images-2.jpg

Importing libraries

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.metrics import accuracy_score, classification_report,
confusion_matrix
import warnings
warnings.filterwarnings("ignore")

plt.style.use('ggplot')
plt.rcParams['font.family'] = 'sans-serif'
plt.rcParams['font.serif'] = 'Ubuntu'
plt.rcParams['font.monospace'] = 'Ubuntu Mono'
plt.rcParams['font.size'] = 14
plt.rcParams['axes.labelsize'] = 17
plt.rcParams['axes.labelweight'] = 'bold'
plt.rcParams['axes.titlesize'] = 17
plt.rcParams['xtick.labelsize'] = 12
plt.rcParams['ytick.labelsize'] = 12
plt.rcParams['legend.fontsize'] = 12
plt.rcParams['figure.titlesize'] = 12
plt.rcParams['image.cmap'] = 'jet'
plt.rcParams['image.interpolation'] = 'none'
plt.rcParams['figure.figsize'] = (18, 12)
plt.rcParams['axes.grid']=True
plt.rcParams['lines.linewidth'] = 2
plt.rcParams['lines.markersize'] = 8
```

Import Dataset

```
data = pd.read_csv('train.csv')

print(data)
```

```
      battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0               842     0          2.2         0   1       0
7
1              1021     1          0.5         1   0       1
53
2               563     1          0.5         1   2       1
41
3               615     1          2.5         0   0       0
```

```
10
4              1821     1          1.2         0  13       1
44
...             ...   ...         ...       ...  ..     ...         .
..
1995            794     1          0.5         1   0       1
2
1996           1965     1          2.6         1   0       0
39
1997           1911     0          0.9         1   1       1
36
1998           1512     0          0.9         0   4       1
46
1999            510     1          2.0         1   5       1
45

      m_dep  mobile_wt  n_cores  ...  px_height  px_width   ram  sc_h
sc_w  \
0       0.6        188        2  ...         20       756  2549     9
7
1       0.7        136        3  ...        905      1988  2631    17
3
2       0.9        145        5  ...       1263      1716  2603    11
2
3       0.8        131        6  ...       1216      1786  2769    16
8
4       0.6        141        2  ...       1208      1212  1411     8
2
...     ...        ...      ...  ...        ...       ...   ...   ...
...
1995    0.8        106        6  ...       1222      1890   668    13
4
1996    0.2        187        4  ...        915      1965  2032    11
10
1997    0.7        108        8  ...        868      1632  3057     9
1
1998    0.1        145        5  ...        336       670   869    18
10
1999    0.9        168        6  ...        483       754  3919    19
4

      talk_time  three_g  touch_screen  wifi  price_range
0            19        0             0     1            1
1             7        1             1     0            2
2             9        1             1     0            2
3            11        1             0     0            2
4            15        1             1     0            1
...         ...      ...           ...   ...          ...
1995         19        1             1     0            0
1996         16        1             1     1            2
```

```
1997          5        1             1     0           3
1998         19        1             1     1           0
1999          2        1             1     1           3

[2000 rows x 21 columns]
```

data

```
      battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0               842     0          2.2         0   1       0
7
1              1021     1          0.5         1   0       1
53
2               563     1          0.5         1   2       1
41
3               615     1          2.5         0   0       0
10
4              1821     1          1.2         0  13       1
44
...             ...   ...          ...       ...  ..     ...         .
..
1995            794     1          0.5         1   0       1
2
1996           1965     1          2.6         1   0       0
39
1997           1911     0          0.9         1   1       1
36
1998           1512     0          0.9         0   4       1
46
1999            510     1          2.0         1   5       1
45

      m_dep  mobile_wt  n_cores  ...  px_height  px_width   ram  sc_h
sc_w  \
0       0.6        188        2  ...         20       756  2549     9
7
1       0.7        136        3  ...        905      1988  2631    17
3
2       0.9        145        5  ...       1263      1716  2603    11
2
3       0.8        131        6  ...       1216      1786  2769    16
8
4       0.6        141        2  ...       1208      1212  1411     8
2
...     ...        ...      ...  ...        ...       ...   ...   ...
...
1995    0.8        106        6  ...       1222      1890   668    13
4
1996    0.2        187        4  ...        915      1965  2032    11
```

```
10
1997    0.7        108        8  ...        868      1632  3057     9
1
1998    0.1        145        5  ...        336       670   869    18
10
1999    0.9        168        6  ...        483       754  3919    19
4

      talk_time  three_g  touch_screen  wifi  price_range
0            19        0             0     1            1
1             7        1             1     0            2
2             9        1             1     0            2
3            11        1             0     0            2
4            15        1             1     0            1
...         ...      ...           ...   ...          ...
1995         19        1             1     0            0
1996         16        1             1     1            2
1997          5        1             1     0            3
1998         19        1             1     1            0
1999          2        1             1     1            3

[2000 rows x 21 columns]
```

Testing Data

```
test_data = pd.read_csv("test.csv")

print(test_data)
```

```
       id  battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0       1           1043     1          1.8         1  14       0
5
1       2            841     1          0.5         1   4       1
61
2       3           1807     1          2.8         0   1       0
27
3       4           1546     0          0.5         1  18       1
25
4       5           1434     0          1.4         0  11       1
49
..    ...            ...   ...          ...       ...  ..     ...
...
995   996           1700     1          1.9         0   0       1
54
996   997            609     0          1.8         1   0       0
13
997   998           1185     0          1.4         0   1       1
8
998   999           1533     1          0.5         1   0       0
50
```

```
999  1000           1270     1          0.5         0   4       1
35

     m_dep  mobile_wt  ...  pc  px_height  px_width   ram  sc_h  sc_w
\
0      0.1        193  ...  16        226      1412  3476    12     7

1      0.8        191  ...  12        746       857  3895     6     0

2      0.9        186  ...   4       1270      1366  2396    17    10

3      0.5         96  ...  20        295      1752  3893    10     0

4      0.5        108  ...  18        749       810  1773    15     8

..     ...        ...  ...  ..        ...       ...   ...   ...   ...

995    0.5        170  ...  17        644       913  2121    14     8

996    0.9        186  ...   2       1152      1632  1933     8     1

997    0.5         80  ...  12        477       825  1223     5     0

998    0.4        171  ...  12         38       832  2509    15    11

999    0.1        140  ...  19        457       608  2828     9     2


     talk_time  three_g  touch_screen  wifi
0            2        0             1     0
1            7        1             0     0
2           10        0             1     1
3            7        1             1     0
4            7        1             0     1
..         ...      ...           ...   ...
995         15        1             1     0
996         19        0             1     1
997         14        1             0     0
998          6        0             1     0
999          3        1             0     1

[1000 rows x 21 columns]

test_data

       id  battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0       1           1043     1          1.8         1  14       0
5
```

```
1       2            841     1          0.5         1   4       1
61
2       3           1807     1          2.8         0   1       0
27
3       4           1546     0          0.5         1  18       1
25
4       5           1434     0          1.4         0  11       1
49
..    ...            ...   ...          ...       ...  ..     ...
...
995   996           1700     1          1.9         0   0       1
54
996   997            609     0          1.8         1   0       0
13
997   998           1185     0          1.4         0   1       1
8
998   999           1533     1          0.5         1   0       0
50
999  1000           1270     1          0.5         0   4       1
35

     m_dep  mobile_wt  ...  pc  px_height  px_width   ram  sc_h  sc_w
\
0      0.1        193  ...  16        226      1412  3476    12     7

1      0.8        191  ...  12        746       857  3895     6     0

2      0.9        186  ...   4       1270      1366  2396    17    10

3      0.5         96  ...  20        295      1752  3893    10     0

4      0.5        108  ...  18        749       810  1773    15     8

..     ...        ...  ...  ..        ...       ...   ...   ...   ...

995    0.5        170  ...  17        644       913  2121    14     8

996    0.9        186  ...   2       1152      1632  1933     8     1

997    0.5         80  ...  12        477       825  1223     5     0

998    0.4        171  ...  12         38       832  2509    15    11

999    0.1        140  ...  19        457       608  2828     9     2


     talk_time  three_g  touch_screen  wifi
0            2        0             1     0
1            7        1             0     0
```

```
2           10        0             1     1
3            7        1             1     0
4            7        1             0     1
..         ...      ...           ...   ...
995         15        1             1     0
996         19        0             1     1
997         14        1             0     0
998          6        0             1     0
999          3        1             0     1

[1000 rows x 21 columns]
```

```
test_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   id             1000 non-null   int64
 1   battery_power  1000 non-null   int64
 2   blue           1000 non-null   int64
 3   clock_speed    1000 non-null   float64
 4   dual_sim       1000 non-null   int64
 5   fc             1000 non-null   int64
 6   four_g         1000 non-null   int64
 7   int_memory     1000 non-null   int64
 8   m_dep          1000 non-null   float64
 9   mobile_wt      1000 non-null   int64
 10  n_cores        1000 non-null   int64
 11  pc             1000 non-null   int64
 12  px_height      1000 non-null   int64
 13  px_width       1000 non-null   int64
 14  ram            1000 non-null   int64
 15  sc_h           1000 non-null   int64
 16  sc_w           1000 non-null   int64
 17  talk_time      1000 non-null   int64
 18  three_g        1000 non-null   int64
 19  touch_screen   1000 non-null   int64
 20  wifi           1000 non-null   int64
dtypes: float64(2), int64(19)
memory usage: 164.2 KB
```

```
test_data.describe(include ='all')
```

```
                id  battery_power         blue  clock_speed
dual_sim  \
count  1000.000000    1000.000000  1000.000000  1000.000000
1000.000000
mean    500.500000    1248.510000     0.516000     1.540900
0.517000
```

```
std     288.819436     432.458227     0.499994     0.829268
0.499961
min       1.000000     500.000000     0.000000     0.500000
0.000000
25%     250.750000     895.000000     0.000000     0.700000
0.000000
50%     500.500000    1246.500000     1.000000     1.500000
1.000000
75%     750.250000    1629.250000     1.000000     2.300000
1.000000
max    1000.000000    1999.000000     1.000000     3.000000
1.000000

                fc       four_g   int_memory        m_dep   mobile_wt
...  \
count  1000.000000  1000.000000  1000.000000  1000.000000  1000.00000
...
mean      4.593000     0.487000    33.652000     0.517500   139.51100
...
std       4.463325     0.500081    18.128694     0.280861    34.85155
...
min       0.000000     0.000000     2.000000     0.100000    80.00000
...
25%       1.000000     0.000000    18.000000     0.300000   109.75000
...
50%       3.000000     0.000000    34.500000     0.500000   139.00000
...
75%       7.000000     1.000000    49.000000     0.800000   170.00000
...
max      19.000000     1.000000    64.000000     1.000000   200.00000
...

