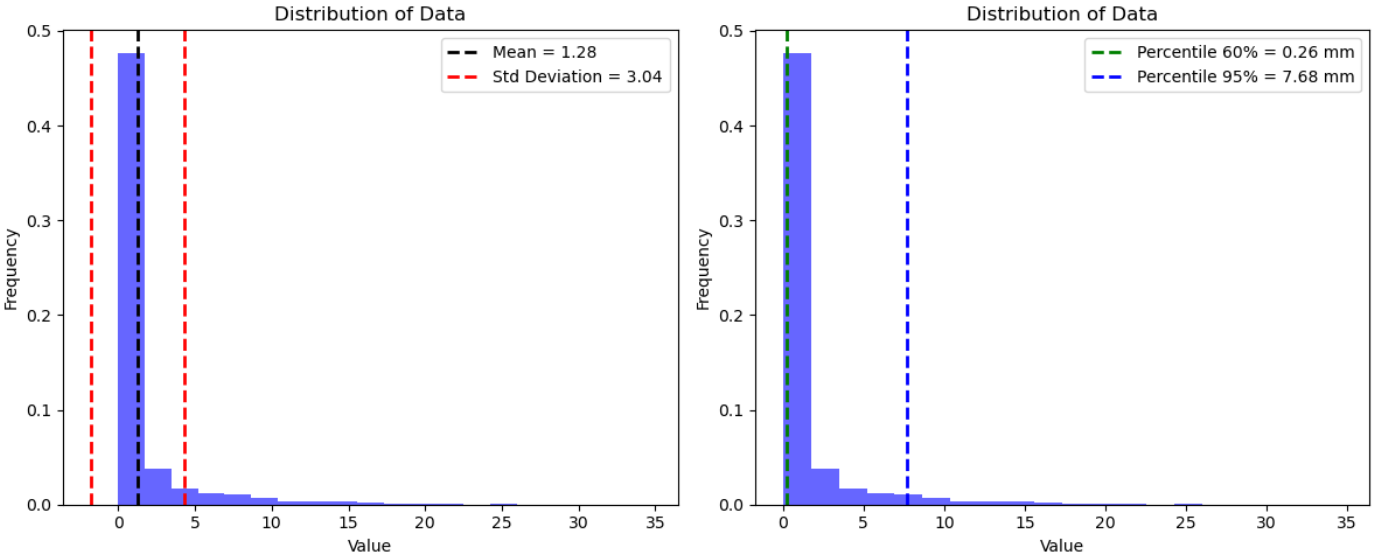
```
ny['nxtpr_cat'] = catAn(ny)
```



```
Category 0 is from 0 to 1.391 mm of rain
Number of data points below the 60.0% percentile: 10452
Category 1 is from 1.391 mm of rain to 19.378 mm of rain
Number of data points in the 60.0% to 95.0% range: 6098
Category 2 is from 19.378 mm of rain to the maximum
Number of data points above the 95.0% percentile: 872
```

In [150…

```
fl['nxtpr_cat'] = catAn(fl)
```



```
Category 0 is from 0 to 0.255 mm of rain
Number of data points below the 60.0% percentile: 5189
Category 1 is from 0.255 mm of rain to 7.678 mm of rain
Number of data points in the 60.0% to 95.0% range: 3027
Category 2 is from 7.678 mm of rain to the maximum
Number of data points above the 95.0% percentile: 433
```

Data

In [151…

```
print(ny[['next_day_prcp_total', 'nxtpr_cat']])
```

```
       next_day_prcp_total  nxtpr_cat
0                 0.000858          0
1                10.728631          1
2                 0.001715          0
3                 0.001715          0
4                 3.843783          1
...                    ...        ...
17417             1.180921          0
17418            11.342675          1
17419             3.285482          1
17420             1.258963          0
17421             0.165100          0

[17422 rows x 2 columns]
```

In [152…

```
print(fl[['next_day_prcp_total', 'nxtpr_cat']])
```

```
      next_day_prcp_total  nxtpr_cat
0                0.428093          1
1                0.001057          0
2                0.000529          0
3                0.016912          0
4                0.125785          0
...                   ...        ...
8644             0.228316          0
8645             0.025368          0
8646             0.935990          1
8647             0.420694          1
8648             0.082199          0

[8649 rows x 2 columns]
```

