st125457_ulugbek_assignment

September 6, 2024

1 Exploratory data analysis

More resources for understanding data visualization

- https://builtin.com/data-science/boxplot
- https://www.reddit.com/r/dataisbeautiful/
- https://mode.com/blog/violin-plot-examples/
- https://www.knowledgehut.com/blog/data-science/data-visualization-in-data-science
- https://www.analyticssteps.com/blogs/data-visualization-techniques

[ ]:
```
from IPython.display import Image
from IPython.core.display import HTML
Image(url= "https://reach2020.eu/wp-content/uploads/2019/05/
↪REACH-data-analytics-sophistication.png")
```

[ ]:
```
<IPython.core.display.Image object>
```

1.1 Step1: fruits data

1.1) Load library and data

[ ]:
```
# Include neccesary library
import pandas as pd
import matplotlib.pyplot as plt

# make the plot appear without explicitly show()
%matplotlib inline
```

[ ]:
```
fruits = pd.read_csv('http://msds.science.swu.ac.th/csv/fruit_data.csv ')
fruits.head()
```

[ ]:
```
   Area   Perimeter      Length      Width  Bounding Box  Eccentricity  \
0  7293  322.350288  102.772555  90.655051          9100      1.133666
1  6916  310.249783   99.093942  89.173834          8633      1.111245
2  7057  316.007143  101.747826  88.561243          8900      1.148898
3  6897  313.735065   99.056651  88.982012          8633      1.113221
4  6883  309.421356   98.948844  88.909916          8633      1.112911

   Roundness  Convexity  Average Color Red  Average Color Green  \
0   0.641405   1.172637         178.950413           102.710744
```

```
1   0.641755   1.186141         177.669421          104.322314
2   0.633996   1.183518         178.628099          106.057851
3   0.639992   1.172964         178.851240          107.793388
4   0.638693   1.189317         179.628099          109.760331

   Average Color Blue Target
0           65.719008  Apple
1           61.289256  Apple
2           61.933884  Apple
3           62.743802  Apple
4           64.462810  Apple
```

1.2) Explore data

[ ]:
```python
# data dimension
fruits.shape
```

[ ]:
```
(80, 12)
```

[ ]:
```python
# show the name of data columns (they are candidates for the model's features)
fruits.columns
```

[ ]:
```
Index(['Area', 'Perimeter', 'Length', 'Width', 'Bounding Box', 'Eccentricity',
       'Roundness', 'Convexity', 'Average Color Red', 'Average Color Green',
       'Average Color Blue', 'Target'],
      dtype='object')
```

[ ]:
```python
# check if any feature has null or empty value
fruits.isnull().sum()
```

[ ]:
```
Area                   0
Perimeter              0
Length                 0
Width                  0
Bounding Box           0
Eccentricity           0
Roundness              0
Convexity              0
Average Color Red      0
Average Color Green    0
Average Color Blue     0
Target                 0
dtype: int64
```

[ ]:
```python
# Data stat
fruits.describe()
```

```
[ ]:              Area   Perimeter      Length      Width  Bounding Box  \
     count    80.00000   80.000000   80.000000  80.000000     80.000000
     mean   6274.46250  312.445633  101.136797  82.003298   8547.337500
     std    1433.14043   14.467298    4.347729  13.551783    897.119327
     min    3445.00000  276.007143   93.877625  53.408523   6300.000000
     25%    5915.50000  303.178716   99.001695  78.172658   8175.000000
     50%    6652.50000  309.300036  100.846689  84.732940   8376.000000
     75%    7367.75000  326.967298  102.413086  91.990114   9528.000000
     max    7861.00000  345.462987  119.525558  97.574934   9800.000000

            Eccentricity  Roundness  Convexity  Average Color Red  \
     count     80.000000  80.000000  80.000000          80.000000
     mean       1.272982   0.580589   1.173267         166.620455
     std        0.253911   0.101963   0.018514          44.815759
     min        1.036767   0.368820   1.105078          84.041322
     25%        1.099497   0.574367   1.168206         151.415289
     50%        1.174686   0.634364   1.180198         180.157025
     75%        1.292117   0.644497   1.184057         190.506198
     max        1.863729   0.653344   1.196027         252.231405

            Average Color Green  Average Color Blue
     count            80.000000           80.000000
     mean            130.669008           73.239669
     std              38.577439           59.671417
     min             100.504132           17.834711
     25%             102.710744           27.995868
     50%             122.628099           65.702479
     75%             133.733471           89.654959
     max             252.008264          250.264463
```

```
[ ]: #fruits.groupby(['Target']).size()
```

```
[ ]: # Count number of samples for each target
     fruits.Target.value_counts()
```

```
[ ]: Target
     Apple     20
     Banana    20
     Mango     20
     Orange    20
     Name: count, dtype: int64
```

1.2: First visualization of data

```
[ ]: # load seaborn library
     import seaborn as sns
```

[ ]:
```python
# create columns name as list and remove target column from the list
allcols = list(fruits.columns)
features = allcols[0:11]
print(features)
```

```
['Area', 'Perimeter', 'Length', 'Width', 'Bounding Box', 'Eccentricity',
'Roundness', 'Convexity', 'Average Color Red', 'Average Color Green', 'Average
Color Blue']
```

[ ]:
```python
fruits.columns
```

[ ]:
```
Index(['Area', 'Perimeter', 'Length', 'Width', 'Bounding Box', 'Eccentricity',
       'Roundness', 'Convexity', 'Average Color Red', 'Average Color Green',
       'Average Color Blue', 'Target'],
      dtype='object')
```

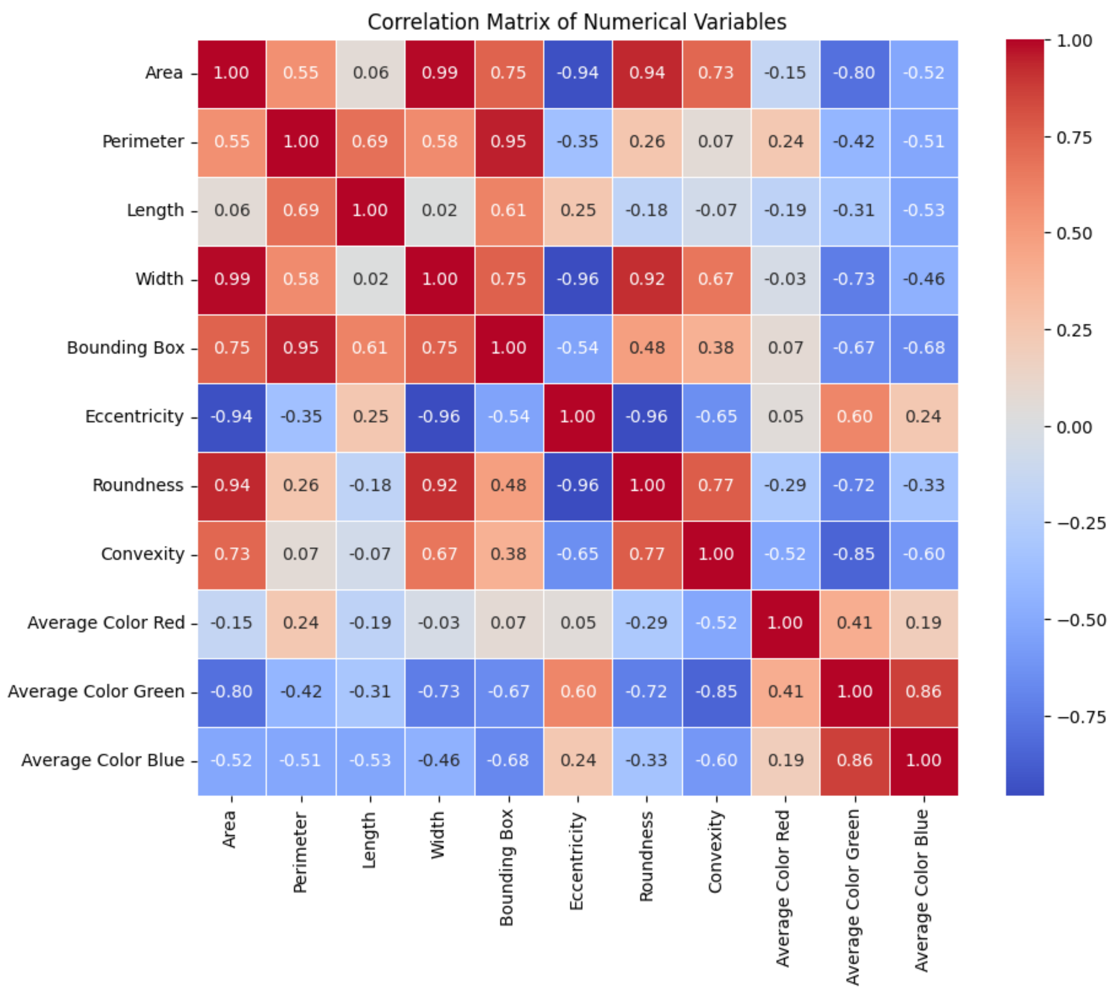
[ ]:
```python
## Heatmap

# Select only the numerical columns for the heatmap
numerical_data = fruits.select_dtypes(include=['float64', 'int64'])

# Compute the correlation matrix for numerical columns
corr_matrix_numerical = numerical_data.corr()

# Plotting the heatmap for numerical columns
plt.figure(figsize=(10, 8))
sns.heatmap(corr_matrix_numerical, annot=True, cmap='coolwarm', fmt=".2f",␣
↪linewidths=0.5)
plt.title('Correlation Matrix of Numerical Variables')
plt.show()

# Features: "Area", "Length", "Eccentricity", "Convexity", "Average Color Red",␣
↪"Average Color Green", "Average Color Blue"
```



box plots are useful for

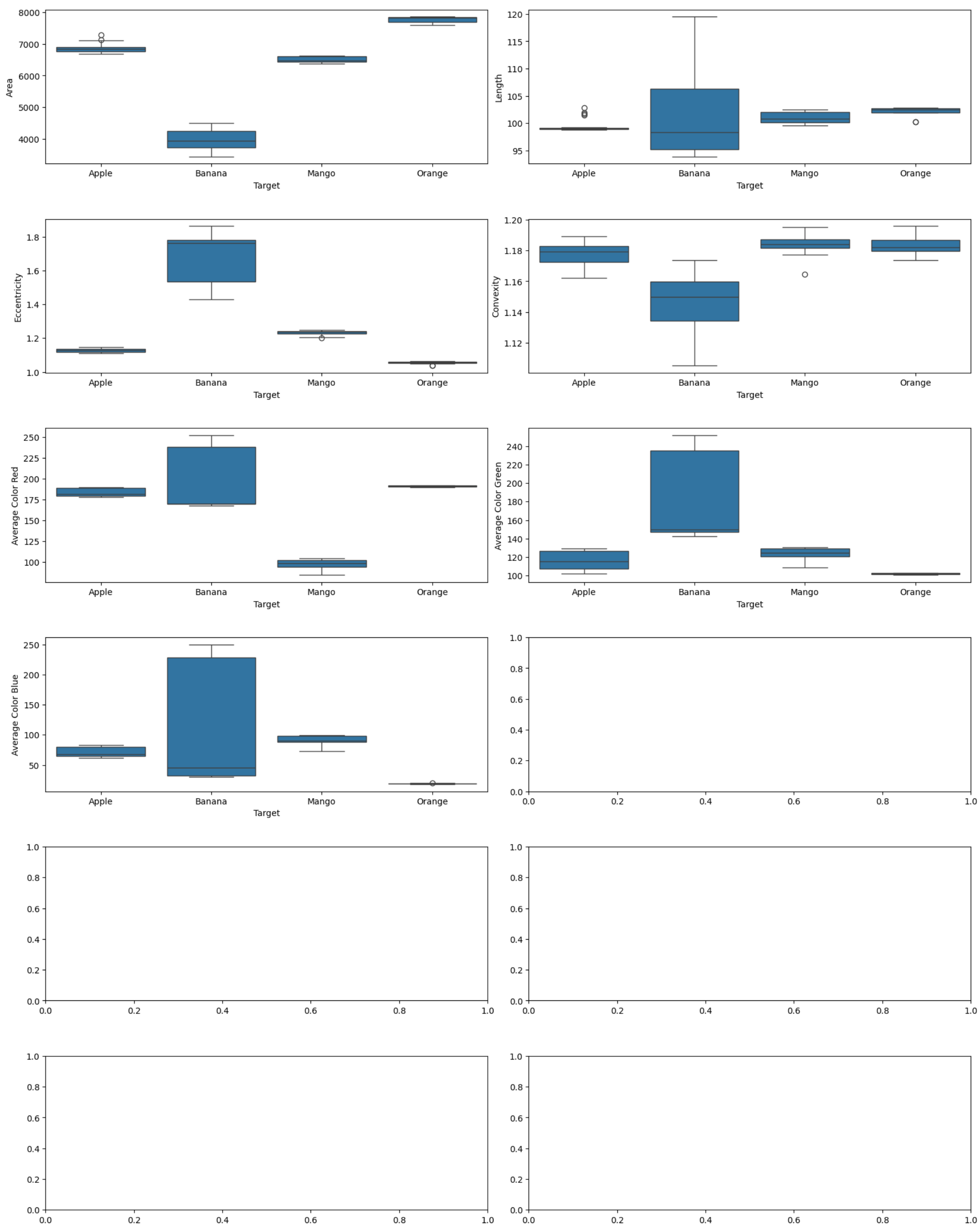
- tell the values of outliers
- Identify if data is symmetrical
- Check Skewness