                pc    px_height     px_width          ram         sc_h
\
count  1000.000000  1000.000000  1000.000000  1000.000000  1000.000000

mean     10.054000   627.121000  1239.774000  2138.998000    11.995000

std       6.095099   432.929699   439.670981  1088.092278     4.320607

min       0.000000     0.000000   501.000000   263.000000     5.000000

25%       5.000000   263.750000   831.750000  1237.250000     8.000000

50%      10.000000   564.500000  1250.000000  2153.500000    12.000000

75%      16.000000   903.000000  1637.750000  3065.500000    16.000000

max      20.000000  1907.000000  1998.000000  3989.000000    19.000000
```

```
              sc_w    talk_time      three_g  touch_screen
wifi
count  1000.000000  1000.000000  1000.000000    1000.00000
1000.000000
mean      5.316000    11.085000     0.756000       0.50000
0.507000
std       4.240062     5.497636     0.429708       0.50025
0.500201
min       0.000000     2.000000     0.000000       0.00000
0.000000
25%       2.000000     6.750000     1.000000       0.00000
0.000000
50%       5.000000    11.000000     1.000000       0.50000
1.000000
75%       8.000000    16.000000     1.000000       1.00000
1.000000
max      18.000000    20.000000     1.000000       1.00000
1.000000

[8 rows x 21 columns]
```

```
pd.DataFrame(test_data.isnull().sum(), columns= ['Number of missing
values'])
```

```
               Number of missing values
id                                    0
battery_power                         0
blue                                  0
clock_speed                           0
dual_sim                              0
fc                                    0
four_g                                0
int_memory                            0
m_dep                                 0
mobile_wt                             0
n_cores                               0
pc                                    0
px_height                             0
px_width                              0
ram                                   0
sc_h                                  0
sc_w                                  0
talk_time                             0
three_g                               0
touch_screen                          0
wifi                                  0
```

Tranning Data

```
data.describe(include='all')
```

```
       battery_power       blue  clock_speed     dual_sim           fc
\
count    2000.000000  2000.0000  2000.000000  2000.000000  2000.000000

mean     1238.518500     0.4950     1.522250     0.509500     4.309500

std       439.418206     0.5001     0.816004     0.500035     4.341444

min       501.000000     0.0000     0.500000     0.000000     0.000000

25%       851.750000     0.0000     0.700000     0.000000     1.000000

50%      1226.000000     0.0000     1.500000     1.000000     3.000000

75%      1615.250000     1.0000     2.200000     1.000000     7.000000

max      1998.000000     1.0000     3.000000     1.000000    19.000000


             four_g   int_memory        m_dep    mobile_wt      n_cores
...  \
count  2000.000000  2000.000000  2000.000000  2000.000000  2000.000000
...
mean      0.521500    32.046500     0.501750   140.249000     4.520500
...
std       0.499662    18.145715     0.288416    35.399655     2.287837
...
min       0.000000     2.000000     0.100000    80.000000     1.000000
...
25%       0.000000    16.000000     0.200000   109.000000     3.000000
...
50%       1.000000    32.000000     0.500000   141.000000     4.000000
...
75%       1.000000    48.000000     0.800000   170.000000     7.000000
...
max       1.000000    64.000000     1.000000   200.000000     8.000000
...

         px_height     px_width          ram         sc_h         sc_w
\
count  2000.000000  2000.000000  2000.000000  2000.000000  2000.000000

mean    645.108000  1251.515500  2124.213000    12.306500     5.767000

std     443.780811   432.199447  1084.732044     4.213245     4.356398

min       0.000000   500.000000   256.000000     5.000000     0.000000
```

```
25%     282.750000   874.750000  1207.500000     9.000000     2.000000

50%     564.000000  1247.000000  2146.500000    12.000000     5.000000

75%     947.250000  1633.000000  3064.500000    16.000000     9.000000

max    1960.000000  1998.000000  3998.000000    19.000000    18.000000


         talk_time      three_g  touch_screen         wifi
price_range
count  2000.000000  2000.000000   2000.000000  2000.000000
2000.000000
mean     11.011000     0.761500      0.503000     0.507000
1.500000
std       5.463955     0.426273      0.500116     0.500076
1.118314
min       2.000000     0.000000      0.000000     0.000000
0.000000
25%       6.000000     1.000000      0.000000     0.000000
0.750000
50%      11.000000     1.000000      1.000000     1.000000
1.500000
75%      16.000000     1.000000      1.000000     1.000000
2.250000
max      20.000000     1.000000      1.000000     1.000000
3.000000

[8 rows x 21 columns]

data.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2000 entries, 0 to 1999
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   battery_power  2000 non-null   int64
 1   blue           2000 non-null   int64
 2   clock_speed    2000 non-null   float64
 3   dual_sim       2000 non-null   int64
 4   fc             2000 non-null   int64
 5   four_g         2000 non-null   int64
 6   int_memory     2000 non-null   int64
 7   m_dep          2000 non-null   float64
 8   mobile_wt      2000 non-null   int64
 9   n_cores        2000 non-null   int64
 10  pc             2000 non-null   int64
 11  px_height      2000 non-null   int64
```

```
 12  px_width       2000 non-null   int64
 13  ram            2000 non-null   int64
 14  sc_h           2000 non-null   int64
 15  sc_w           2000 non-null   int64
 16  talk_time      2000 non-null   int64
 17  three_g        2000 non-null   int64
 18  touch_screen   2000 non-null   int64
 19  wifi           2000 non-null   int64
 20  price_range    2000 non-null   int64
dtypes: float64(2), int64(19)
memory usage: 328.2 KB
```

Checking the missing values

```
pd.DataFrame(data.isnull().sum(), columns= ['Number of missing
values']) #Any missing values.
```

```
               Number of missing values
battery_power                         0
blue                                  0
clock_speed                           0
dual_sim                              0
fc                                    0
four_g                                0
int_memory                            0
m_dep                                 0
mobile_wt                             0
n_cores                               0
pc                                    0
px_height                             0
px_width                              0
ram                                   0
sc_h                                  0
sc_w                                  0
talk_time                             0
three_g                               0
touch_screen                          0
wifi                                  0
price_range                           0
```

There is no missing value in the dataset.✓

```
#Finding number of unique values of each column
pd.DataFrame(data.nunique().sort_values(), columns= ['Number of unique
values'])
```

```
               Number of unique values
blue                                 2
touch_screen                         2
dual_sim                             2
four_g                               2
three_g                              2
wifi                                 2
```

```
price_range                    4
n_cores                        8
m_dep                         10
sc_h                          15
talk_time                     19
sc_w                          19
fc                            20
pc                            21
clock_speed                   26
int_memory                    63
mobile_wt                    121
battery_power               1094
px_width                    1109
px_height                   1137
ram                         1562
```

Testing data Missing Values

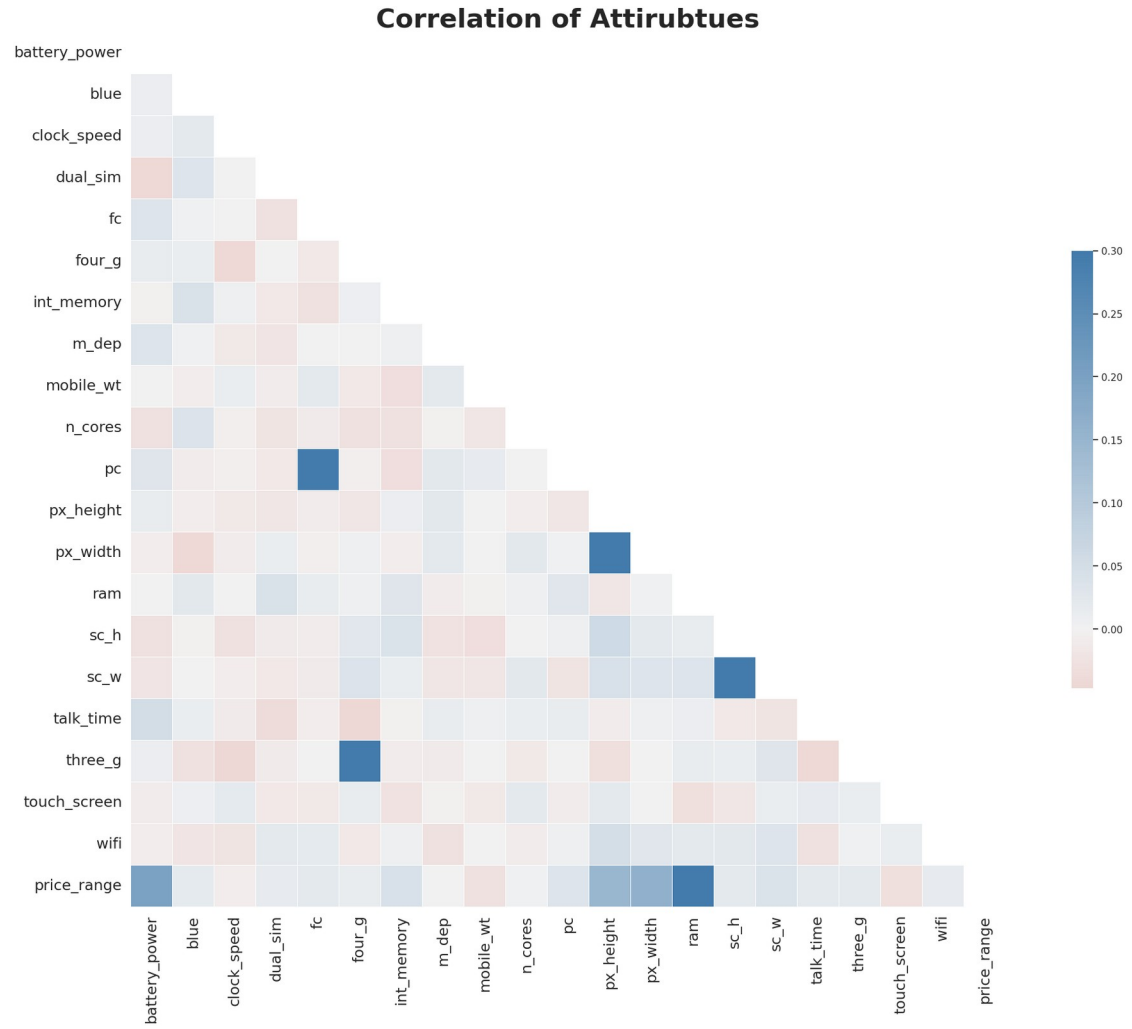
```
pd.DataFrame(test_data.nunique().sort_values(), columns= ['Number of
unique values'])
```