Load Models

In [153…

```
# Load the Neural Network model using joblib
model_nn = joblib.load("nn_rain_ext.pkl")

# Load the Random Forest model using joblib
model_rf = joblib.load("rf_rain_ext.pkl")

# Load the XGBoost model using joblib
model_xg = joblib.load("xg_rain_ext.pkl")

print("Models Loaded")
```

```
Models Loaded
```

Generate Predictions

In [154…

```
def gen_pred(df):
    exclude = ['next_day_prcp_total', 'nxtpr_cat', 'time', 'lat', 'lon']
    features = df.loc[:, ~df.columns.isin(exclude)]
    pred_nn = model_nn.predict(features)
    pred_rf = model_rf.predict(features)
    pred_xg = model_xg.predict(features)

    df['nn_pred'] = pred_nn # separate assigning it to df as a column bc otherwise the f
    df['rf_pred'] = pred_rf
    df['xg_pred'] = pred_xg

    return df
```

In [155…

```
pred_ny = ny
pred_fl = fl
pred_ny = gen_pred(pred_ny)
pred_fl = gen_pred(pred_fl)
pred_ny = pred_ny.loc[:,['next_day_prcp_total', 'nxtpr_cat','time','nn_pred','rf_pred','
pred_fl = pred_fl.loc[:,['next_day_prcp_total', 'nxtpr_cat','time','nn_pred','rf_pred','
```

```
545/545 [==============================] - 0s 564us/step
271/271 [==============================] - 0s 610us/step
```

In [156…

```
pred_ny.dtypes
```

Out[156]:

```
next_day_prcp_total            float64
nxtpr_cat                     category
time                    datetime64[ns]
nn_pred                        float32
rf_pred                         object
xg_pred                          int64
dtype: object
```

In [165…

```
# Check if there are any NA values in the specified columns
any_na = pred_ny[['xg_pred', 'rf_pred', 'nxtpr_cat']].isna().any()
print(any_na)
```

```
xg_pred      False
rf_pred       True
nxtpr_cat     True
dtype: bool
```

In [166…

```
# Check for NA values in 'xg_pred' column
xg_pred_na = pred_ny['xg_pred'].isna().sum()

# Check for NA values in 'rf_pred' column
rf_pred_na = pred_ny['rf_pred'].isna().sum()

# Check for NA values in 'nxtpr_cat' column
nxtpr_cat_na = pred_ny['nxtpr_cat'].isna().sum()
```

```
print(f'NA values in xg_pred: {xg_pred_na}')
print(f'NA values in rf_pred: {rf_pred_na}')
print(f'NA values in nxtpr_cat: {nxtpr_cat_na}')
```

```
NA values in xg_pred: 0
NA values in rf_pred: 17422
NA values in nxtpr_cat: 17422
```

In [157…

```
# Convert 'xg_pred' and 'rf_pred' to categorical with specified categories
categories = [0, 1, 2]  # Define the categories

pred_ny.loc[:, 'xg_pred'] = pd.Categorical(pred_ny['xg_pred'], categories=categories)
pred_ny.loc[:, 'rf_pred'] = pd.Categorical(pred_ny['rf_pred'], categories=categories)
```

```
C:\Users\yepesim\AppData\Local\Temp\ipykernel_31312\2912659506.py:5: DeprecationWarning:
In a future version, `df.iloc[:, i] = newvals` will attempt to set the values inplace in
stead of always setting a new array. To retain the old behavior, use either `df[df.colum
ns[i]] = newvals` or, if columns are non-unique, `df.isetitem(i, newvals)`
  pred_ny.loc[:, 'rf_pred'] = pd.Categorical(pred_ny['rf_pred'], categories=categories)
```