Nature of data: Qualitative: (Nominal & Ordinal) and Quantitative: (Discrete and Continuos)

[ ]:
```
# plot box plot of all candidate features for each target
candidate_features = ["Area", "Length", "Eccentricity", "Convexity", "Average Color Red", "Average Color Green", "Average Color Blue"]

fig, axs = plt.subplots(ncols=2, nrows=6, figsize=(16, 20))
index = 0
axs = axs.flatten()
```

```python
for i, k in enumerate(candidate_features):
    sns.boxplot(x='Target', y=k, data=fruits, ax=axs[i])
plt.tight_layout(pad=0.5, w_pad=0.5, h_pad=3)
```



[ ]:
```
# plot distribution of all candidate features
fig, axs = plt.subplots(ncols=3, nrows=4, figsize=(16, 10))
index = 0
axs = axs.flatten()

# sns.distplot(fruits[k].values, bins=20, ax=axs[index])
#for k,v in fruits.items():
for i, k in enumerate(candidate_features):
    sns.distplot(fruits[k].values, bins=20, ax=axs[i])

plt.tight_layout(pad=0.5, w_pad=0.5, h_pad=3)
```

```
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\2473474893.py:9: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(fruits[k].values, bins=20, ax=axs[i])
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\2473474893.py:9: UserWarning:

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  sns.distplot(fruits[k].values, bins=20, ax=axs[i])
```
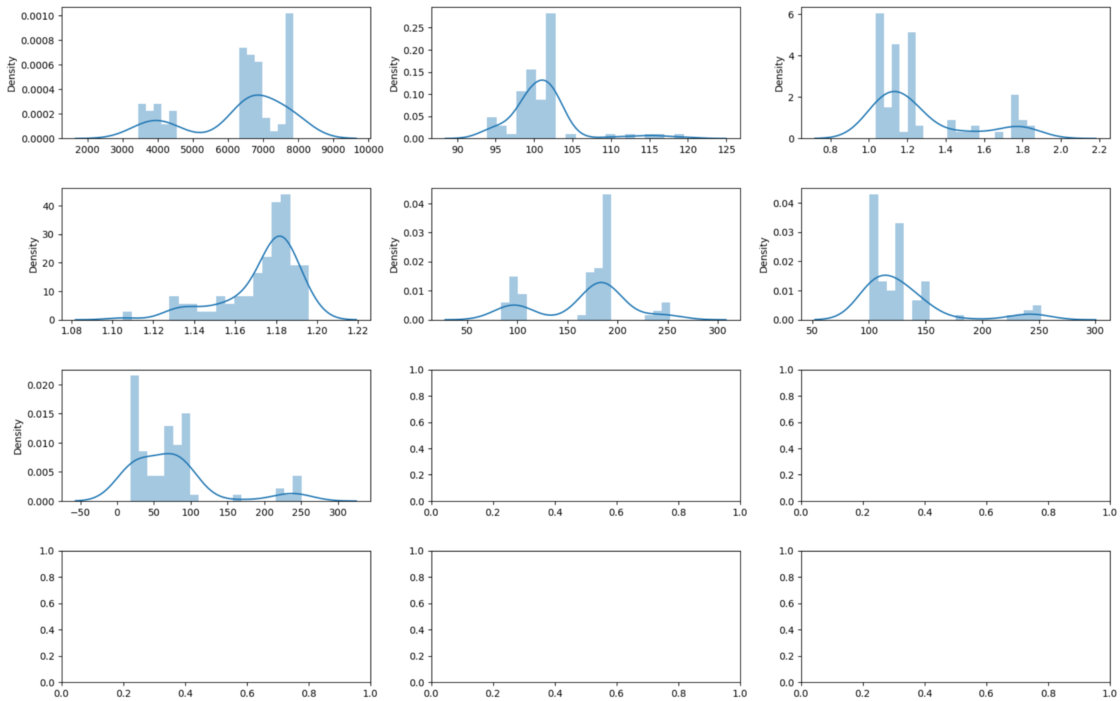
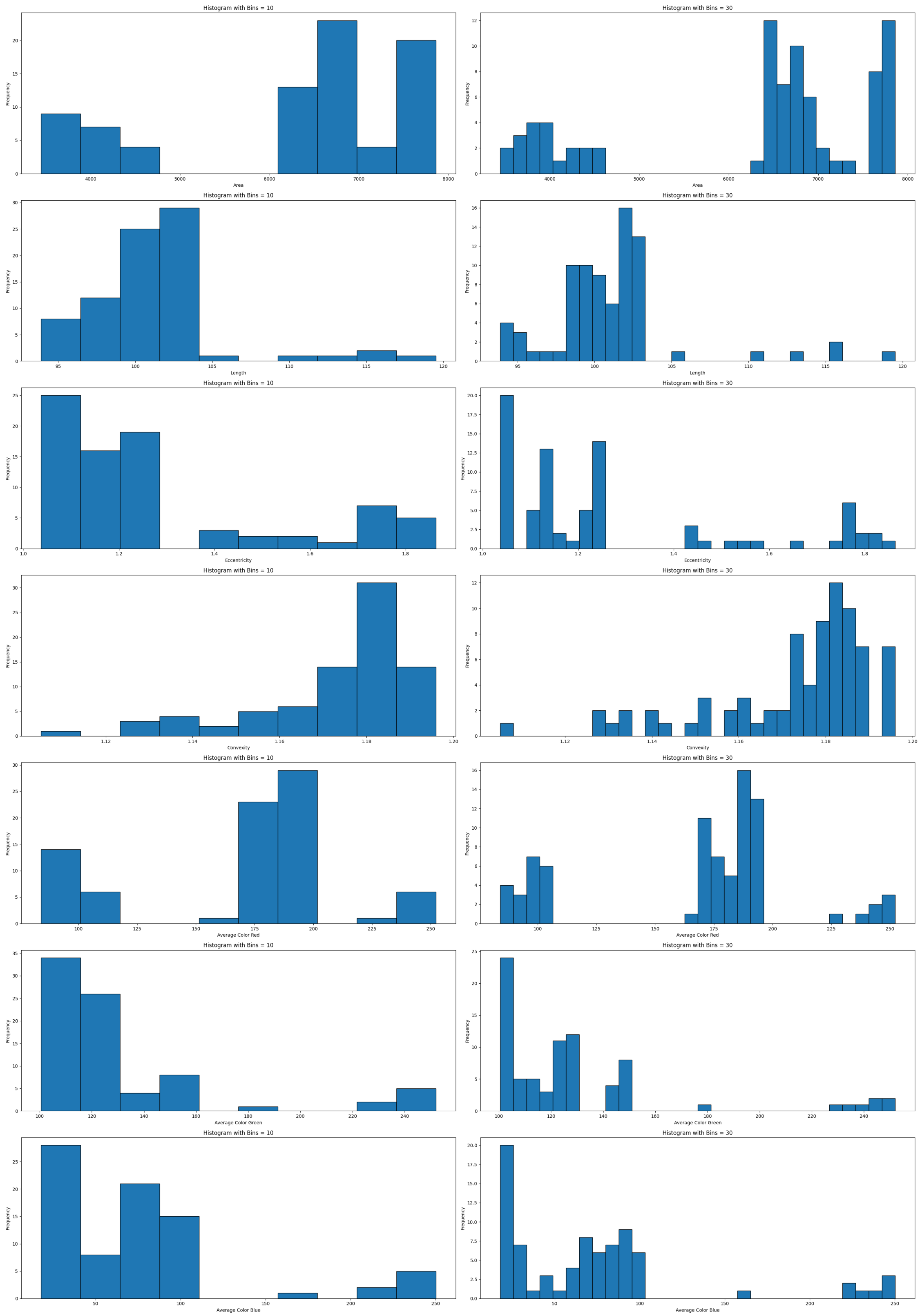



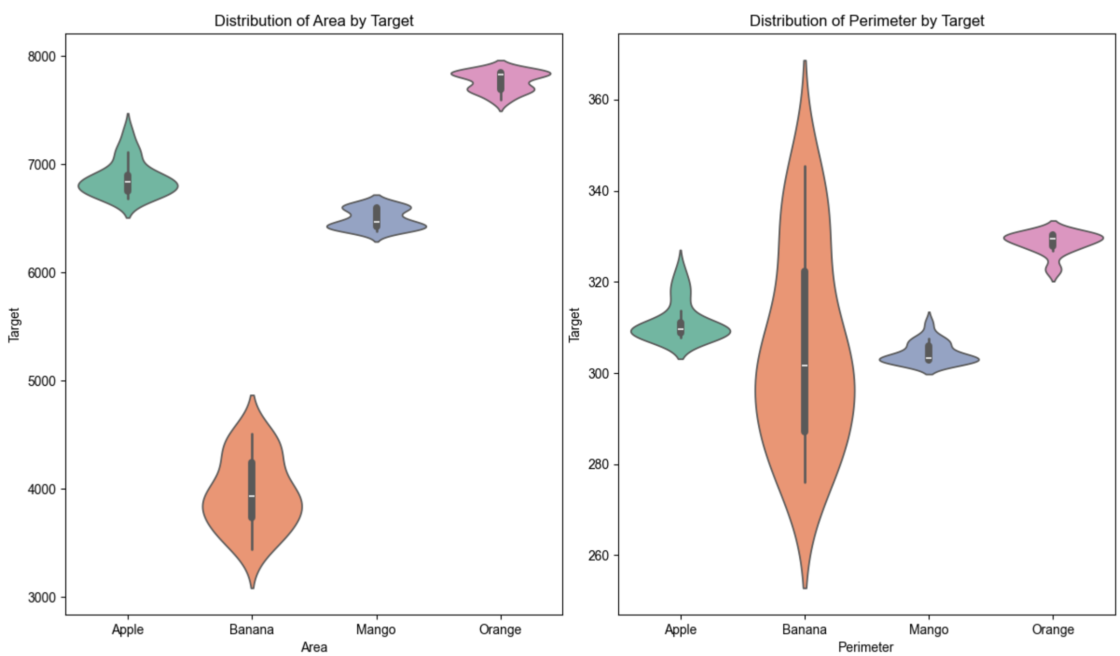

```
[ ]: # exercise1 :  create histrogram with bins = 10 and 30
numerical_data = fruits.select_dtypes(include=['float64', 'int64'])

fig, axs = plt.subplots(nrows=7, ncols=2, figsize=(28, 40))

for i, k in enumerate(candidate_features):
    axs[i, 0].hist(fruits[candidate_features[i]], bins=10, edgecolor='black')
    axs[i, 0].set_title('Histogram with Bins = 10')
    axs[i, 0].set_xlabel(candidate_features[i])
    axs[i, 0].set_ylabel('Frequency')

    axs[i, 1].hist(fruits[candidate_features[i]], bins=30,edgecolor='black')
    axs[i, 1].set_title('Histogram with Bins = 30')
    axs[i, 1].set_xlabel(candidate_features[i])
    axs[i, 1].set_ylabel('Frequency')

plt.tight_layout()
plt.show()
```


Histogram with Bins = 10
Histogram with Bins = 30
Frequency
Area
Length
Eccentricity
Convexity
Average Color Red
Average Color Green
Average Color Blue

How to select number of bins: http://en.wikipedia.org/wiki/Histogram#Number_of_bins_and_w

violin plots combines box plots and kde

[ ]:
```
# plot distribution of all candidate features for each target

fig, axs = plt.subplots(ncols=2, nrows=1, figsize=(12, 7))
index = 0
axs = axs.flatten()
sns.set_style('whitegrid')

for i, feature in enumerate(features[:2]):
    sns.violinplot(x='Target', hue='Target', data=fruits, ax=axs[i], y=feature,␣
 ↪palette='Set2')
    axs[i].set_title(f'Distribution of {feature} by Target')
    axs[i].set_xlabel(feature)
    axs[i].set_ylabel('Target')
plt.tight_layout(pad=0.5, w_pad=0.5, h_pad=3)
```