```
               Number of unique values
wifi                                 2
three_g                              2
blue                                 2
touch_screen                         2
dual_sim                             2
four_g                               2
n_cores                              8
m_dep                               10
sc_h                                15
sc_w                                19
talk_time                           19
fc                                  20
pc                                  21
clock_speed                         26
int_memory                          63
mobile_wt                          121
px_height                          694
battery_power                      721
px_width                           743
ram                                872
id                                1000
```

Correlation of Attirubtues

```
sns.set(style="white")
# Compute the correlation matrix
corr = data.corr()
# Generate a mask for the upper triangle
```

```
mask = np.zeros_like(corr, dtype=np.bool)
mask[np.triu_indices_from(mask)] = True
# Set up the matplotlib figure
f, ax = plt.subplots(figsize=(27,18))
# Generate a custom diverging colormap
cmap = sns.diverging_palette(15,963 ,as_cmap=True)
# Draw the heatmap with the mask and correct aspect ratio
sns.heatmap(corr, mask=mask, cmap=cmap, vmax=.3, center=0,square=True,
linewidths=.5, cbar_kws={"shrink": .5})
plt.title("Correlation of Attirubtues",fontsize=30,fontweight='bold')
ax.xaxis.set_tick_params(labelsize=17)
ax.yaxis.set_tick_params(labelsize=17)
```



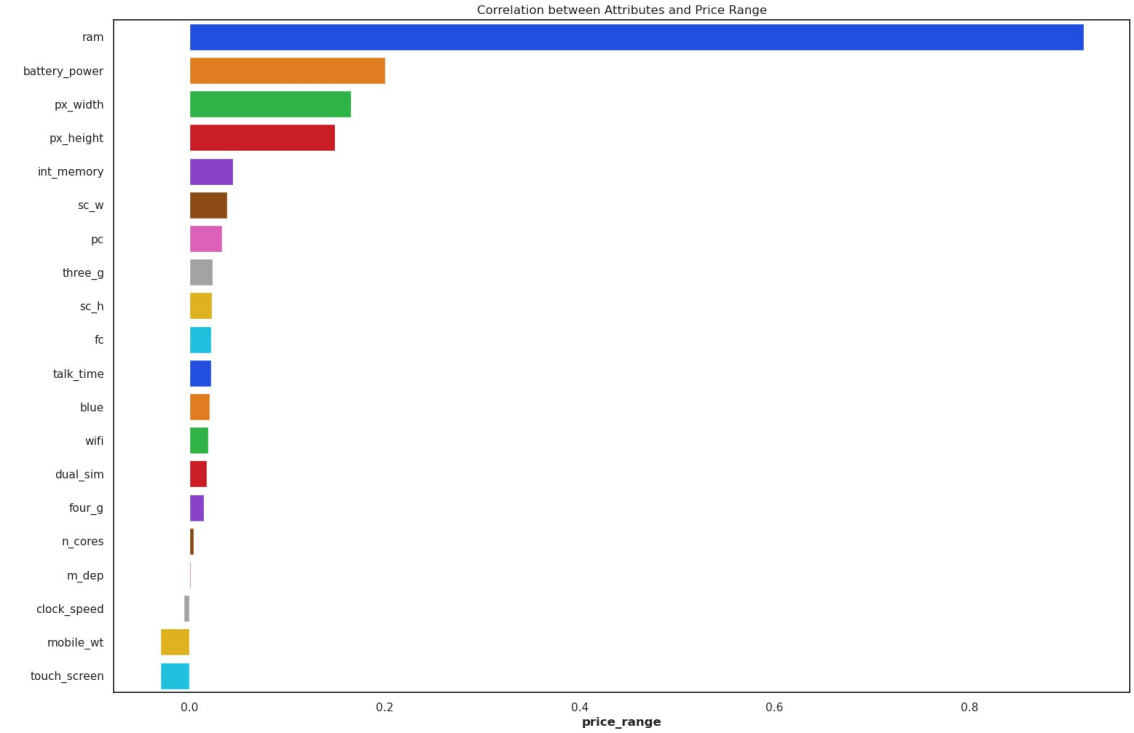
have high correlation with each other

- pc and fc
- three_g and four_g
- px_width and px_height

Correlation between Attributes and Price Range

```
corr = data.corr()
corr = corr.price_range
cr = corr.sort_values(ascending = False)[1:]
sns.barplot(x=cr, y=cr.index,palette = "bright")
plt.title("Correlation between Attributes and Price Range")
```

```
Text(0.5, 1.0, 'Correlation between Attributes and Price Range')
```



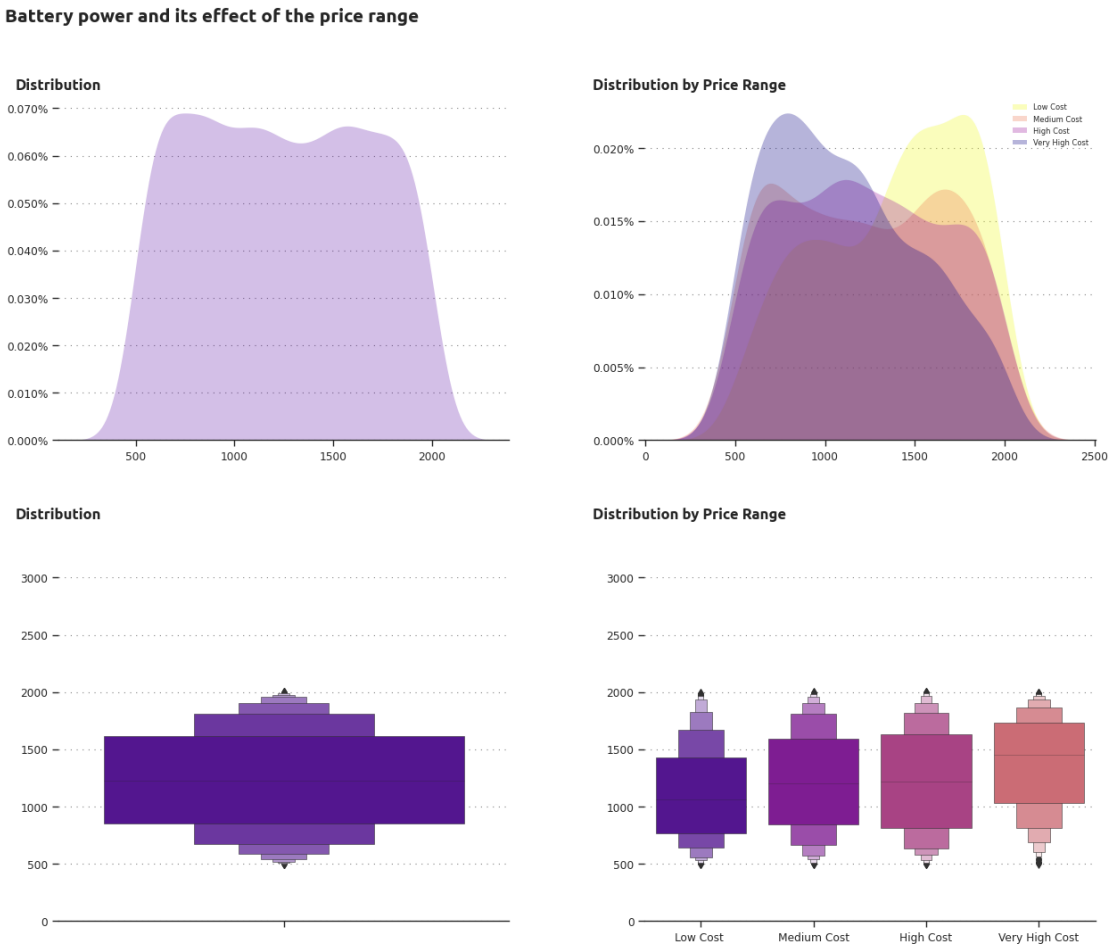

```
import matplotlib.ticker as mtick
```

Battery power

```
sns.set(rc={"figure.dpi":100})
sns.set_context('paper')
sns.set_style("ticks")

fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Battery power and its effect of the price range
', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0],ylim=(0, 3000),xlim=(0,5))
ax3 = fig.add_subplot(gs[1,1],ylim=(0, 3000))
```

```
#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='battery_power',
            data=data,
            shade=True,
            ax=ax0,
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='battery_power',
           hue='price_range',
           shade=True,
           data=data,
           palette='plasma',
           ax=ax1,
           fill=True,
           alpha=.3,
           linewidth=0

           )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2
```

```
ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='battery_power',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y', dashes=(1,5))
sns.boxenplot(x='price_range',
              y='battery_power',
              data=data,
              ax=ax3,
              linewidth=0.4