In [162…

```
# Define the categories for nxtpr_cat
nxtpr_cat_categories = [0, 1, 2]

# Convert 'nxtpr_cat' to categorical with specified categories
pred_ny['nxtpr_cat'] = pd.Categorical(pred_ny['nxtpr_cat'], categories=nxtpr_cat_categor

# Define the categories for 'rf_pred' and 'xg_pred'
categories = [0, 1, 2]

# Convert 'rf_pred' and 'xg_pred' to categorical with specified categories
pred_ny['rf_pred'] = pd.Categorical(pred_ny['rf_pred'], categories=categories)
pred_ny['xg_pred'] = pd.Categorical(pred_ny['xg_pred'], categories=categories)

# Ensure the categories match for 'rf_pred' and 'xg_pred'
assert pred_ny['rf_pred'].cat.categories.equals(pred_ny['xg_pred'].cat.categories), "Cat

# Now you can compare the categorical columns
rf_accuracy = (pred_ny['nxtpr_cat'] == pred_ny['rf_pred']).mean()
xg_accuracy = (pred_ny['nxtpr_cat'] == pred_ny['xg_pred']).mean()
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[162], line 18
     15 assert pred_ny['rf_pred'].cat.categories.equals(pred_ny['xg_pred'].cat.categorie
s), "Categories do not match."
     17 # Now you can compare the categorical columns
---> 18 rf_accuracy = (pred_ny['nxtpr_cat'] == pred_ny['rf_pred']).mean()
     19 xg_accuracy = (pred_ny['nxtpr_cat'] == pred_ny['xg_pred']).mean()

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\ops\common.py:72, in _unpack
_zerodim_and_defer.<locals>.new_method(self, other)
     68             return NotImplemented
     70 other = item_from_zerodim(other)
---> 72 return method(self, other)

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\arraylike.py:42, in OpsMixi
n.__eq__(self, other)
     40 @unpack_zerodim_and_defer("__eq__")
     41 def __eq__(self, other):
---> 42     return self._cmp_method(other, operator.eq)

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\series.py:6243, in Series._c
mp_method(self, other, op)
   6240 rvalues = extract_array(other, extract_numpy=True, extract_range=True)
   6242 with np.errstate(all="ignore"):
```

```
-> 6243     res_values = ops.comparison_op(lvalues, rvalues, op)
   6245 return self._construct_result(res_values, name=res_name)

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\ops\array_ops.py:273, in comparison_op(left, right, op)
    264         raise ValueError(
    265             "Lengths must match to compare", lvalues.shape, rvalues.shape
    266         )
    268 if should_extension_dispatch(lvalues, rvalues) or (
    269     (isinstance(rvalues, (Timedelta, BaseOffset, Timestamp)) or right is NaT)
    270     and not is_object_dtype(lvalues.dtype)
    271 ):
    272     # Call the method on lvalues
--> 273     res_values = op(lvalues, rvalues)
    275 elif is_scalar(rvalues) and isna(rvalues):  # TODO: but not pd.NA?
    276     # numpy does not like comparisons vs None
    277     if op is operator.ne:

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\ops\common.py:72, in _unpack_zerodim_and_defer.<locals>.new_method(self, other)
     68             return NotImplemented
     70 other = item_from_zerodim(other)
---> 72 return method(self, other)

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\arrays\categorical.py:153, in _cat_compare_op.<locals>.func(self, other)
    151 msg = "Categoricals can only be compared if 'categories' are the same."
    152 if not self._categories_match_up_to_permutation(other):
--> 153     raise TypeError(msg)
    155 if not self.ordered and not self.categories.equals(other.categories):
    156     # both unordered and different order
    157     other_codes = recode_for_categories(
    158         other.codes, other.categories, self.categories, copy=False
    159     )

TypeError: Categoricals can only be compared if 'categories' are the same.
```

In [163…

```
pred_ny.dtypes
```

Out[163]:

```
next_day_prcp_total            float64
nxtpr_cat                     category
time                    datetime64[ns]
nn_pred                        float32
rf_pred                       category
xg_pred                       category
dtype: object
```

In [167…

```
pred_ny
```

Out[167]:

	next_day_prcp_total	nxtpr_cat	time	nn_pred	rf_pred	xg_pred
0	0.000858	NaN	2022-12-01	278726.656250	NaN	1
1	10.728631	NaN	2022-12-02	-46810.664062	NaN	0
2	0.001715	NaN	2022-12-03	917657.062500	NaN	0
3	0.001715	NaN	2022-12-04	336517.875000	NaN	1
4	3.843783	NaN	2022-12-05	-33175.972656	NaN	0
...	...	...	...	...	...	...
17417	1.180921	NaN	2022-12-27	43307.023438	NaN	0
17418	11.342675	NaN	2022-12-28	43064.070312	NaN	0
17419	3.285482	NaN	2022-12-29	73968.187500	NaN	1