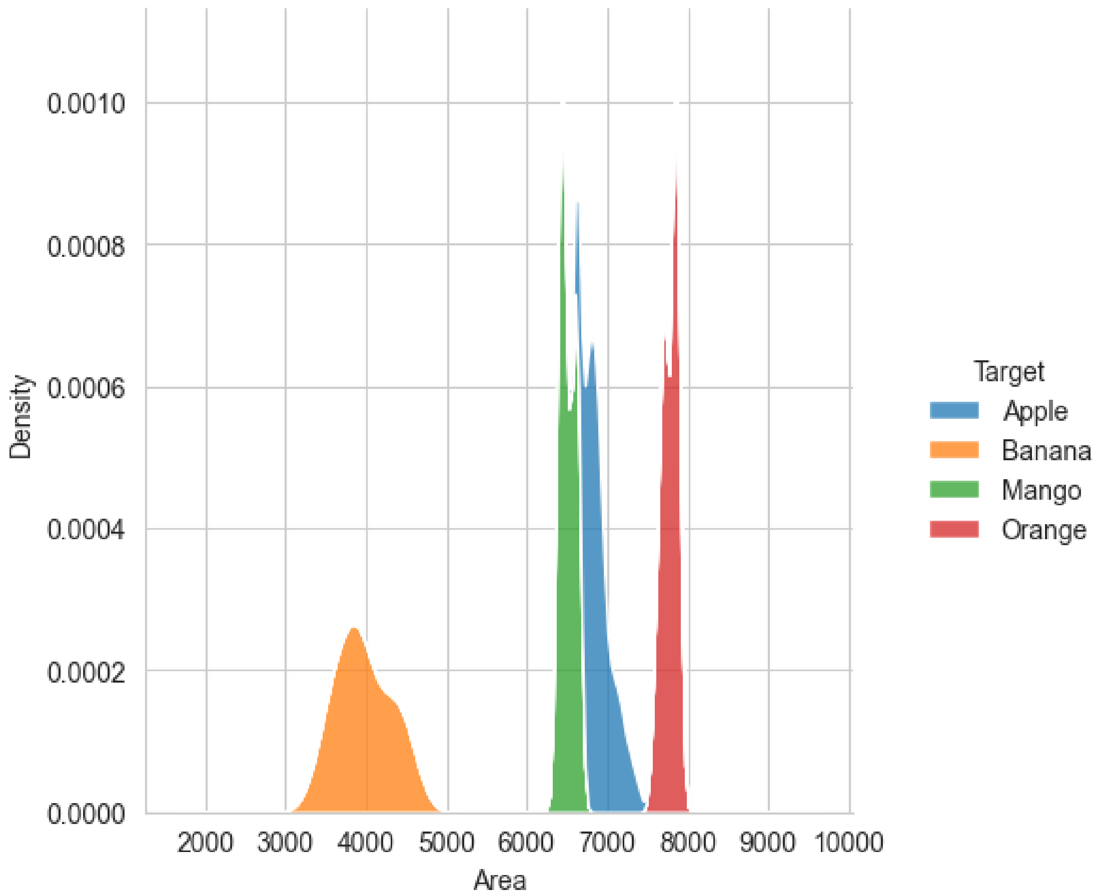


[ ]:
```
sns.__version__
```

[ ]: '0.13.2'

[ ]:
```
# see the distribution of individual feature by target value using kdeplot
sns.displot(data=fruits, x="Area", hue="Target", multiple="stack", kind="kde")
```

[ ]: <seaborn.axisgrid.FacetGrid at 0x20aff71a400>



[ ]:
```python
# depreciated after the seaborn version 0.14
sns.distplot(fruits[fruits['Target']=='Apple']['Area'], bins=20,color='r')
sns.distplot(fruits[fruits['Target']=='Banana']['Area'], bins=20,color='g')
sns.distplot(fruits[fruits['Target']=='Mango']['Area'], bins=20,color='b')
sns.distplot(fruits[fruits['Target']=='Orange']['Area'], bins=20,color='m')
```

```
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\2696945370.py:2: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

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https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(fruits[fruits['Target']=='Apple']['Area'], bins=20,color='r')
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\2696945370.py:3: UserWarning:
```
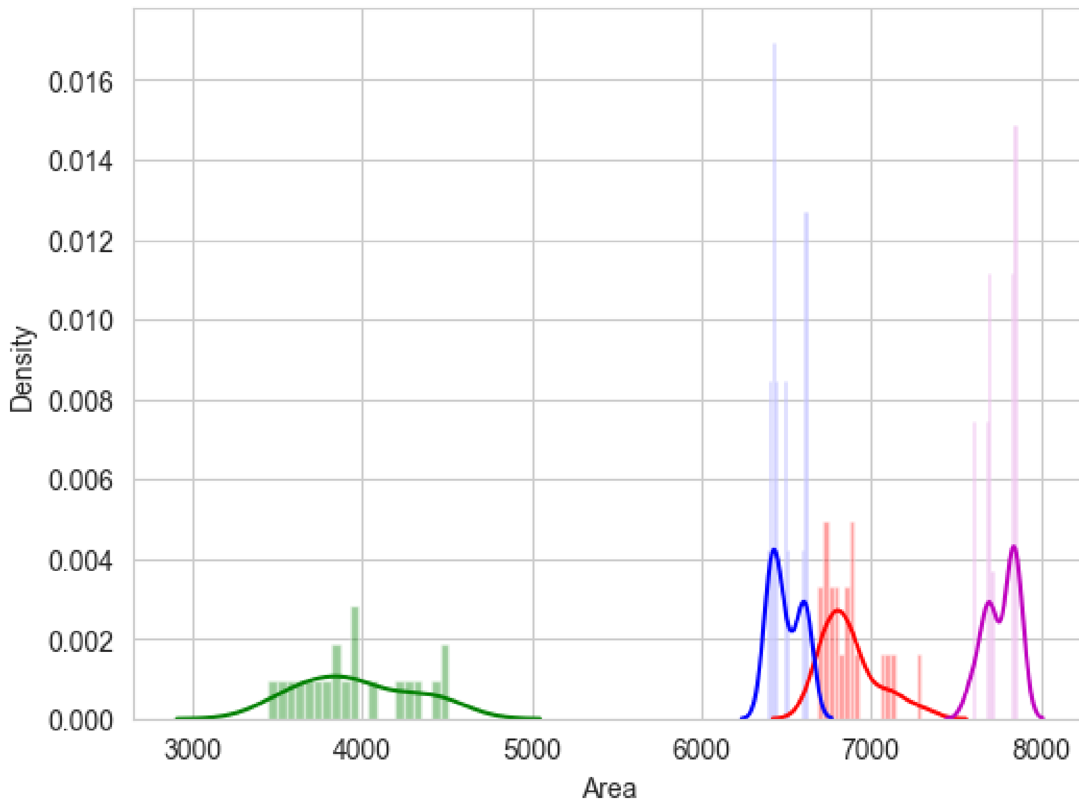
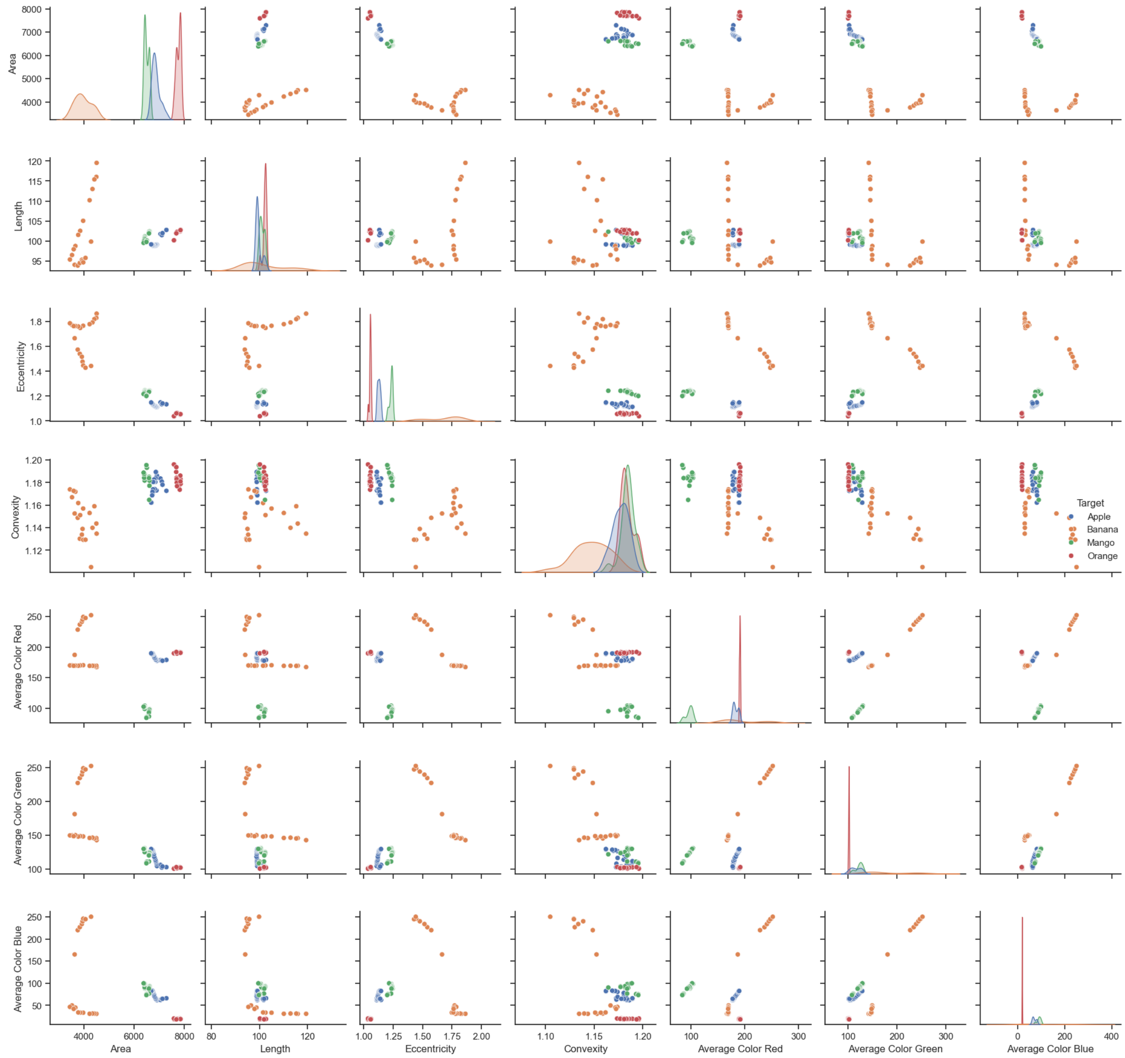

```
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(fruits[fruits['Target']=='Banana']['Area'], bins=20,color='g')
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\2696945370.py:4: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(fruits[fruits['Target']=='Mango']['Area'], bins=20,color='b')
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\2696945370.py:5: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(fruits[fruits['Target']=='Orange']['Area'], bins=20,color='m')
```

```
[ ]: <Axes: xlabel='Area', ylabel='Density'>
```



[ ]:
```
# # plot distribution of all candidate features for each target

# # fig, axs = plt.subplots(ncols=2, nrows=8, figsize=(12, 7))
# index = 0
# axs = axs.flatten()
sns.set_style('whitegrid')
sns.set(style="ticks", color_codes=True)

sns.pairplot(data=fruits[candidate_features + ['Target']], hue='Target')
plt.tight_layout(pad=0.5, w_pad=0.5, h_pad=3)
```