             )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

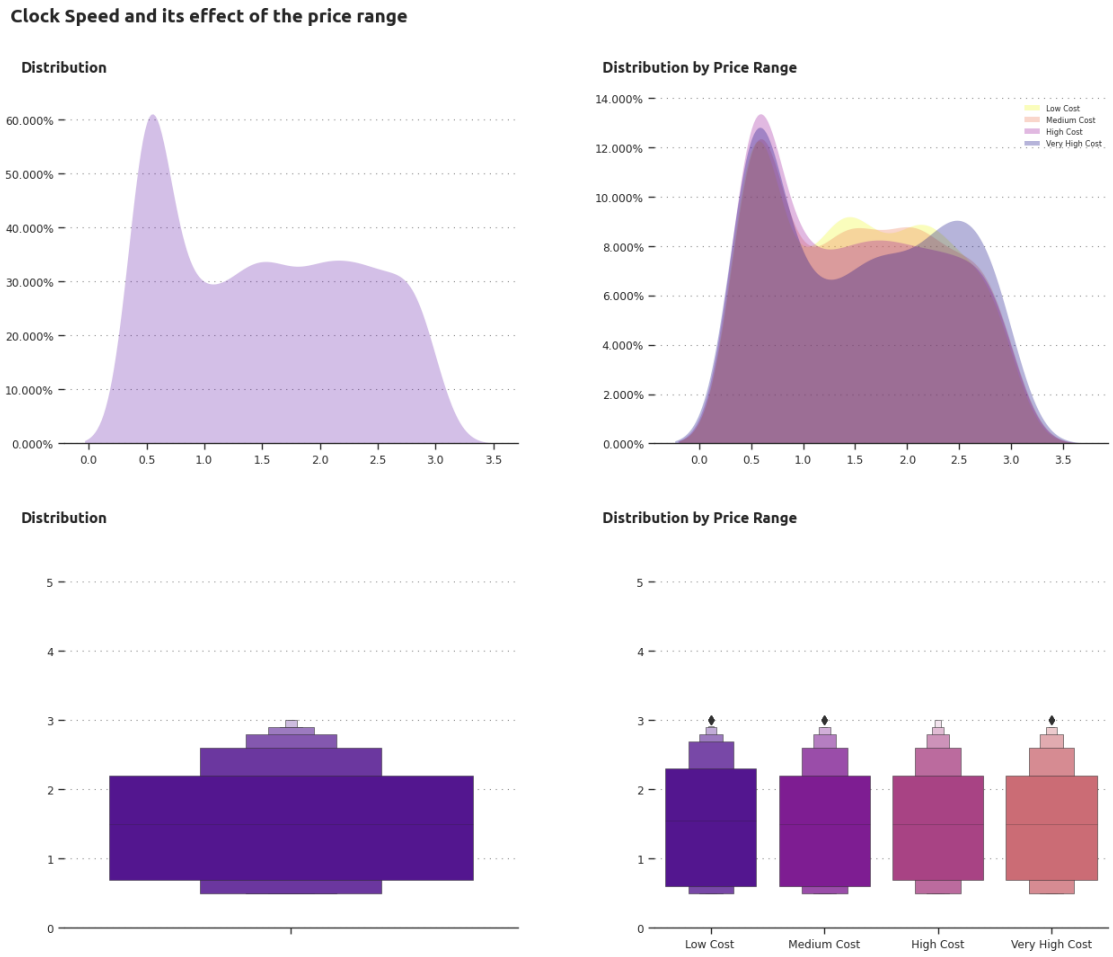


Clock Speed

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Clock Speed and its effect of the price range ',
fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0],ylim=(0,5))
ax3 = fig.add_subplot(gs[1,1],ylim=(0,5))

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='clock_speed',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='clock_speed',
            hue='price_range',
            shade=True,
            data=data,
            palette='plasma',
            ax=ax1,
            fill=True,
            alpha=.3,
            linewidth=0

            )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='clock_speed',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='clock_speed',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

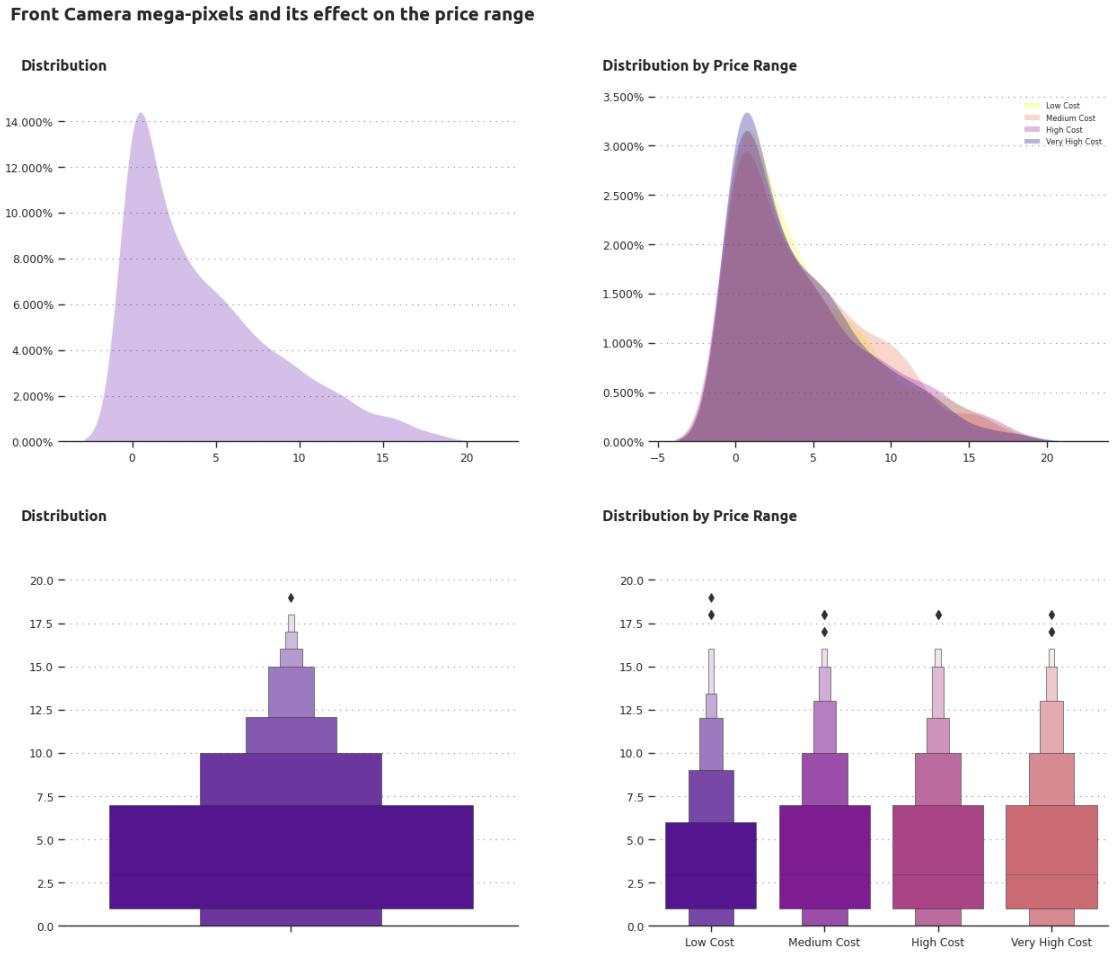


Front Camera mega-pixels

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Front Camera mega-pixels and its effect on the
price range', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0],ylim=(0,20))
ax3 = fig.add_subplot(gs[1,1],ylim=(0,20))

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='fc',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='fc',
            hue='price_range',
            shade=True,
            data=data,
            palette='plasma',
            ax=ax1,
            fill=True,
            alpha=.3,
            linewidth=0

            )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='fc',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='fc',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

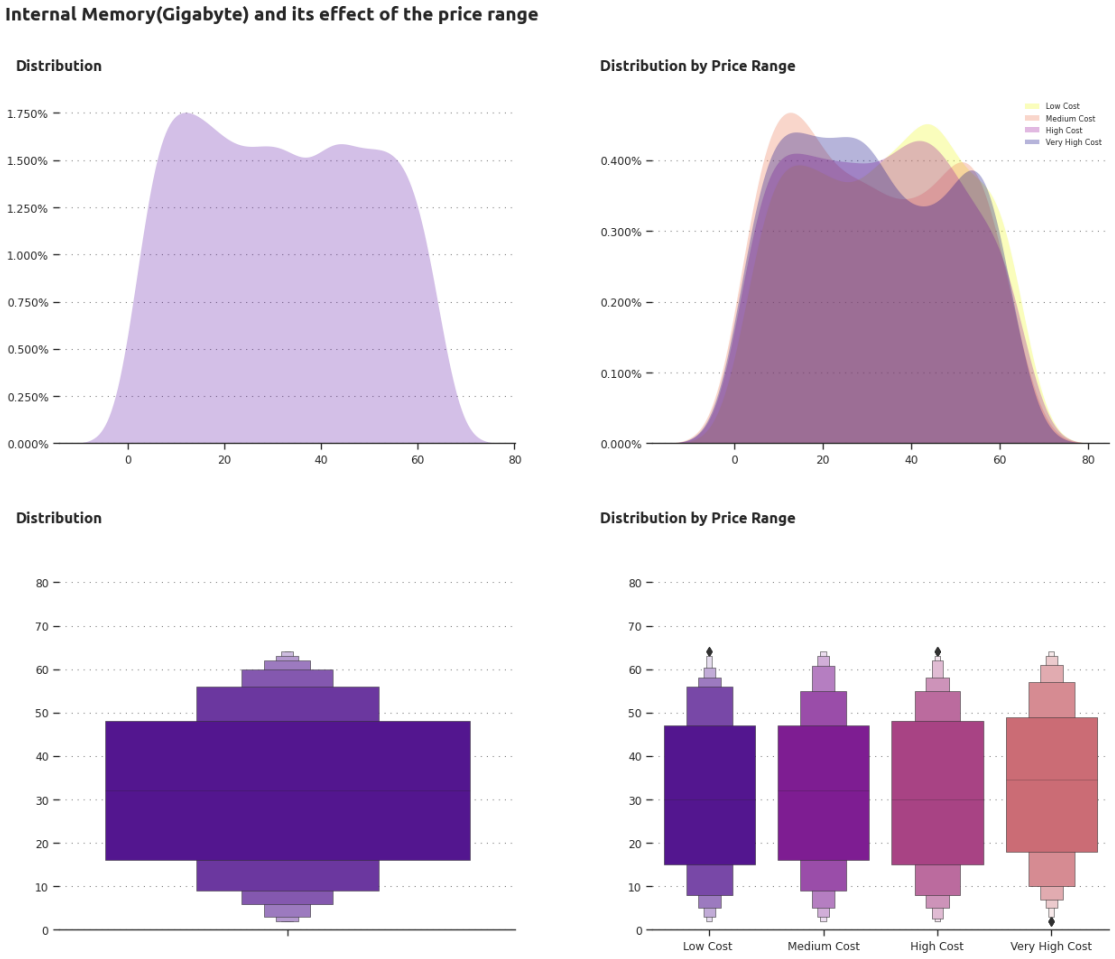


Internal Memory(Gigabyte)

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Internal Memory(Gigabyte) and its effect of the
price range ', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0],ylim=(0,80))
ax3 = fig.add_subplot(gs[1,1],ylim=(0,80))