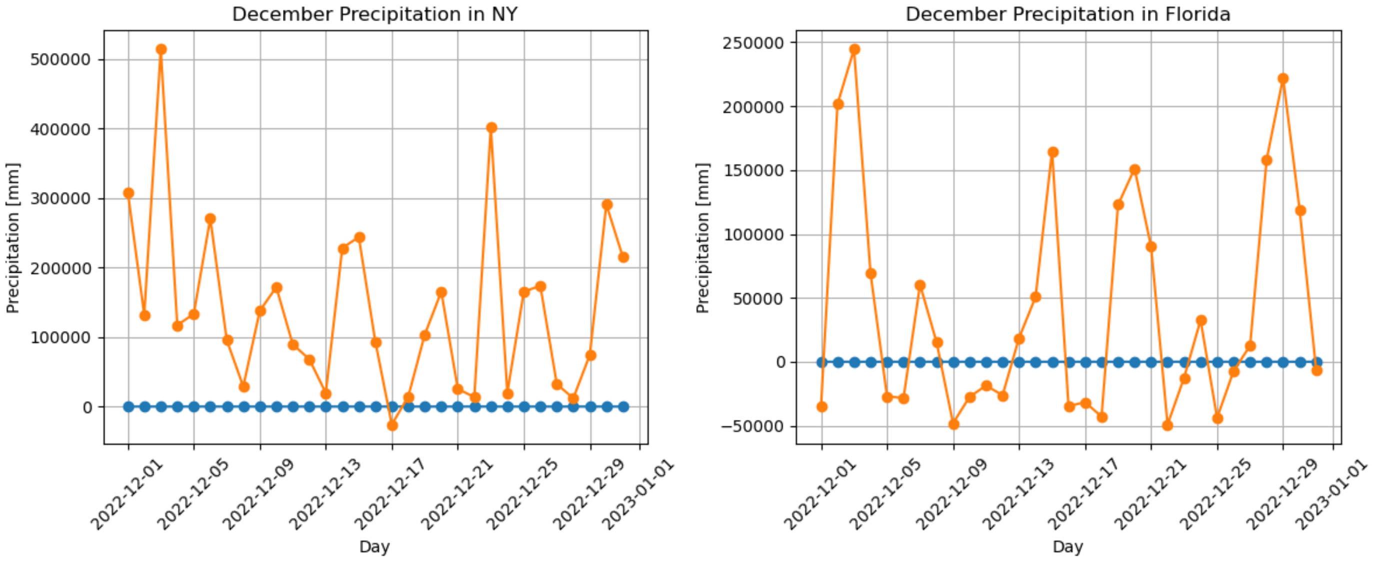
17420	1.258963	NaN	2022-12-30	399345.156250	NaN	0
17421	0.165100	NaN	2022-12-31	45468.457031	NaN	0

17422 rows × 6 columns

Evaluate Neural Network Regression

In [158…

```
# Initialize DataFrames
ny_snip_pred = pred_ny.copy()
fl_snip_pred = pred_fl.copy()

# Convert 'time' column to datetime
ny_snip_pred['time'] = pd.to_datetime(ny_snip_pred['time'])
fl_snip_pred['time'] = pd.to_datetime(fl_snip_pred['time'])

# Group by date and calculate the average precipitation for each day
ny_snip_pred = ny_snip_pred.groupby(ny_snip_pred['time'].dt.date)[['next_day_prcp_total'
fl_snip_pred = fl_snip_pred.groupby(fl_snip_pred['time'].dt.date)[['next_day_prcp_total'

# Create subplots with two line graphs
plt.figure(figsize=(12, 5))

# Plot NY data
plt.subplot(1, 2, 1)
plt.plot(ny_snip_pred['time'], ny_snip_pred['next_day_prcp_total'], marker='o', linestyl
plt.plot(ny_snip_pred['time'], ny_snip_pred['nn_pred'], marker='o', linestyle='-', label
plt.xlabel('Day')
plt.ylabel('Precipitation [mm]')
plt.title('December Precipitation in NY')
plt.grid(True)
plt.xticks(rotation=45)

# Plot FL data
plt.subplot(1, 2, 2)
plt.plot(fl_snip_pred['time'], fl_snip_pred['next_day_prcp_total'], marker='o', linestyl
plt.plot(fl_snip_pred['time'], fl_snip_pred['nn_pred'], marker='o', linestyle='-', label
plt.xlabel('Day')
plt.ylabel('Precipitation [mm]')
plt.title('December Precipitation in Florida')
plt.grid(True)
plt.xticks(rotation=45)

plt.tight_layout()  # Adjust spacing between subplots
plt.show()
```