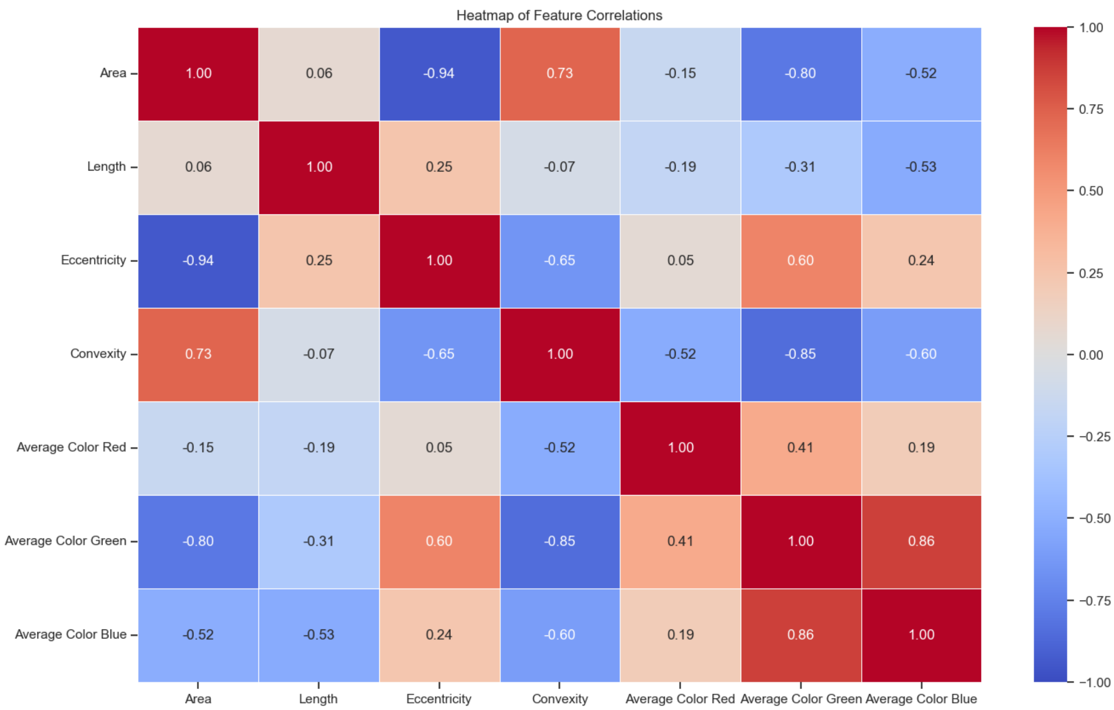



```
[ ]: fruits.columns
```

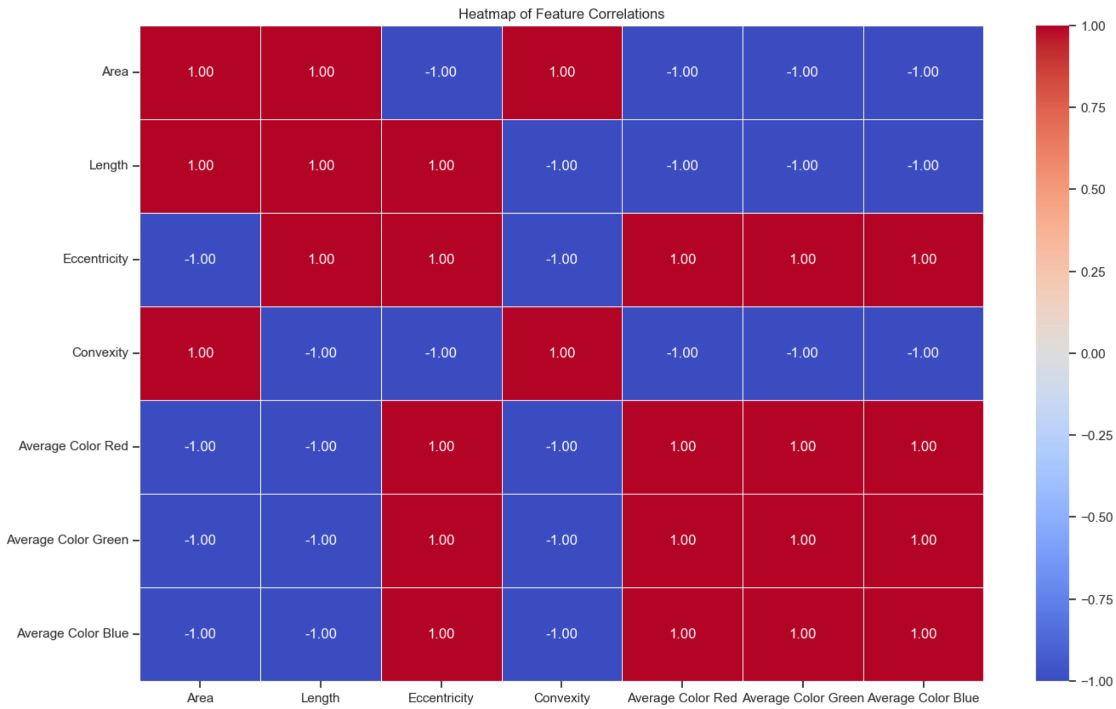
```
[ ]: Index(['Area', 'Perimeter', 'Length', 'Width', 'Bounding Box', 'Eccentricity',
            'Roundness', 'Convexity', 'Average Color Red', 'Average Color Green',
            'Average Color Blue', 'Target'],
           dtype='object')
```

```
[ ]: correlation = fruits[candidate_features].corr()

     # plot the cross relationship between each pair using heatmap
     plt.figure(figsize=(16, 10))

     # Plot the heatmap
     sns.heatmap(correlation, annot=True, cmap='coolwarm', vmin=-1, vmax=1, fmt='.
      ↪2f', linewidths=0.5)
```

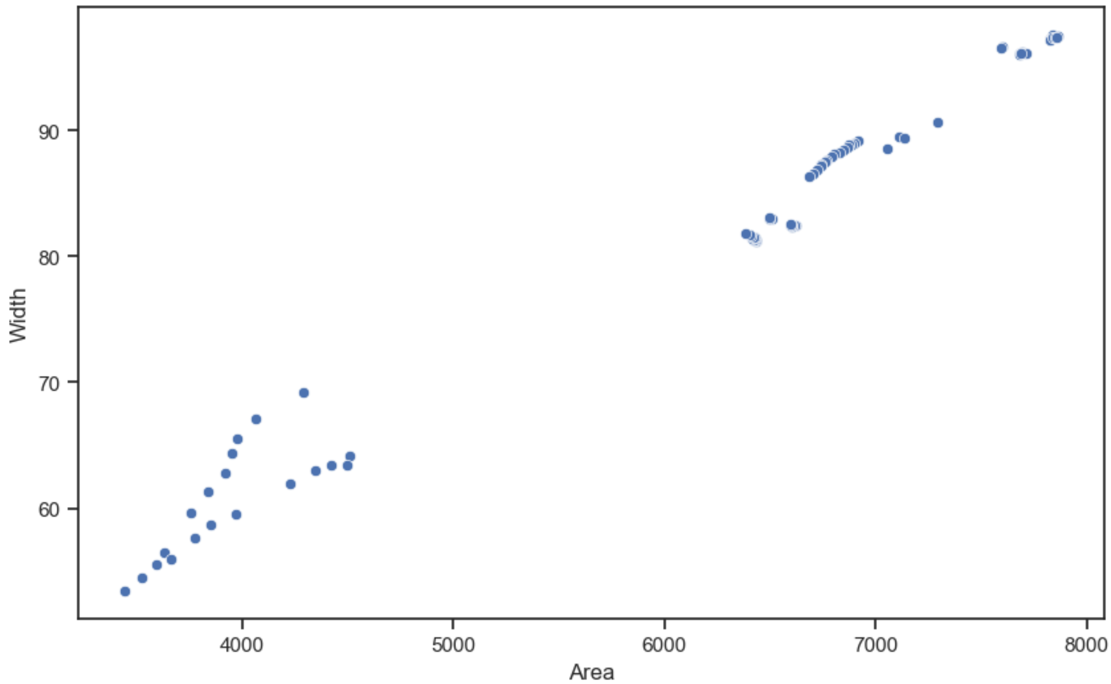
```
plt.title('Heatmap of Feature Correlations')
plt.show()
```



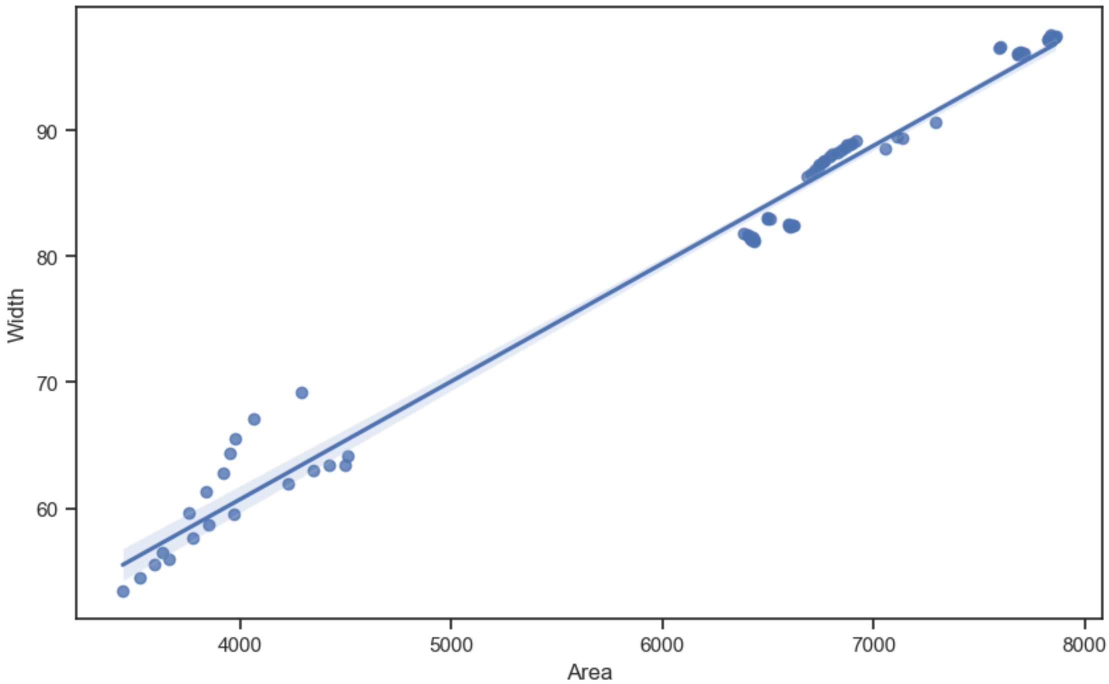

```
[ ]: import numpy as np
# exercise2: find correlation with positive and negative (hint:np.sign)
plt.figure(figsize=(16, 10))

# Plot the heatmap
sns.heatmap(np.sign(correlation), annot=True, cmap='coolwarm', vmin=-1, vmax=1,␣
↪fmt='.2f', linewidths=0.5)
plt.title('Heatmap of Feature Correlations')
plt.show()
```



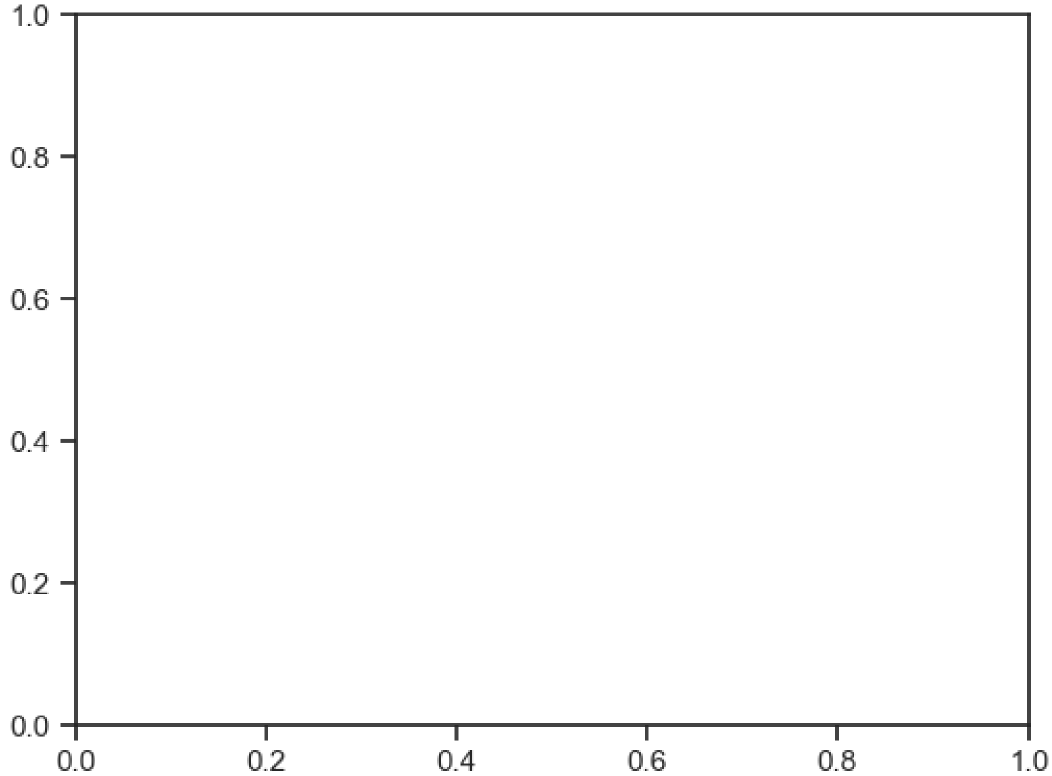
[ ]:
```python
# See the relationship between the area and width since it has 0.99
plt.figure(figsize=(10,6))

sns.scatterplot(data=fruits, x='Area', y='Width')
plt.show()
```



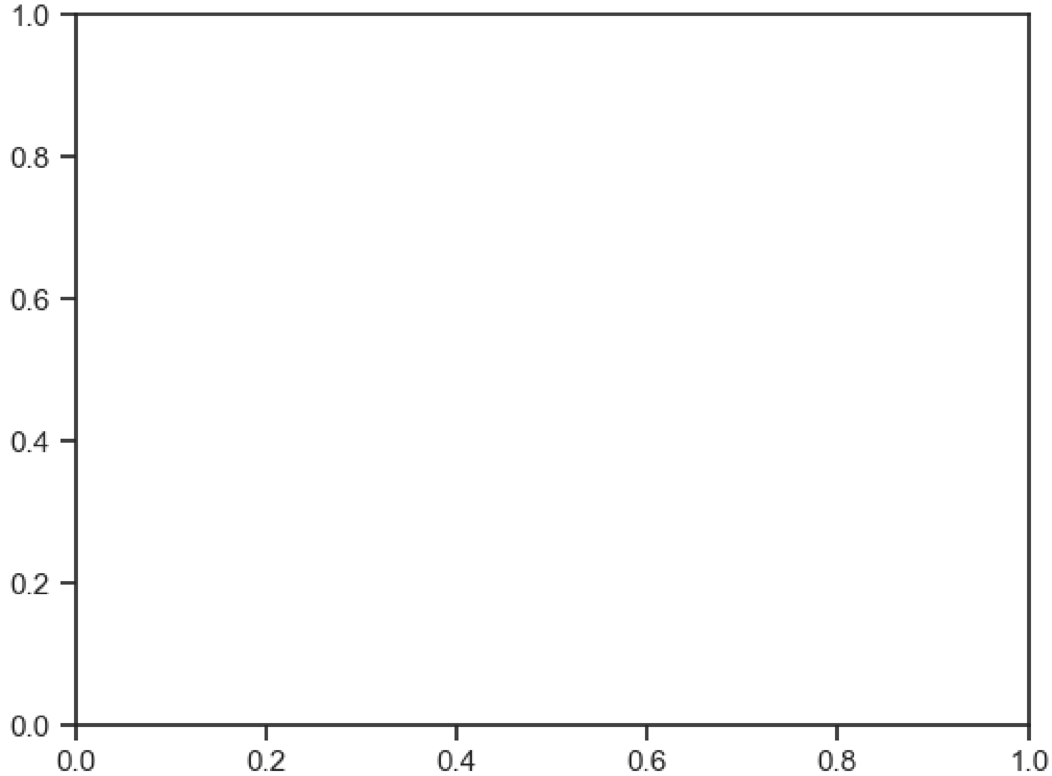

```
[ ]: # exercise3: select any 2 features that may be linearly dependent and plot␣
     ↪regplot
     plt.figure(figsize=(10,6))
     sns.regplot(data=fruits, x='Area', y='Width')
     plt.show()
```