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='int_memory',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='int_memory',
            hue='price_range',
            shade=True,
            data=data,
            palette='plasma',
            ax=ax1,
            fill=True,
            alpha=.3,
            linewidth=0

            )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='int_memory',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='int_memory',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

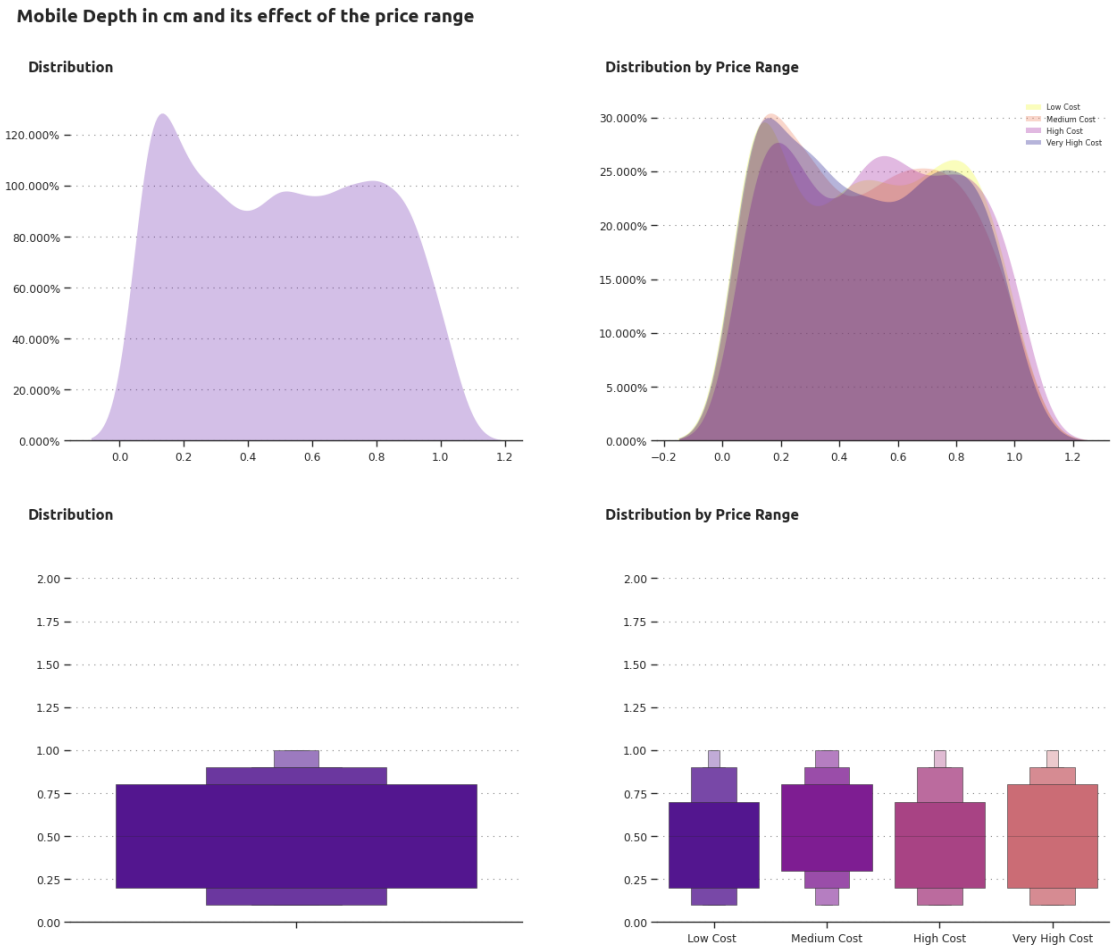


Mobile Depth in cm

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Mobile Depth in cm and its effect of the price
range ', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0],ylim=(0,2))
ax3 = fig.add_subplot(gs[1,1],ylim=(0,2))

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='m_dep',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='m_dep',
            hue='price_range',
            shade=True,
            data=data,
            palette='plasma',
            ax=ax1,
            fill=True,
            alpha=.3,
            linewidth=0

            )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='m_dep',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='m_dep',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

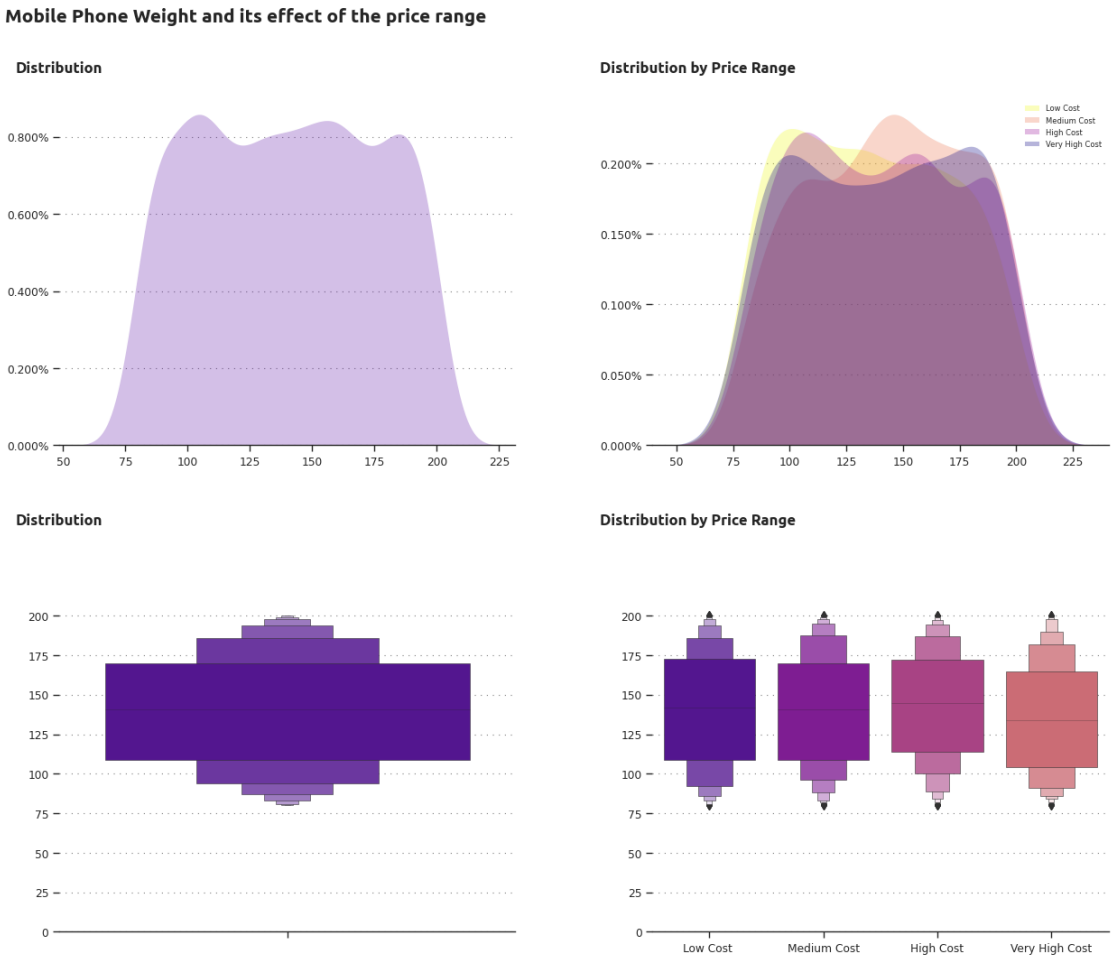


Mobile Phone Weight

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Mobile Phone Weight and its effect of the price
range ', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0],ylim=(0,220))
ax3 = fig.add_subplot(gs[1,1],ylim=(0,220))

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='mobile_wt',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='mobile_wt',
           hue='price_range',
           shade=True,
           data=data,
           palette='plasma',
           ax=ax1,
           fill=True,
           alpha=.3,
           linewidth=0

           )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='mobile_wt',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y', dashes=(1,5))
sns.boxenplot(x='price_range',
              y='mobile_wt',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```



Number of cores

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Number of cores and its effect of the price range
', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0],ylim=(0,10))
ax3 = fig.add_subplot(gs[1,1],ylim=(0,10))

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='n_cores',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='n_cores',
            hue='price_range',
            shade=True,
            data=data,
            palette='plasma',
            ax=ax1,
            fill=True,
            alpha=.3,
            linewidth=0

            )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='n_cores',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