Evaluate Random Forest & XGBoost Classifiers

In [159…

```
pred_ny['nxtpr_cat'] = pred_ny['nxtpr_cat'].astype('category')

# Select the columns of interest
columns_to_compare = ['nxtpr_cat', 'rf_pred', 'xg_pred']

# Create a new DataFrame containing only these columns
comparison_df = pred_ny[columns_to_compare]

# Example 1: Count the occurrences of each category in each column
value_counts = comparison_df.apply(lambda x: x.value_counts()).T

# Example 2: Create a cross-tabulation table
cross_tab = pd.crosstab(index=comparison_df['nxtpr_cat'], columns=[comparison_df['rf_pre

# Example 3: Calculate the agreement between 'nxtpr_cat' and 'rf_pred'
rf_accuracy = (comparison_df['nxtpr_cat'] == comparison_df['rf_pred']).mean()

# Example 4: Calculate the agreement between 'nxtpr_cat' and 'xg_pred'
xg_accuracy = (comparison_df['nxtpr_cat'] == comparison_df['xg_pred']).mean()
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[159], line 16
     13 cross_tab = pd.crosstab(index=comparison_df['nxtpr_cat'], columns=[comparison_df
['rf_pred'], comparison_df['xg_pred']])
     15 # Example 3: Calculate the agreement between 'nxtpr cat' and 'rf pred'
---> 16 rf_accuracy = (comparison_df['nxtpr_cat'] == comparison_df['rf_pred']).mean()
     18 # Example 4: Calculate the agreement between 'nxtpr_cat' and 'xg_pred'
     19 xg_accuracy = (comparison_df['nxtpr_cat'] == comparison_df['xg_pred']).mean()

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\ops\common.py:72, in _unpack
_zerodim_and_defer.<locals>.new_method(self, other)
     68         return NotImplemented
     70 other = item_from_zerodim(other)
---> 72 return method(self, other)

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\arraylike.py:42, in OpsMixi
n.__eq__(self, other)
     40 @unpack_zerodim_and_defer("__eq__")
     41 def __eq__(self, other):
---> 42     return self._cmp_method(other, operator.eq)

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\series.py:6243, in Series._c
```

```
mp_method(self, other, op)
   6240 rvalues = extract_array(other, extract_numpy=True, extract_range=True)
   6242 with np.errstate(all="ignore"):
-> 6243     res_values = ops.comparison_op(lvalues, rvalues, op)
   6245 return self._construct_result(res_values, name=res_name)

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\ops\array_ops.py:273, in com
parison_op(left, right, op)
    264         raise ValueError(
    265             "Lengths must match to compare", lvalues.shape, rvalues.shape
    266         )
    268 if should_extension_dispatch(lvalues, rvalues) or (
    269     (isinstance(rvalues, (Timedelta, BaseOffset, Timestamp)) or right is NaT)
    270     and not is_object_dtype(lvalues.dtype)
    271 ):
    272     # Call the method on lvalues
--> 273     res_values = op(lvalues, rvalues)
    275 elif is_scalar(rvalues) and isna(rvalues):  # TODO: but not pd.NA?
    276     # numpy does not like comparisons vs None
    277     if op is operator.ne:

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\ops\common.py:72, in _unpack
_zerodim_and_defer.<locals>.new_method(self, other)
     68             return NotImplemented
     70 other = item_from_zerodim(other)
---> 72 return method(self, other)

File ~\Anaconda3\envs\PakiMod\lib\site-packages\pandas\core\arrays\categorical.py:153, i
n _cat_compare_op.<locals>.func(self, other)
    151 msg = "Categoricals can only be compared if 'categories' are the same."
    152 if not self._categories_match_up_to_permutation(other):
--> 153     raise TypeError(msg)
    155 if not self.ordered and not self.categories.equals(other.categories):
    156     # both unordered and different order
    157     other_codes = recode_for_categories(
    158         other.codes, other.categories, self.categories, copy=False
    159     )

TypeError: Categoricals can only be compared if 'categories' are the same.
```

In [ ]:

```python
print(f'Value counts are {value_counts}')
print(f'Cross tab is {cross_tab}')
print(f'XGBoost accuracy is {xg_accuracy}')
print(f'Random Forest accuracy is {rf_accuracy}')
```

Discussion