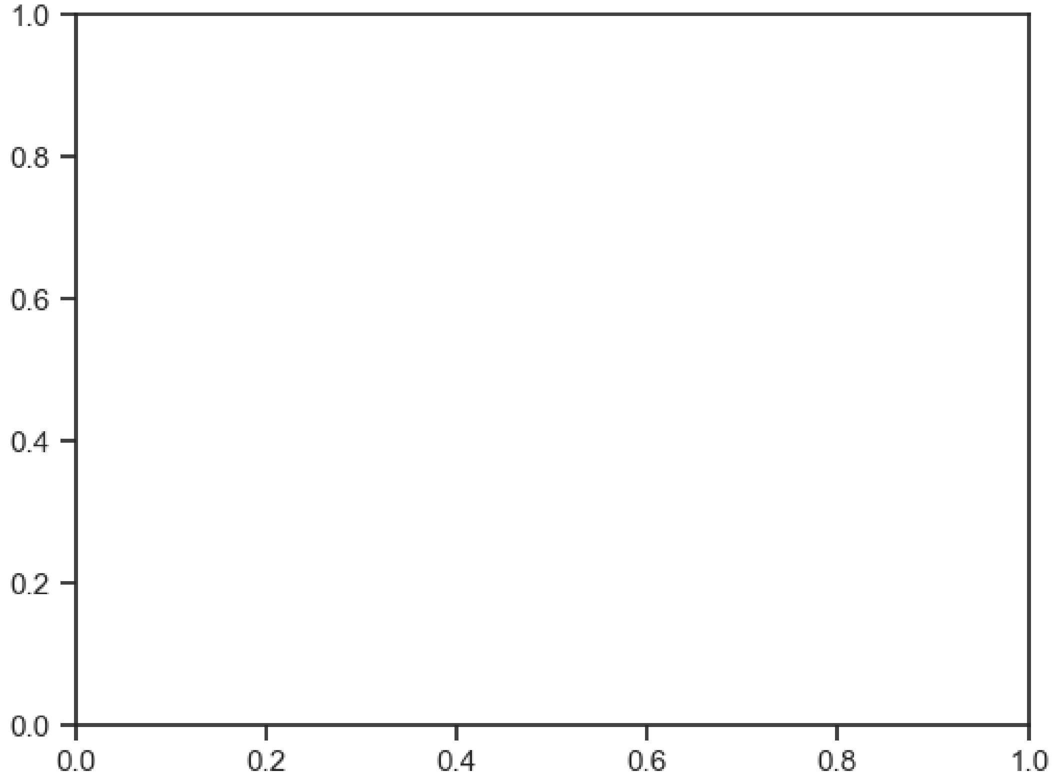
[ ]:
```
# see the relationship between Perimeter and Length for each target
# color = r,g,b,m

fig, ax = plt.subplots()
```



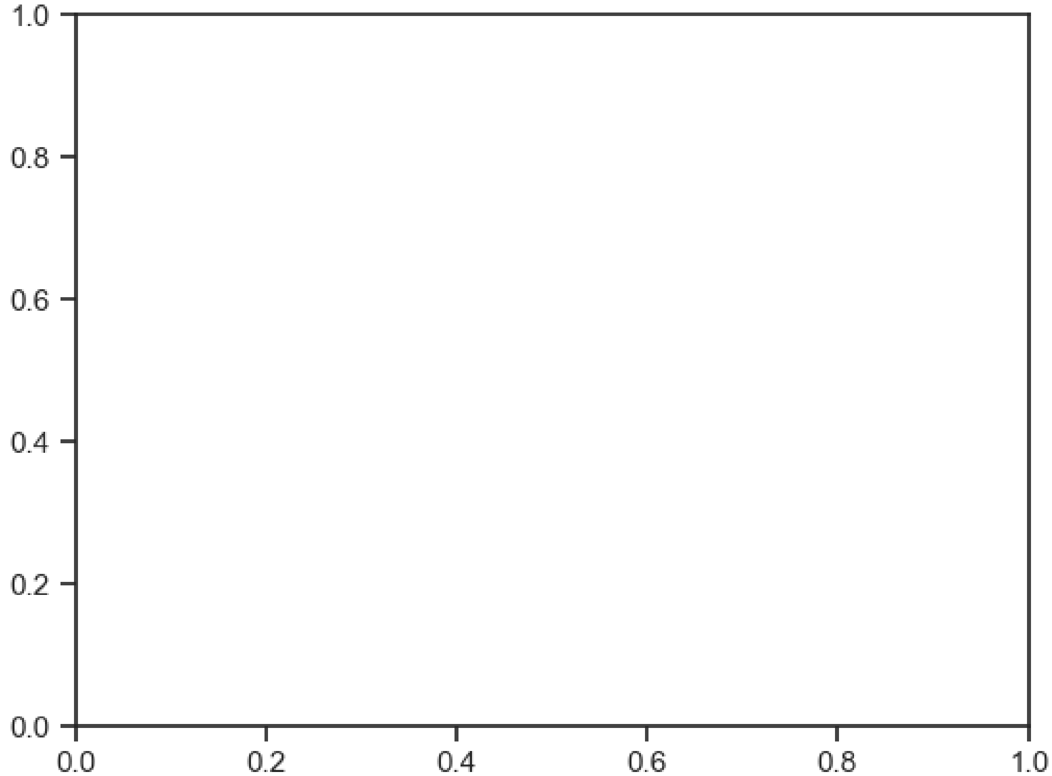
[ ]:
```
# see the relationship between Width and Length for each target
fig, ax = plt.subplots()
```



[ ]:
```
# Exercise: see the relationship between Roundness and Eccentricity for each␣
↪target
fig, ax = plt.subplots()
```



[ ]:
```
# Exercise: see the relationship between Area and "Average Color Red" for each
↪target
fig, ax = plt.subplots()
```



[ ]:
```
# exercise4: choose other pair of feature and scatter plot them.
```

1.2: Scale data

[ ]:
```
# Load library for scaling
from sklearn import preprocessing
scaler = preprocessing.MinMaxScaler()
#scaler = preprocessing.StandardScaler()
```

[ ]:
```
# function to scale each column
def scaleColumns(df, cols_to_scale):
   pass
```

[ ]:
```
# scale data in each column
scaled_fruits = scaleColumns(fruits,features)
```

[ ]:
```
# see the data after scaled
scaled_fruits.head()
```

[ ]:
```
# distribution after scaled
fig, axs = plt.subplots(ncols=3, nrows=4, figsize=(16, 10))
index = 0
```

```
axs = axs.flatten()

# sns.distplot(fruits[k].values, bins=20, ax=axs[index])
#for k,v in scaled_fruits.items():
for k in features:
    scaled_fruits[k].hist(bins=20, ax=axs[index])
    axs[index].set_title(k)
    index += 1
plt.tight_layout(pad=0.5, w_pad=0.5, h_pad=3)
```

Dataset taken from `https://www.kaggle.com/datasets/harishkumardatalab/data-science-salary-2021-`

[ ]:
```
salary_data = pd.read_csv('data_science_salary_2021_2023.csv')
```

[ ]:
```
salary_data.shape
```

[ ]:
```
(3761, 9)
```

[ ]:
```
salary_data.head()
```

[ ]:
```
   work_year experience_level employment_type                 job_title  \
0       2023               EN              FT         Applied Scientist
1       2023               EN              FT         Applied Scientist
2       2023               EN              FT      Data Quality Analyst
3       2023               EN              FT   Compliance Data Analyst
4       2023               EN              FT         Applied Scientist

   salary salary_currency  salary_in_usd company_location company_size
0  213660             USD         213660               US            L
1  130760             USD         130760               US            L
2  100000             USD         100000               NG            L
3   30000             USD          30000               NG            L
4  204620             USD         204620               US            L
```

[ ]:
```
salary_data.columns
```

[ ]:
```
Index(['work_year', 'experience_level', 'employment_type', 'job_title',
       'salary', 'salary_currency', 'salary_in_usd', 'company_location',
       'company_size'],
      dtype='object')
```

[ ]:
```
salary_data['experience_level'].unique()
```

[ ]:
```
array(['EN', 'EX', 'MI', 'SE'], dtype=object)
```

[ ]:
```
salary_data['company_location'].unique()
```

[ ]: array(['US', 'NG', 'IN', 'CA', 'ES', 'GH', 'DE', 'CH', 'AU', 'SE', 'BR',
       'GB', 'VN', 'BA', 'GR', 'HK', 'NL', 'FI', 'IE', 'SG', 'SI', 'MX',
       'FR', 'HR', 'AM', 'KE', 'RO', 'TH', 'CF', 'UA', 'IL', 'CO', 'PT',
       'EE', 'LV', 'MK', 'PK', 'IT', 'MA', 'AR', 'CR', 'IR', 'HU', 'AS',
       'BE', 'AT', 'ID', 'LU', 'MY', 'CZ', 'DZ', 'RU', 'PL', 'LT', 'TR',
       'BO', 'EG', 'AL', 'SK', 'PR', 'AE', 'DK', 'IQ', 'CN', 'BS', 'JP',
       'CL', 'MD', 'MT', 'PH', 'HN', 'NZ'], dtype=object)

[ ]:
```
salary_data['job_title'].value_counts()
```

[ ]:
```
job_title
Data Engineer                1040
Data Scientist                840
Data Analyst                  614
Machine Learning Engineer     291
Analytics Engineer            103
                             …
Compliance Data Analyst         1
BI Data Engineer                1
Deep Learning Researcher        1
Head of Machine Learning        1
Staff Data Analyst              1
Name: count, Length: 93, dtype: int64
```

[ ]:
```
salary_data['work_year'].unique()
```

[ ]: array([2023, 2022, 2021, 2020], dtype=int64)

[ ]:
```
salary_data['job_title'].unique()
```

[ ]:
```
array(['Applied Scientist', 'Data Quality Analyst',
       'Compliance Data Analyst', 'Machine Learning Engineer',
       'Research Scientist', 'Data Engineer', 'Data Analyst',
       'Data Scientist', 'BI Data Engineer', 'Research Engineer',
       'Business Data Analyst', 'Autonomous Vehicle Technician',
       'Applied Machine Learning Scientist', 'AI Programmer',
       'AI Developer', 'Computer Vision Engineer', 'BI Developer',
       'Big Data Engineer', 'Deep Learning Engineer', 'Head of Data',
       'Analytics Engineer', 'Data Architect', 'Director of Data Science',
       'Head of Data Science', 'Data Analytics Manager', 'ML Engineer',
       'Applied Machine Learning Engineer', 'Applied Data Scientist',
       'ETL Engineer', 'Data Specialist', 'Lead Data Analyst',
       'Data Manager', 'Machine Learning Scientist', 'MLOps Engineer',
       'Financial Data Analyst', 'Software Data Engineer',
       'Data Science Manager', 'Data Science Consultant',
       'Machine Learning Infrastructure Engineer', 'Insight Analyst',
       'AI Scientist', 'Data Infrastructure Engineer',
       'Data Science Lead', 'Product Data Analyst', 'Data Analytics Lead',
```

```
       'Machine Learning Research Engineer', 'Principal Data Scientist',
       'Data Modeler', 'Business Intelligence Engineer',
       'Data Strategist', 'Data DevOps Engineer',
       'Machine Learning Researcher', 'Cloud Database Engineer',
       'Data Operations Engineer', 'Deep Learning Researcher',
       'BI Analyst', 'Data Analytics Specialist', 'BI Data Analyst',
       'Machine Learning Software Engineer', 'Big Data Architect',
       'Computer Vision Software Engineer', 'Azure Data Engineer',
       'Data Lead', 'Data Science Engineer', 'NLP Engineer',
       'Machine Learning Developer', 'Data Analytics Engineer',
       'Data Analytics Consultant', '3D Computer Vision Researcher',
       'Lead Data Engineer', 'Head of Machine Learning',
       'Data Scientist Lead', 'Lead Data Scientist', 'ETL Developer',
       'Principal Data Analyst', 'Manager Data Management',
       'Principal Machine Learning Engineer',
       'Data Management Specialist', 'Data Science Tech Lead',
       'Cloud Data Engineer', 'Data Operations Analyst',
       'Marketing Data Analyst', 'Product Data Scientist',
       'Principal Data Architect', 'Machine Learning Manager',
       'Lead Machine Learning Engineer', 'Marketing Data Engineer',
       'Power BI Developer', 'Cloud Data Architect',
       'Principal Data Engineer', 'Staff Data Scientist',
       'Finance Data Analyst', 'Staff Data Analyst'], dtype=object)
```