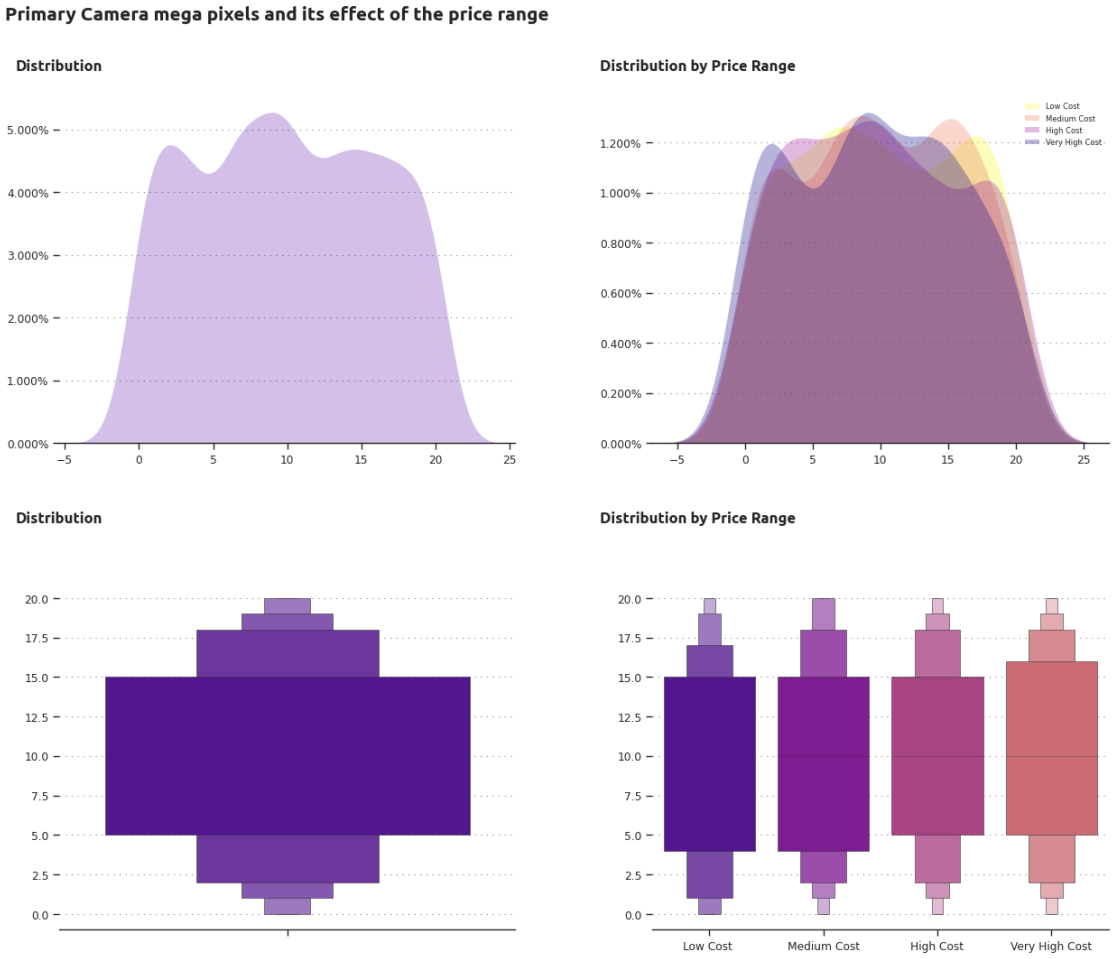
```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y', dashes=(1,5))
sns.boxenplot(x='price_range',
              y='n_cores',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

Primary Camera mega pixels

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Primary Camera mega pixels and its effect of the
price range ', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0])
ax3 = fig.add_subplot(gs[1,1])

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='pc',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='pc',
            hue='price_range',
            shade=True,
            data=data,
            palette='plasma',
            ax=ax1,
            fill=True,
            alpha=.3,
            linewidth=0

            )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='pc',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='pc',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

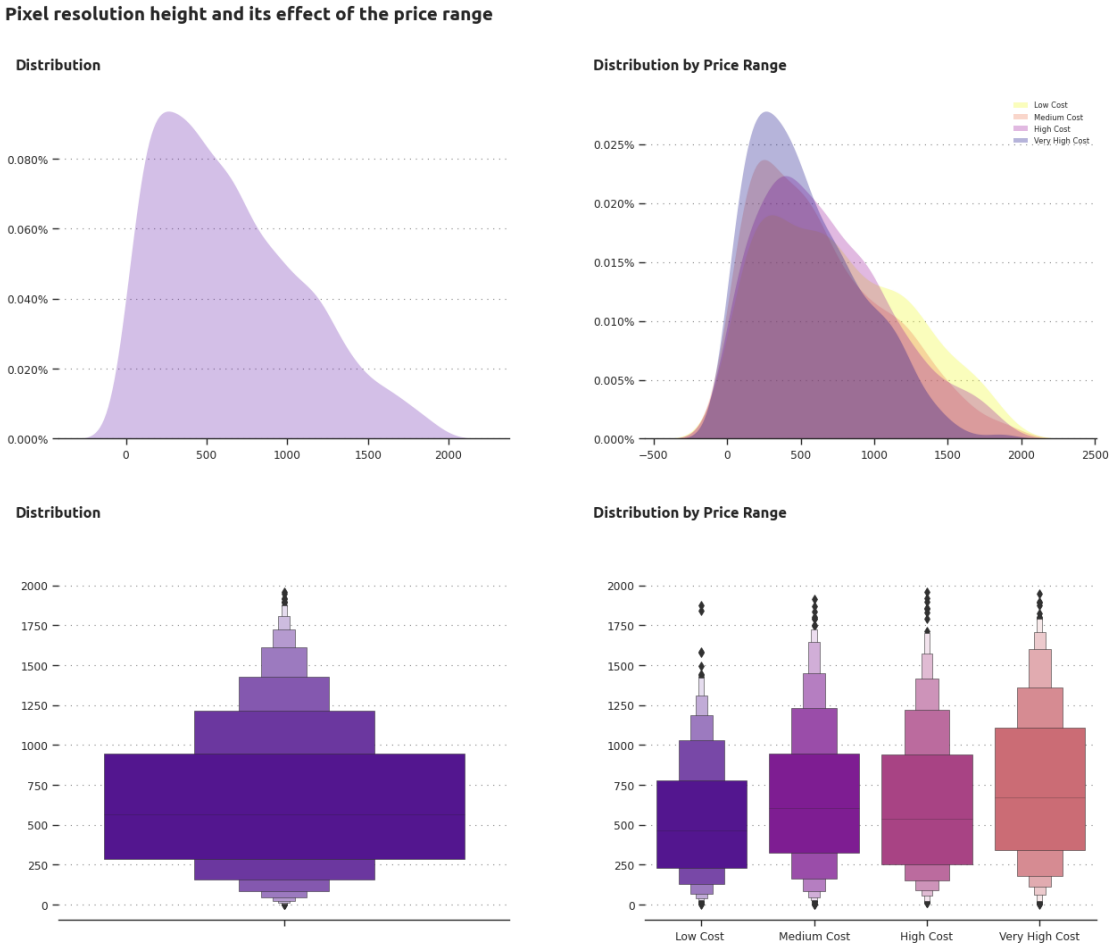


Pixel resolution height

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Pixel resolution height and its effect of the
price range ', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0])
ax3 = fig.add_subplot(gs[1,1])

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='px_height',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='px_height',
           hue='price_range',
           shade=True,
           data=data,
           palette='plasma',
           ax=ax1,
           fill=True,
           alpha=.3,
           linewidth=0

           )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='px_height',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='px_height',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

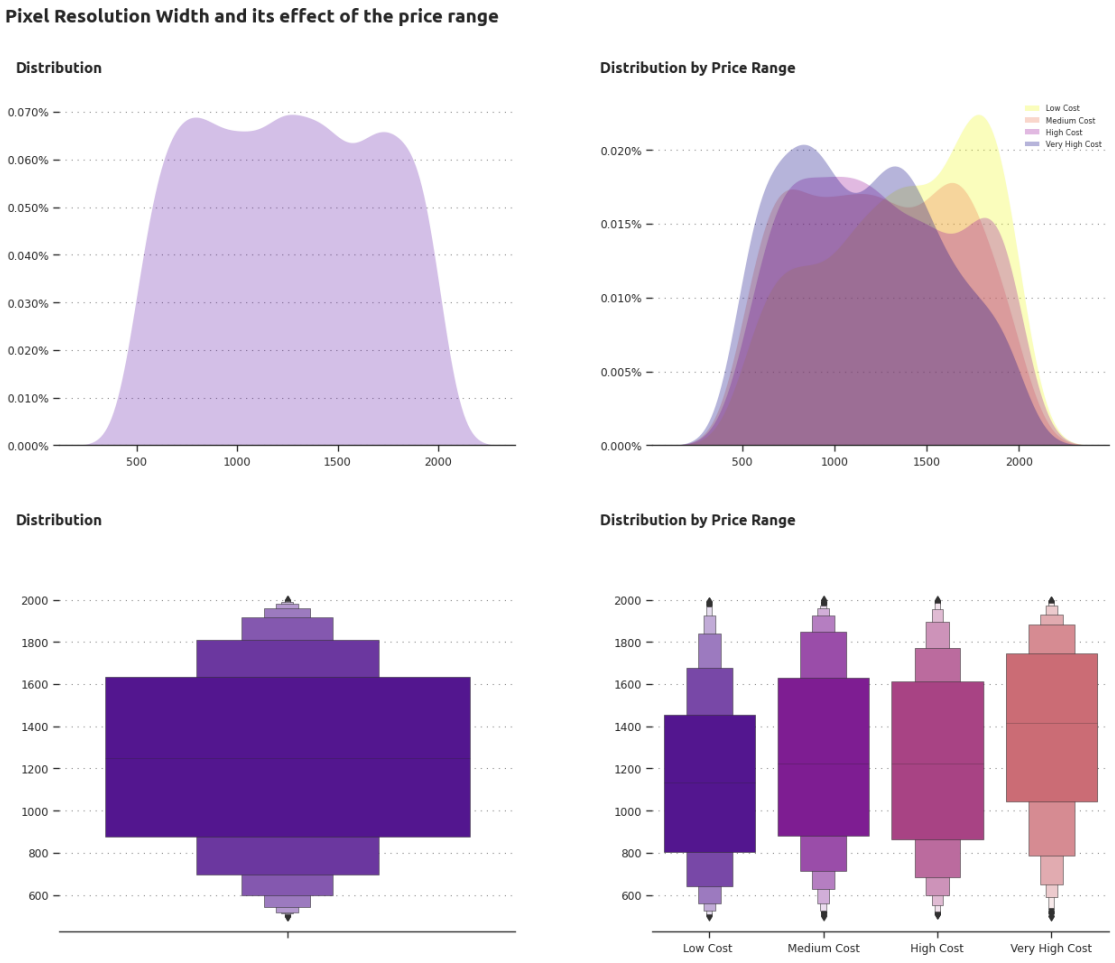


Pixel Resolution Width

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Pixel Resolution Width and its effect of the
price range ', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0])
ax3 = fig.add_subplot(gs[1,1])

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='px_width',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='px_width',
            hue='price_range',
            shade=True,
            data=data,
            palette='plasma',
            ax=ax1,
            fill=True,
            alpha=.3,
            linewidth=0

            )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y', dashes=(1,5))
sns.boxenplot(y='px_width',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='px_width',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

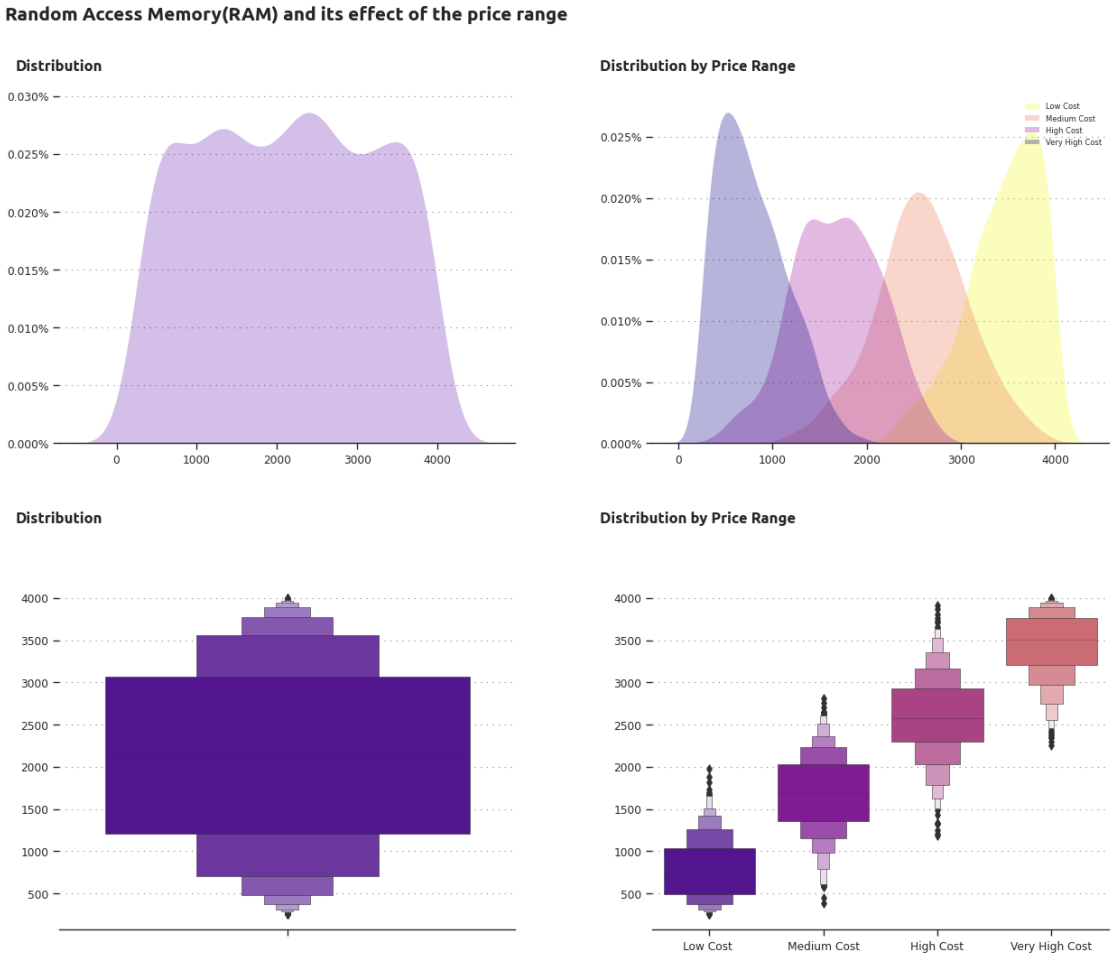


Random Access Memory(RAM)

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Random Access Memory(RAM) and its effect of the
price range ', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0])
ax3 = fig.add_subplot(gs[1,1])

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='ram',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='ram',
            hue='price_range',
            shade=True,
            data=data,
            palette='plasma',
            ax=ax1,
            fill=True,
            alpha=.3,
            linewidth=0

            )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='ram',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='ram',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

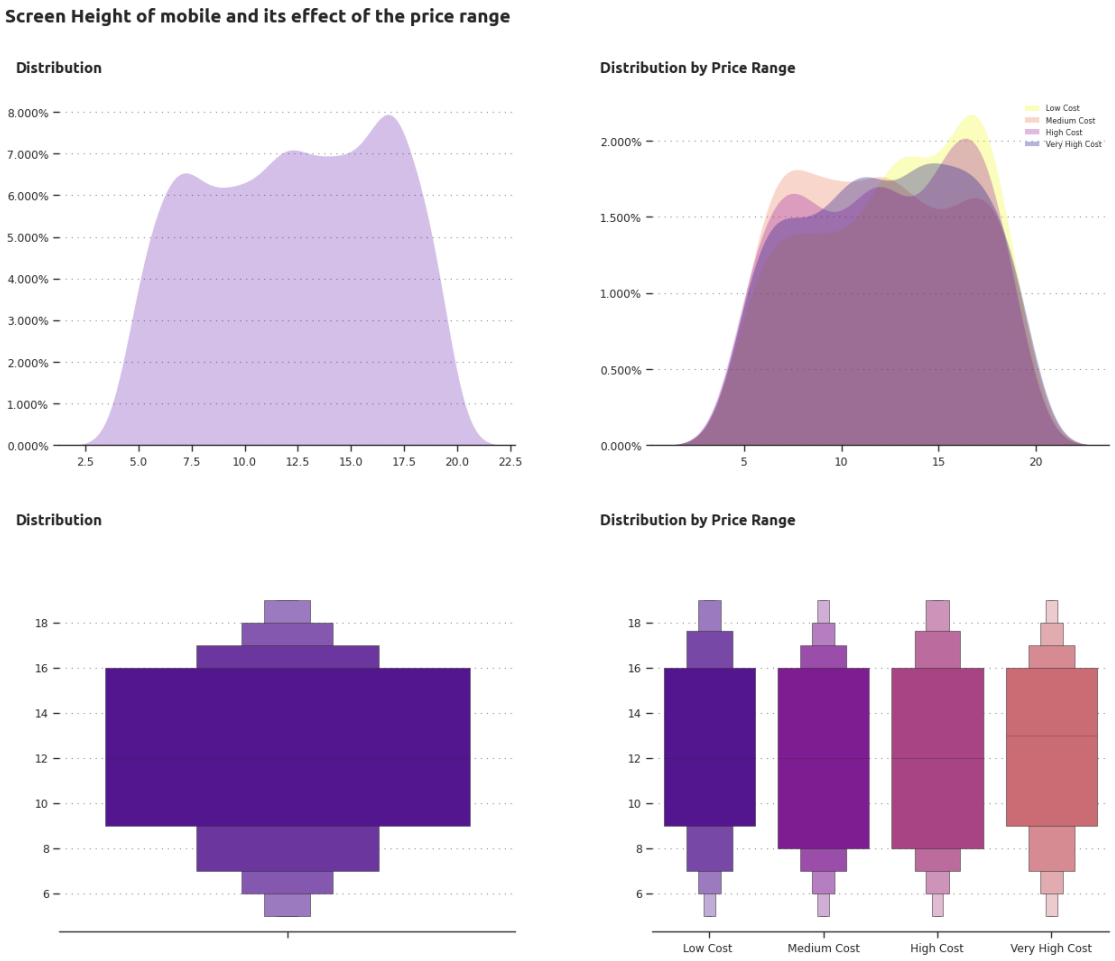


Screen Height of mobile

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Screen Height of mobile and its effect of the
price range ', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0])
ax3 = fig.add_subplot(gs[1,1])

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='sc_h',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='sc_h',
            hue='price_range',
            shade=True,
            data=data,
            palette='plasma',
            ax=ax1,
            fill=True,
            alpha=.3,
            linewidth=0

            )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='sc_h',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='sc_h',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

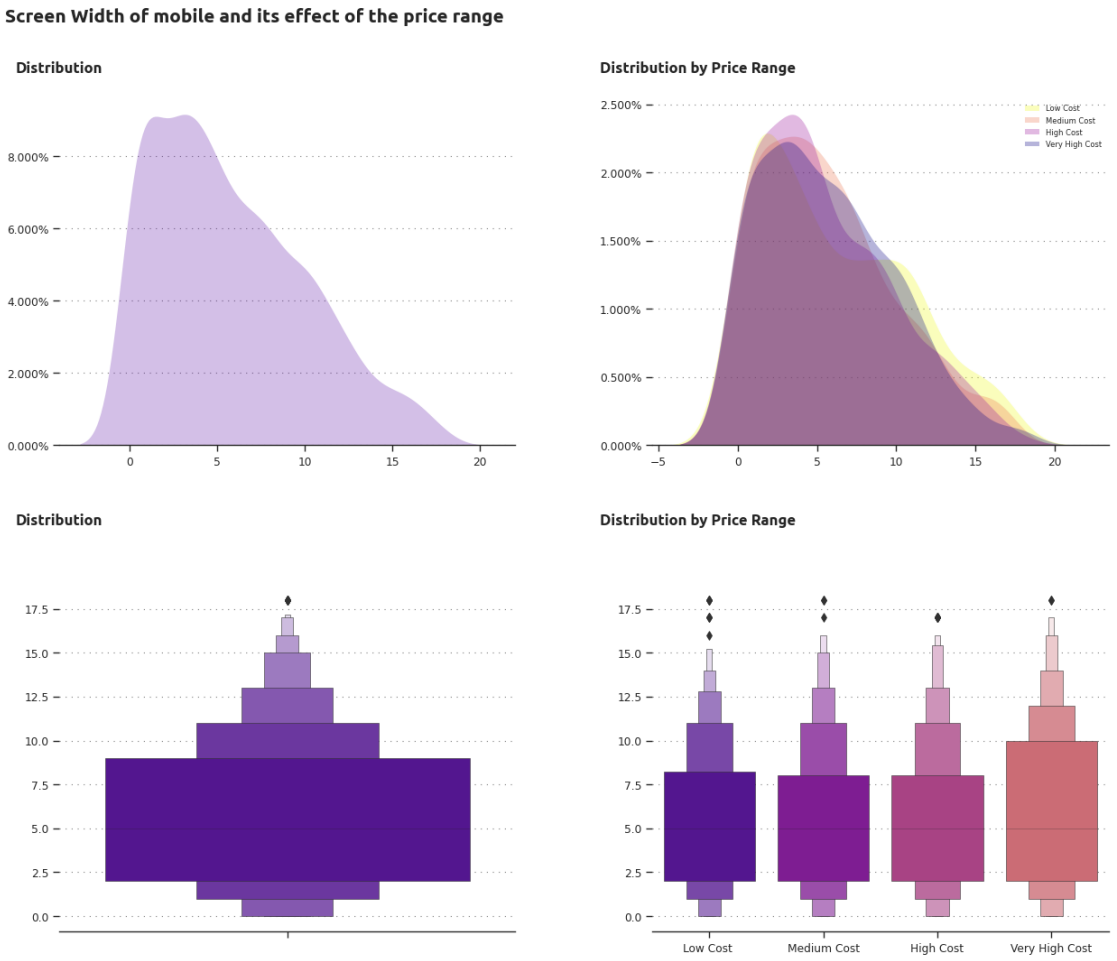


Screen Width of mobile

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Screen Width of mobile and its effect of the
price range ', fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0])
ax3 = fig.add_subplot(gs[1,1])

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='sc_w',
            data=data,
            shade=True,
            ax=ax0,
```

```
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='sc_w',
            hue='price_range',
            shade=True,
            data=data,
            palette='plasma',
            ax=ax1,
            fill=True,
            alpha=.3,
            linewidth=0

            )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='sc_w',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.15)
```

```
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='sc_w',
              data=data,
              ax=ax3,
              linewidth=0.4

            )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```

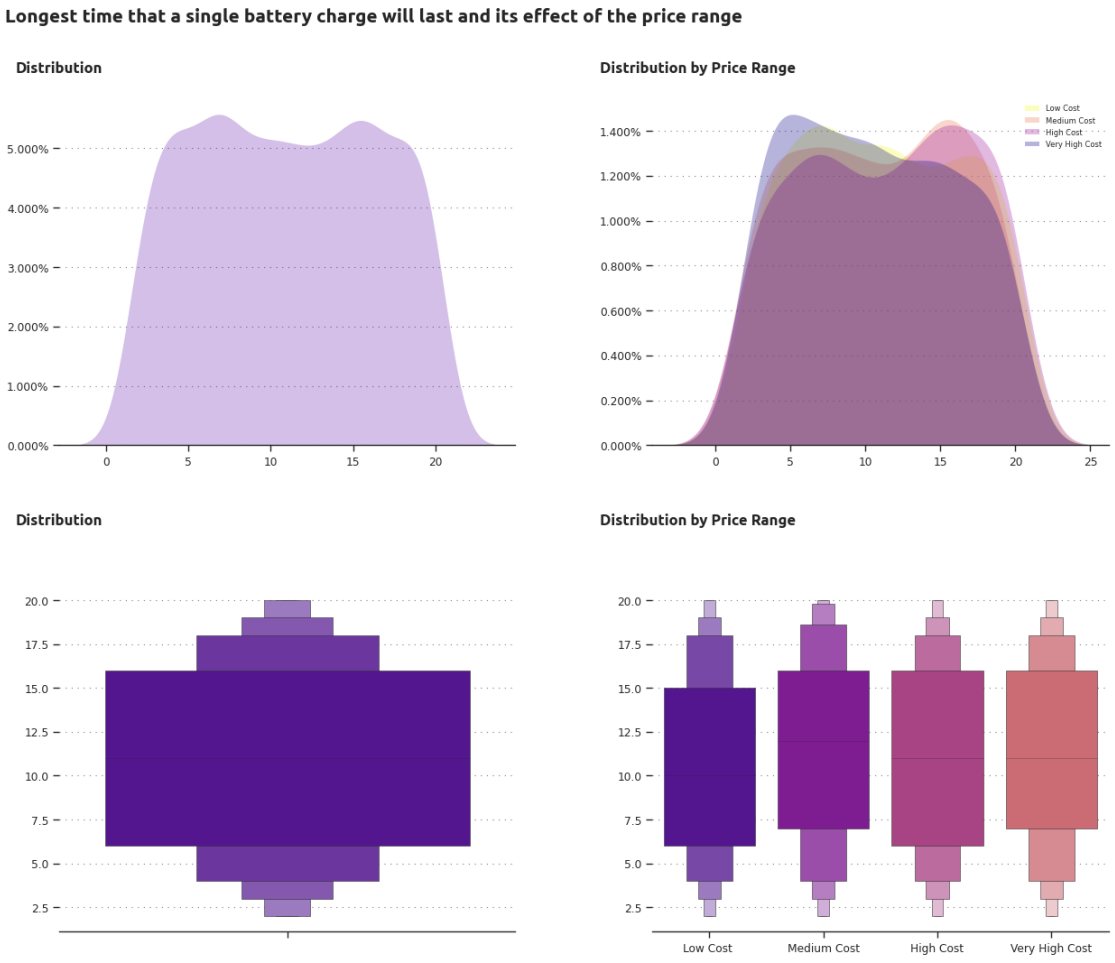


Longest time that a single battery charge will last