[ ]:
```
salary_data.salary
```

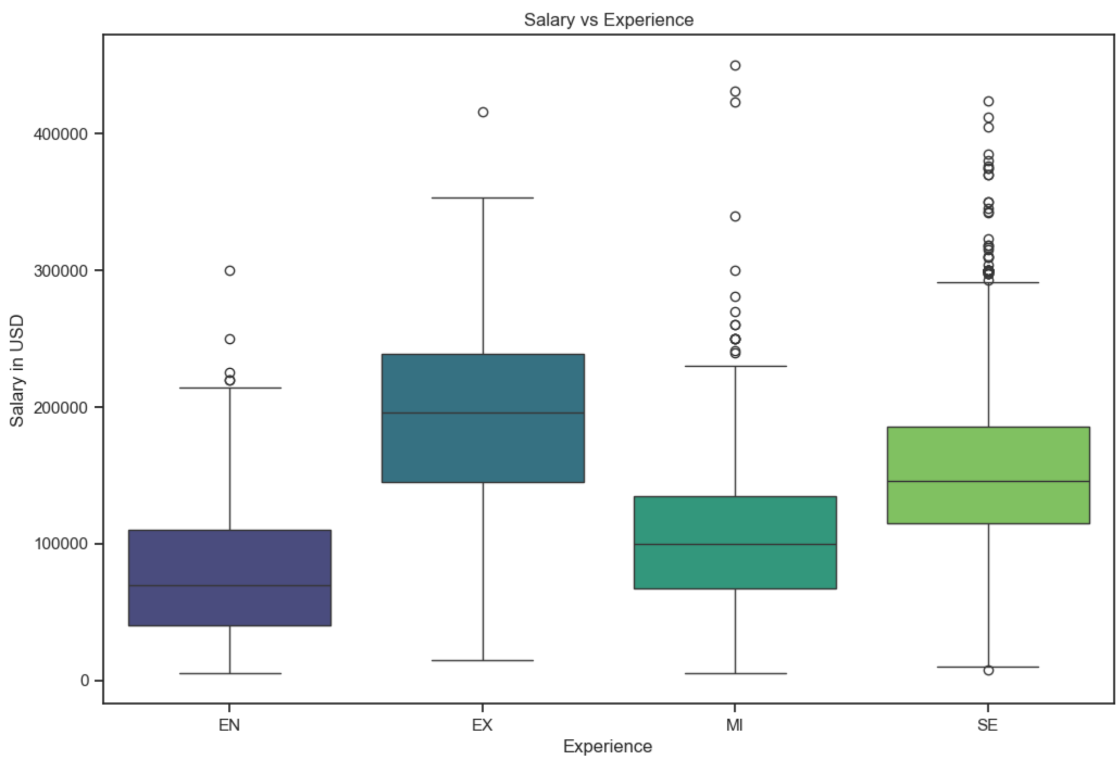
[ ]:
```
0       213660
1       130760
2       100000
3        30000
4       204620
         …
3756    130000
3757     80000
3758    190200
3759     40000
3760    412000
Name: salary, Length: 3761, dtype: int64
```

Salary vs Experience | Use proper visualization technique to show the relationship between salary vs experience (2 marks)

[ ]:
```
plt.figure(figsize=(12, 8))

sns.boxplot(x='experience_level', y='salary_in_usd', data=salary_data,
 palette='viridis')

plt.title('Salary vs Experience')
```

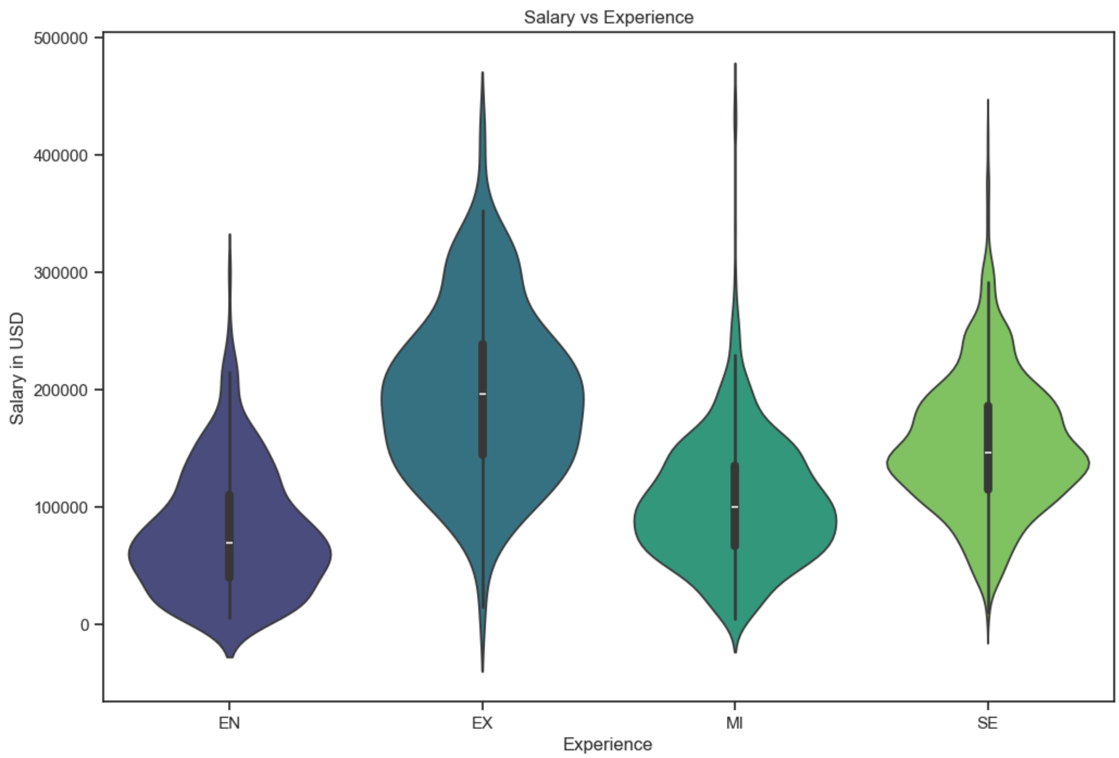
```
plt.xlabel('Experience')
plt.ylabel('Salary in USD')
plt.show()
```

```
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\3867932903.py:3:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.boxplot(x='experience_level', y='salary_in_usd', data=salary_data,
palette='viridis')
```



[ ]:
```
plt.figure(figsize=(12, 8))

sns.violinplot(x='experience_level', y='salary_in_usd', data=salary_data,␣
    ↪palette='viridis')

plt.title('Salary vs Experience')
plt.xlabel('Experience')
plt.ylabel('Salary in USD')
plt.show()
```

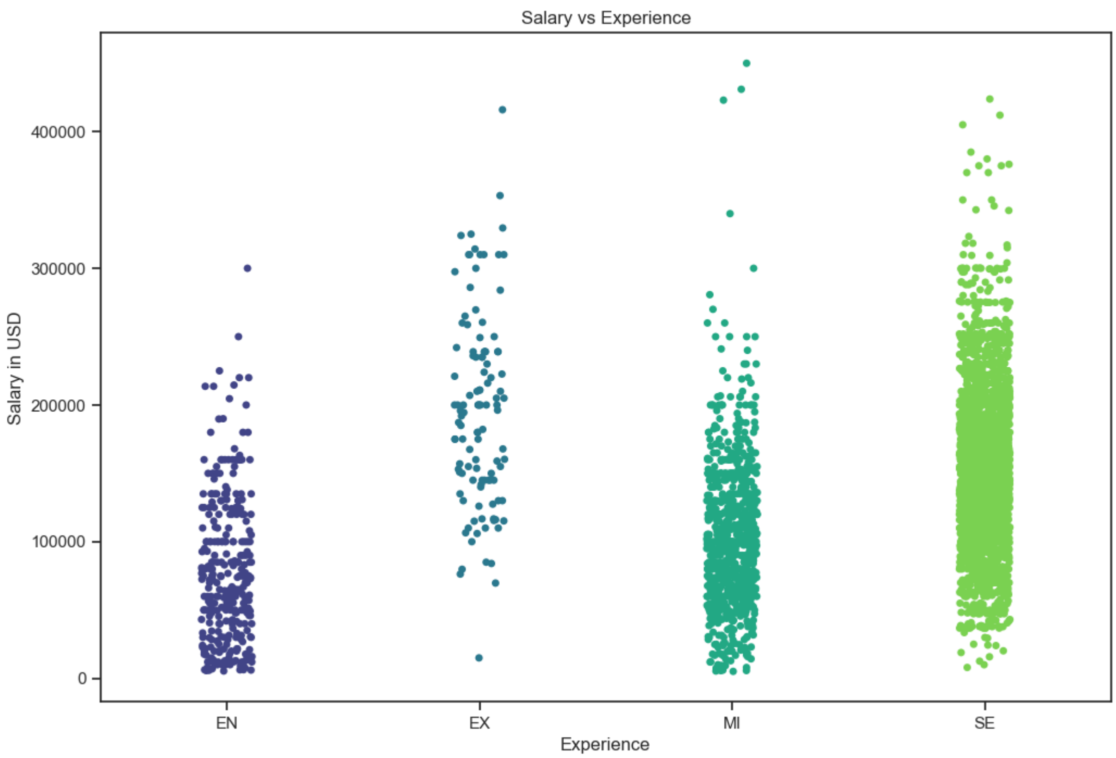
```
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\771222664.py:3: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.violinplot(x='experience_level', y='salary_in_usd', data=salary_data,
palette='viridis')
```



[ ]:
```
plt.figure(figsize=(12, 8))

# Plots individual data points for each category, showing the spread and␣
↪clustering of values
sns.stripplot(x='experience_level', y='salary_in_usd', data=salary_data,␣
↪palette='viridis')

plt.title('Salary vs Experience')
plt.xlabel('Experience')
plt.ylabel('Salary in USD')
plt.show()
```

```
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\2105702522.py:3:
FutureWarning:
```

```
Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.stripplot(x='experience_level', y='salary_in_usd', data=salary_data,
palette='viridis')
```



Salary vs employment_type | Use proper visualization technique to show the relationship between salary vs employment_type (2 marks)

[ ]:
```
salary_data.employment_type.unique()
```

[ ]:
```
array(['FT', 'PT', 'CT', 'FL'], dtype=object)
```

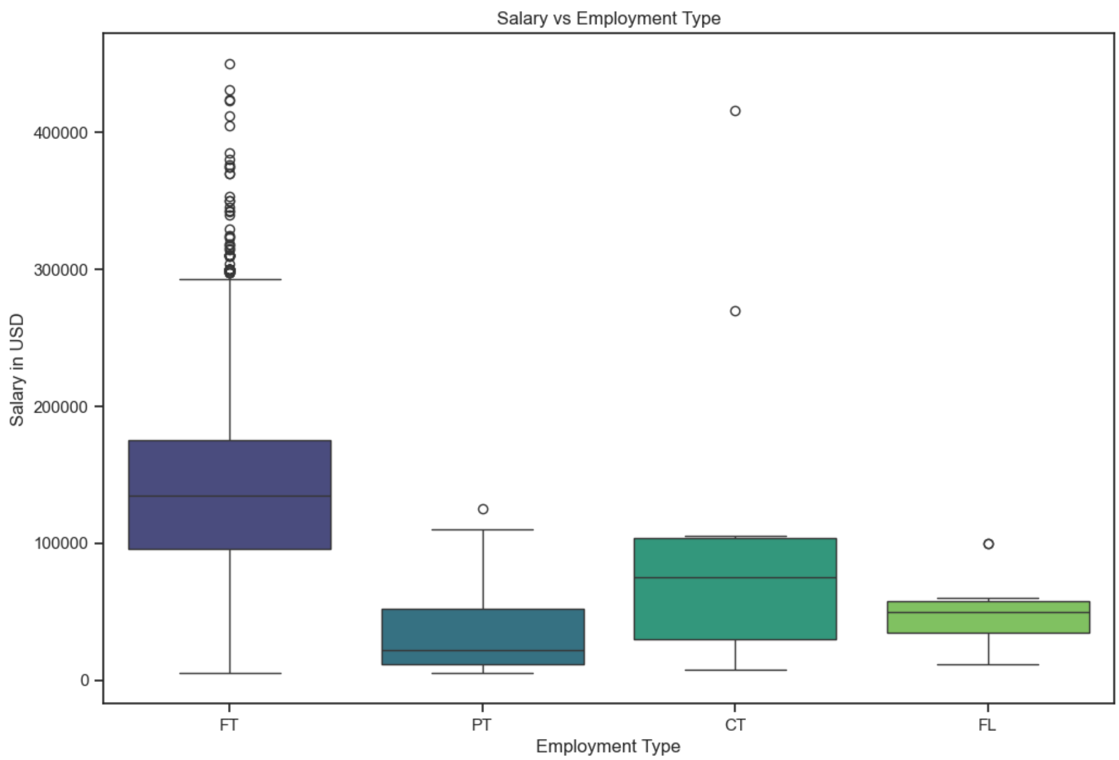
[ ]:
```
plt.figure(figsize=(12, 8))

sns.boxplot(x='employment_type', y='salary_in_usd', data=salary_data,␣
 ↪palette='viridis')

plt.title("Salary vs Employment Type")
plt.xlabel("Employment Type")
plt.ylabel("Salary in USD")
```

```
plt.show()
```

C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\3496671623.py:3:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

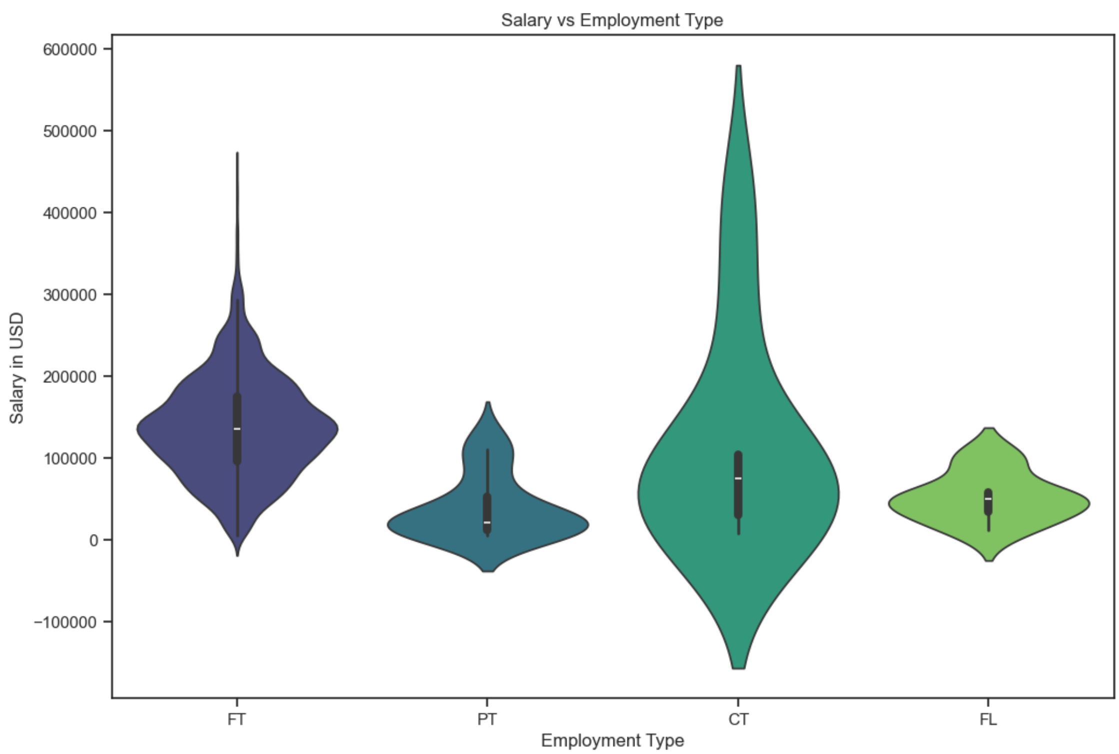
  sns.boxplot(x='employment_type', y='salary_in_usd', data=salary_data,
palette='viridis')




```
[ ]: plt.figure(figsize=(12, 8))

sns.violinplot(x='employment_type', y='salary_in_usd', data=salary_data,␣
 ↪palette='viridis')

plt.title("Salary vs Employment Type")
plt.xlabel("Employment Type")
plt.ylabel("Salary in USD")

plt.show()
```

C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\1881712386.py:3:

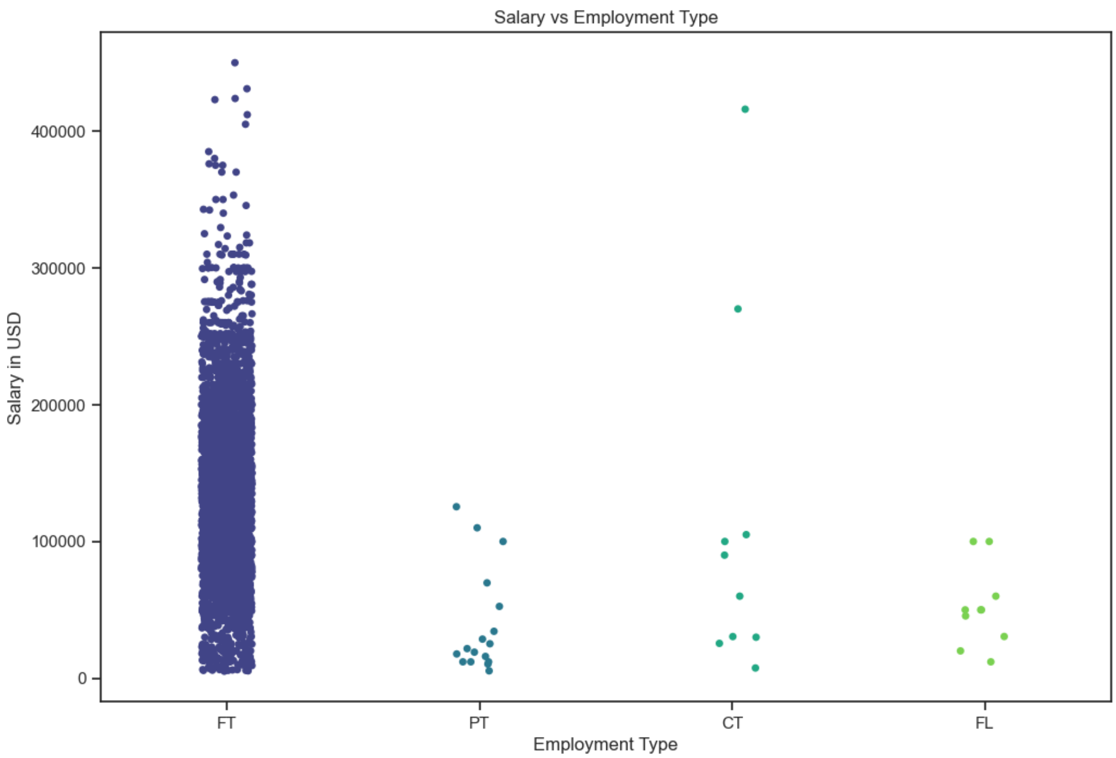
```
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.violinplot(x='employment_type', y='salary_in_usd', data=salary_data,
palette='viridis')
```



[ ]:
```python
plt.figure(figsize=(12, 8))

sns.stripplot(x='employment_type', y='salary_in_usd', data=salary_data,␣
 ↪palette='viridis')

plt.title("Salary vs Employment Type")
plt.xlabel("Employment Type")
plt.ylabel("Salary in USD")

plt.show()
```

```
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\3358226939.py:3:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in
```

```
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.stripplot(x='employment_type', y='salary_in_usd', data=salary_data,
palette='viridis')
```



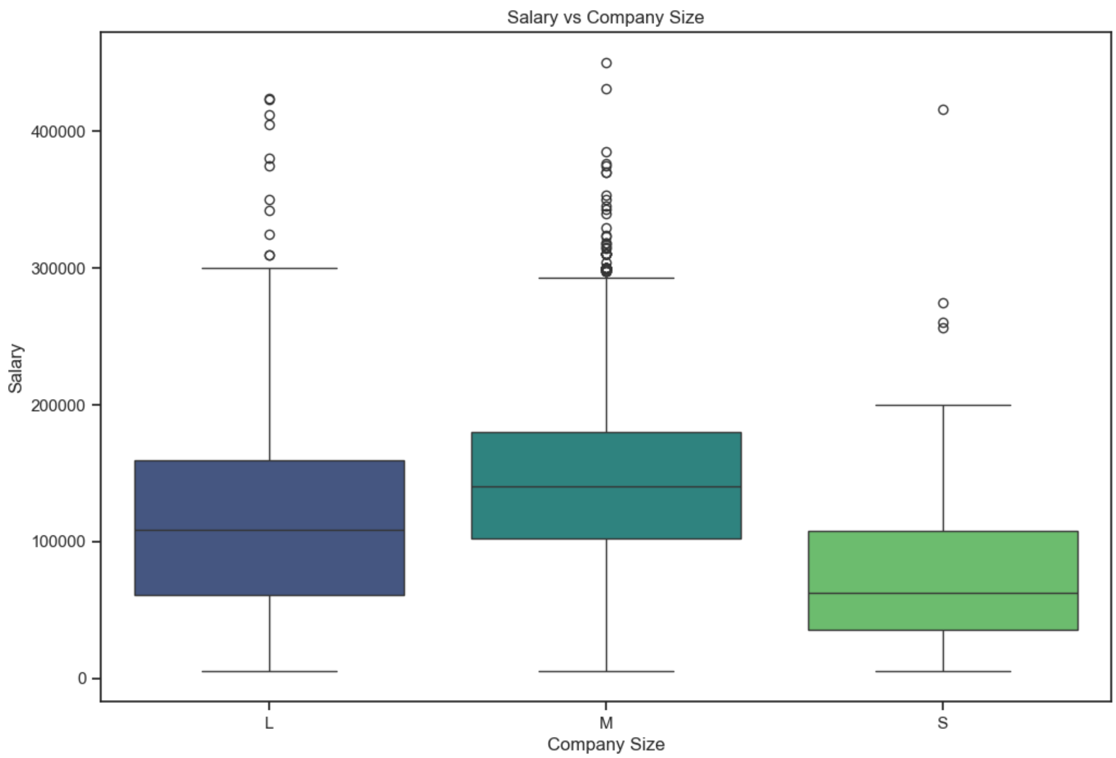
Salary vs company_size | Use proper visualization technique to show the relationship between salary vs company_size (2 marks)

[ ]:
```
salary_data.company_size.unique()
```

[ ]:
```
array(['L', 'M', 'S'], dtype=object)
```

[ ]:
```
plt.figure(figsize=(12, 8))

sns.boxplot(x='company_size', y='salary_in_usd', data=salary_data,␣
 ↪palette='viridis')

plt.title('Salary vs Company Size')
plt.xlabel('Company Size')
plt.ylabel('Salary')

plt.show()
```

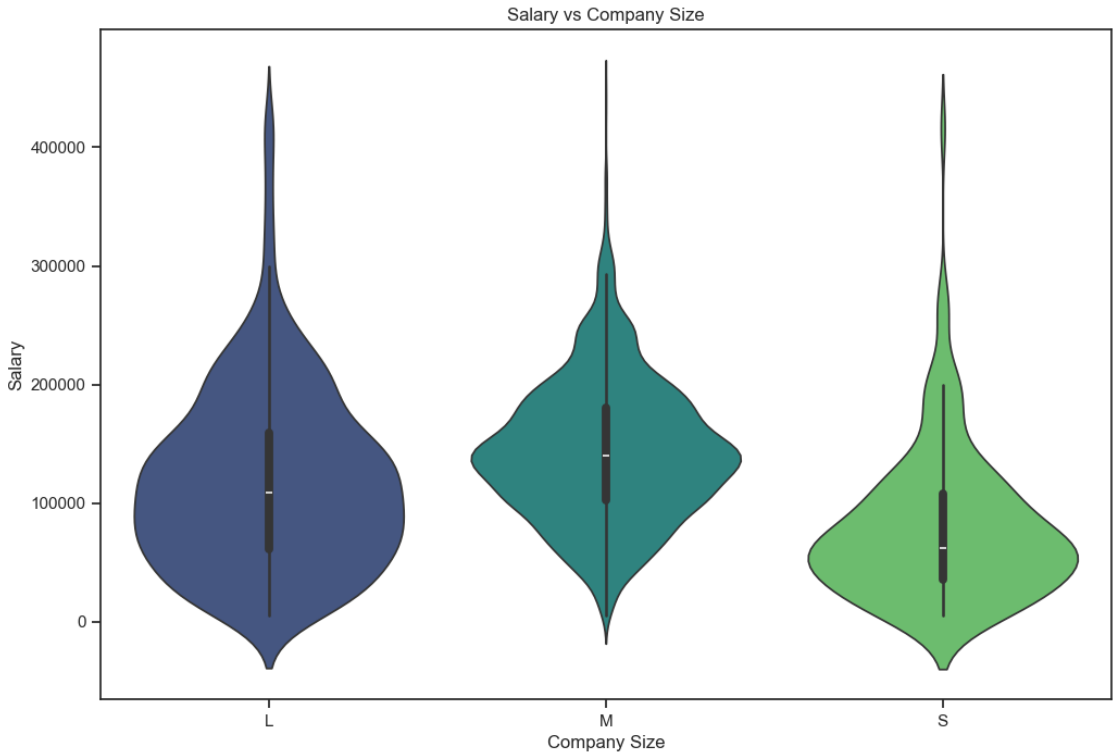
```
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\879199461.py:3: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.boxplot(x='company_size', y='salary_in_usd', data=salary_data,
palette='viridis')
```



[ ]:
```
plt.figure(figsize=(12, 8))

sns.violinplot(x='company_size', y='salary_in_usd', data=salary_data,␣
    ↪palette='viridis')

plt.title('Salary vs Company Size')
plt.xlabel('Company Size')
plt.ylabel('Salary')

plt.show()
```

```
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\3889054652.py:3:
FutureWarning:
```

```
Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.violinplot(x='company_size', y='salary_in_usd', data=salary_data,
palette='viridis')
```

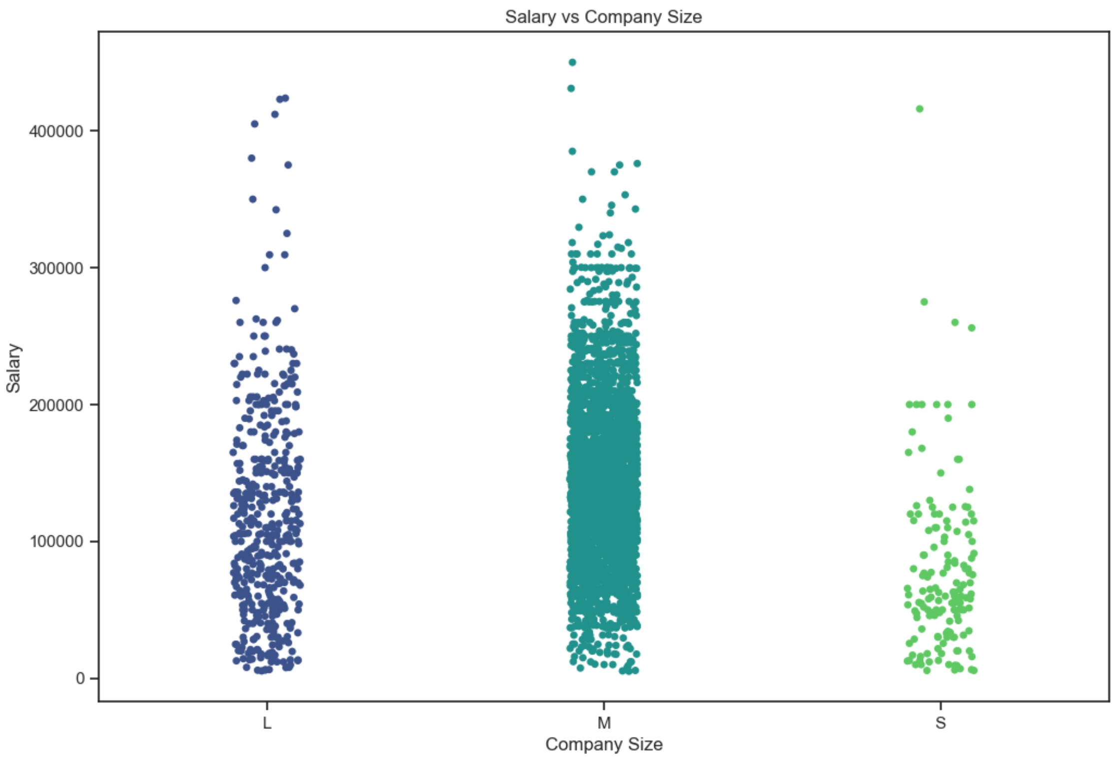


[ ]:
```python
plt.figure(figsize=(12, 8))

sns.stripplot(x='company_size', y='salary_in_usd', data=salary_data,␣
↪palette='viridis')

plt.title('Salary vs Company Size')
plt.xlabel('Company Size')
plt.ylabel('Salary')

plt.show()
```

```
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\2185805539.py:3:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
```

effect.

```
  sns.stripplot(x='company_size', y='salary_in_usd', data=salary_data,
palette='viridis')
```



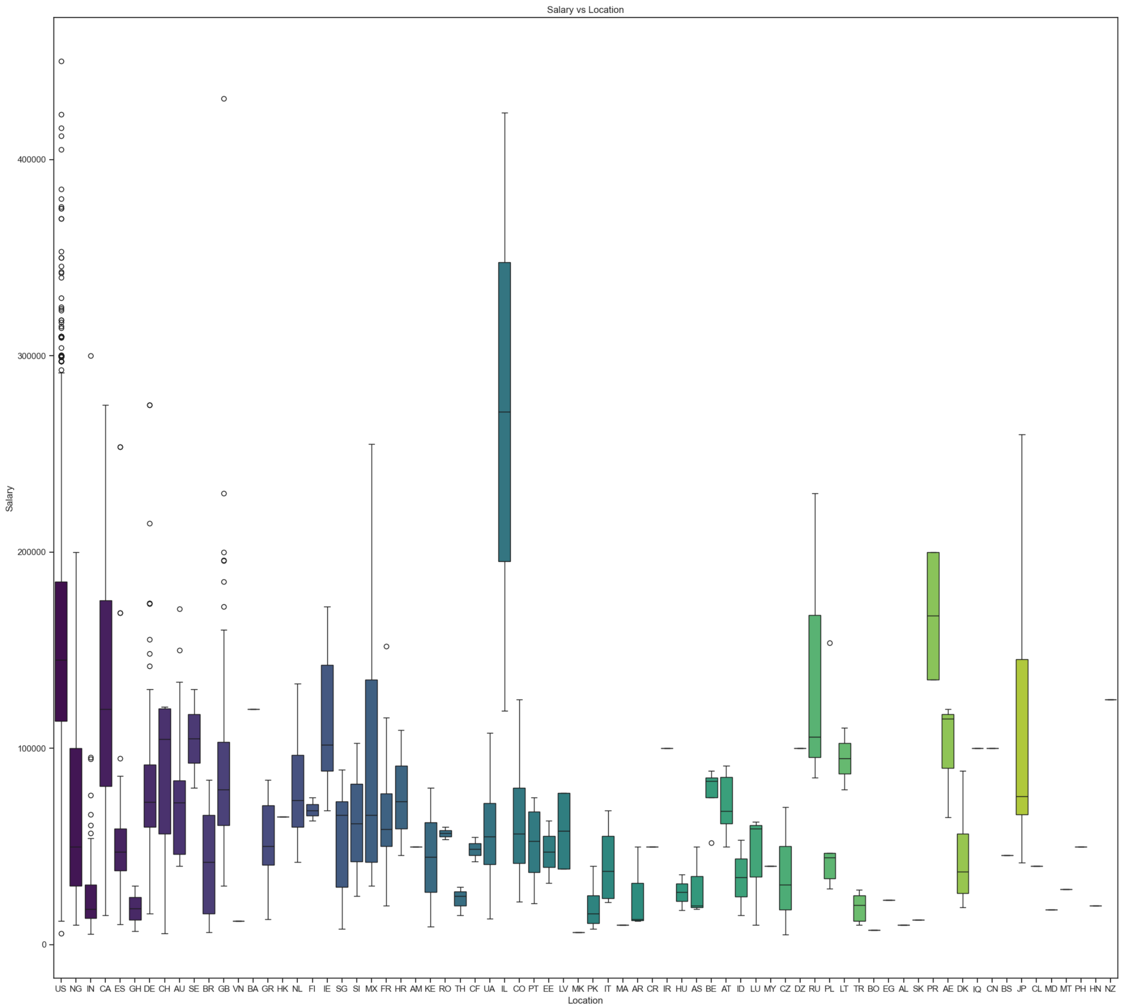
Salary vs Location | Get average salary for all the location and write out the top 3 and botton 3 location according to salaries (5 marks)

[ ]:
```
salary_per_loc = salary_data.groupby('company_location').salary_in_usd.mean().
 ↪reset_index().sort_values(by='salary_in_usd', ascending=False)
top_3_locations = salary_per_loc.head(3)
bottom_3_locations = salary_per_loc.tail(3)

top_3_locations, bottom_3_locations
```

[ ]:
```
(    company_location  salary_in_usd
 37                IL  271446.500000
 59                PR  167500.000000
 70                US  151801.053859,
     company_location  salary_in_usd
 47                MA        10000.0
 9                 BO         7500.0
 49                MK         6304.0)
```

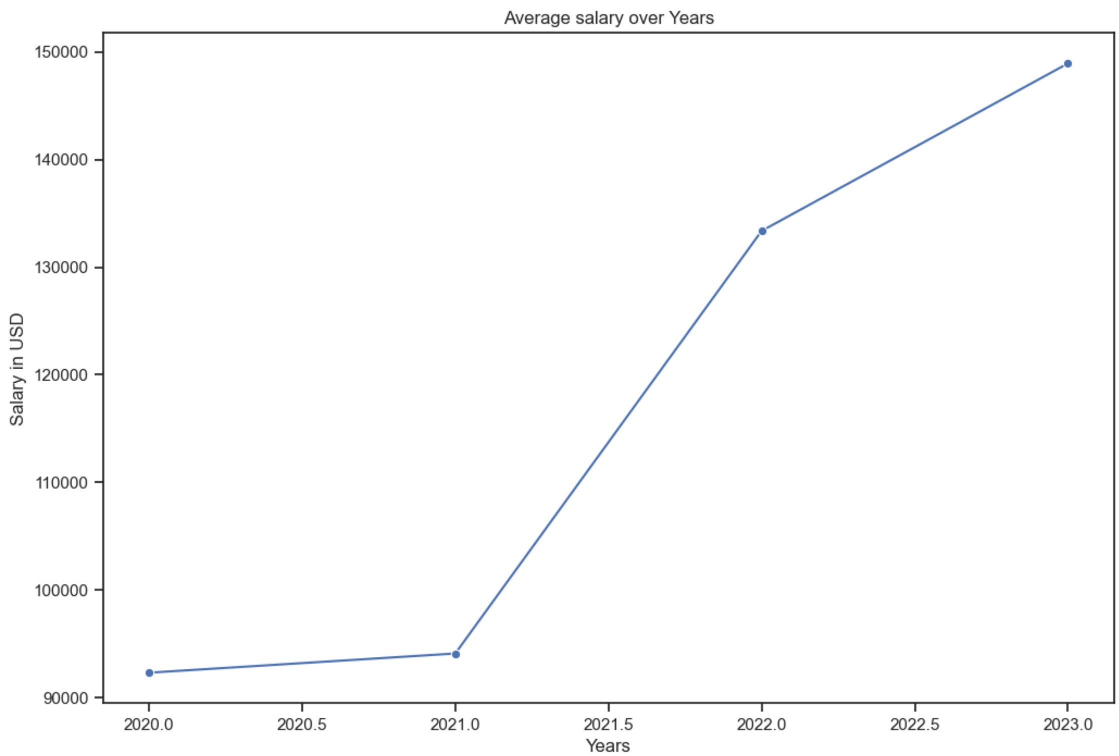
[ ]:
```
plt.figure(figsize=(20, 18))

sns.boxplot(x='company_location', y='salary_in_usd', data=salary_data,␣
 ↪palette='viridis')

plt.title("Salary vs Location")
plt.xlabel("Location")
plt.ylabel("Salary")

plt.tight_layout()
```

```
C:\Users\eraco\AppData\Local\Temp\ipykernel_14268\2941615401.py:3:
FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in
v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same
effect.

  sns.boxplot(x='company_location', y='salary_in_usd', data=salary_data,
palette='viridis')
```



Plot average salaries over the year(line chart). What is the trend of salaries/Is it increasing or decreasing? Explain. (5 marks)

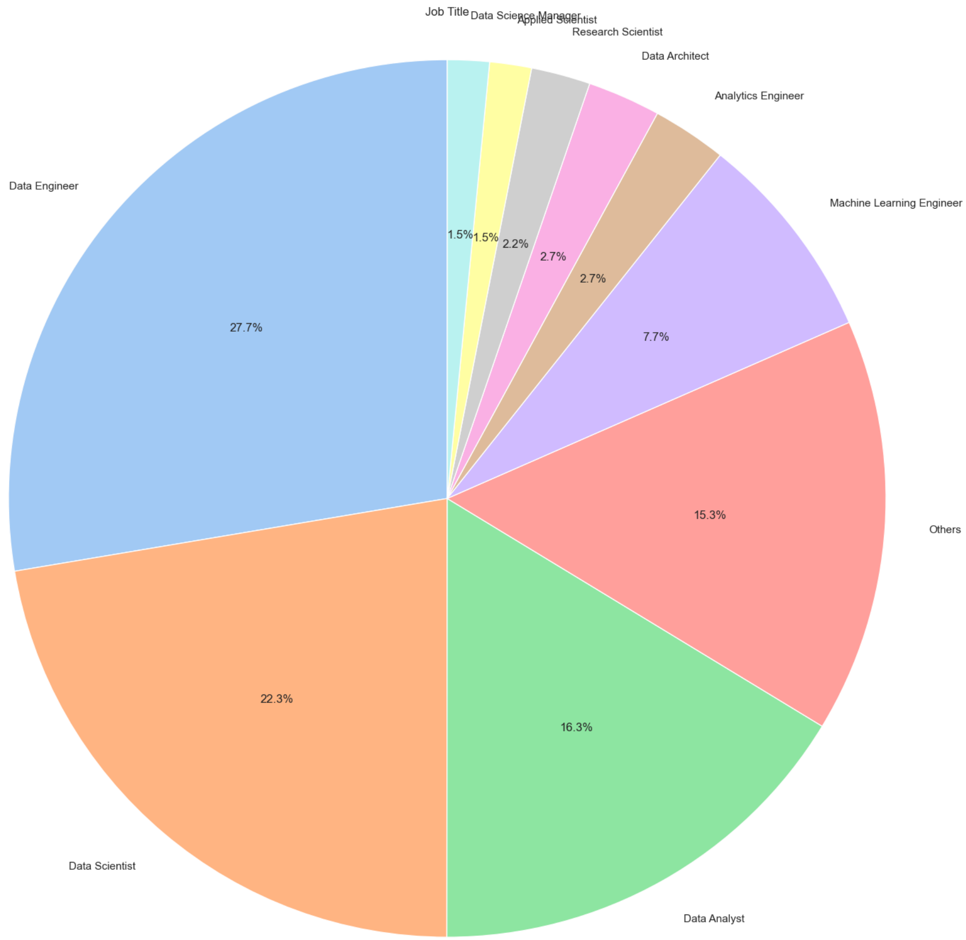
[ ]:
```
avg_salary_year = salary_data.groupby('work_year').salary_in_usd.mean().reset_index()

plt.figure(figsize=(12, 8))

sns.lineplot(x='work_year', y='salary_in_usd', data=avg_salary_year, marker='o', color='b')

plt.title("Average salary over Years")
plt.xlabel("Years")
plt.ylabel("Salary in USD")

plt.show()
```



It is clear that the salary is increasing over the years worker work in the same job. It is natural - the more experience you have, the more you competitive in the market, the more your salary.

Count values for each job title. Select the jobs that have less than 50 entries. Replace those values with `Others`. Create a pie chart. (10 marks)

[ ]:
```
job_counts = salary_data['job_title'].value_counts()

salary_data['job_title'] = salary_data['job_title'].apply(lambda x: x if␣
↪job_counts[x] >= 50 else 'Others')

updated_job_counts = salary_data['job_title'].value_counts()

plt.figure(figsize=(16, 14))
plt.pie(updated_job_counts, labels=updated_job_counts.index, autopct='%1.1f%%',␣
↪startangle=90, colors=sns.color_palette('pastel'))

plt.title('Job Title')
plt.axis('equal')

plt.tight_layout()
```



Job Title
Data Science Manager
Applied Scientist
Research Scientist
Data Architect
Analytics Engineer
Machine Learning Engineer
Others
Data Analyst
Data Scientist
Data Engineer
1.5%
1.5%
2.2%
2.7%
2.7%
7.7%
15.3%
16.3%
22.3%
27.7%