```
fig = plt.figure(figsize=(15,12))
gs = fig.add_gridspec(2, 2)
gs.update(wspace=0.3, hspace=0.4)
fig.text(0.085,0.95,'Longest time that a single battery charge will
last and its effect of the price range ',
fontfamily='serif',fontsize=15, fontweight='bold')
sns.set_palette('plasma')

ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
ax2 = fig.add_subplot(gs[1,0])
ax3 = fig.add_subplot(gs[1,1])

#Axis 0

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='talk_time',
            data=data,
            shade=True,
```

```
            ax=ax0,
            linewidth = 0
            )
ax0.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax0.set_xlabel("")
ax0.set_ylabel("")
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0,y=1.05)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)


#Axis 1

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
sns.kdeplot(x='talk_time',
           hue='price_range',
           shade=True,
           data=data,
           palette='plasma',
           ax=ax1,
           fill=True,
           alpha=.3,
           linewidth=0

           )
ax1.yaxis.set_major_formatter(mtick.PercentFormatter(1, decimals=3))
ax1.set_xlabel("")
ax1.set_ylabel("")
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.05)
ax1.legend(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'],fontsize=6,frameon=False)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)

#Axis 2

ax2.grid(color='gray', linestyle=':', axis='y',  dashes=(1,5))
sns.boxenplot(y='talk_time',
              data=data,
              ax=ax2,
              linewidth=0.4)

ax2.set_xlabel("")
ax2.set_ylabel("")
ax2.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
```

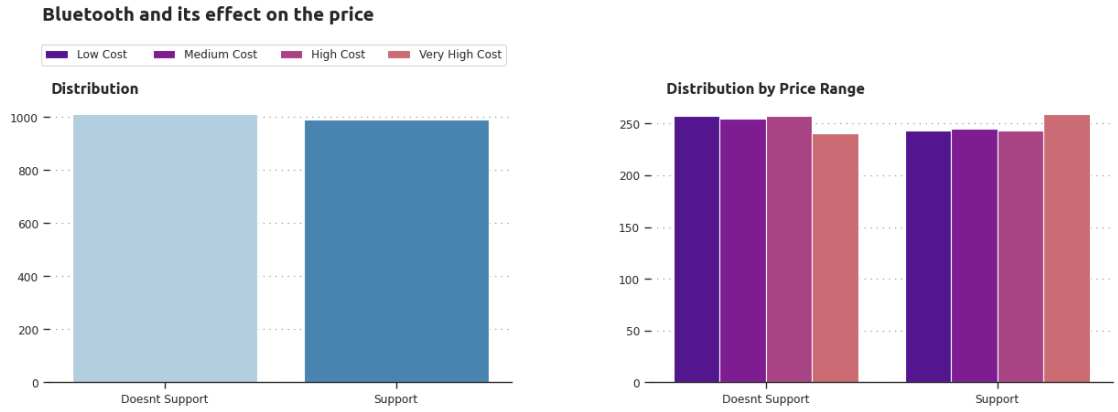
```
='bold',x=0,y=1.15)
ax2.spines['top'].set_visible(False)
ax2.spines['right'].set_visible(False)
ax2.spines['left'].set_visible(False)

#Axis3

ax3.grid(color='gray', linestyle='-', axis='y',  dashes=(1,5))
sns.boxenplot(x='price_range',
              y='talk_time',
              data=data,
              ax=ax3,
              linewidth=0.4

             )

ax3.set_xlabel("")
ax3.set_ylabel("")
ax3.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.1,y=1.15)
ax3.set_xticklabels(['Low Cost ', 'Medium Cost','High Cost','Very High
Cost'])
ax3.spines['top'].set_visible(False)
ax3.spines['right'].set_visible(False)
ax3.spines['left'].set_visible(False)

fig.show()
```



Bluetooth

```
fig = plt.figure(figsize=(15,4))
gs = fig.add_gridspec(1, 2)
gs.update(wspace=0.3, hspace=0)
fig.text(0.120,1.1,'Bluetooth and its effect on the price ',
fontfamily='serif',fontsize=15, fontweight='bold')
ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])


sns.countplot(x='blue',
              data=data,
               palette='Blues',
              ax=ax0)

ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0.1,y=1)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
```

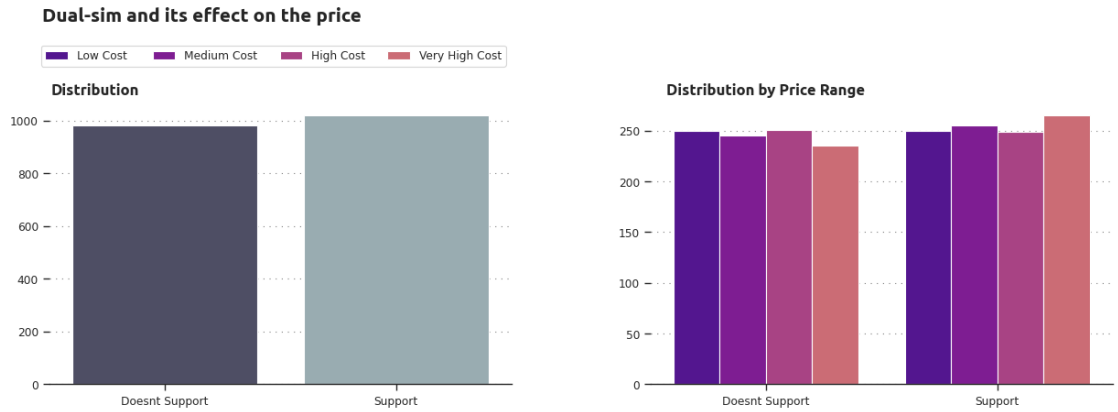
```
ax0.spines['left'].set_visible(False)
ax0.set_xticklabels(["Doesnt Support","Support"])
ax0.set_xlabel("")
ax0.set_ylabel("")

sns.countplot(x='blue',
              data=data,
              hue='price_range',
              ax=ax1)

ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.25,y=1)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)
ax1.get_legend().remove()
legend_labels, _= ax1.get_legend_handles_labels()
ax1.legend(legend_labels, ['Low Cost ', 'Medium Cost','High
Cost','Very High Cost'], ncol=4, bbox_to_anchor=(-0.30, 1.22))
ax1.set_xticklabels(["Doesnt Support","Support"])
ax1.set_xlabel("")
ax1.set_ylabel("")

fig.show()
```



Dual-sim

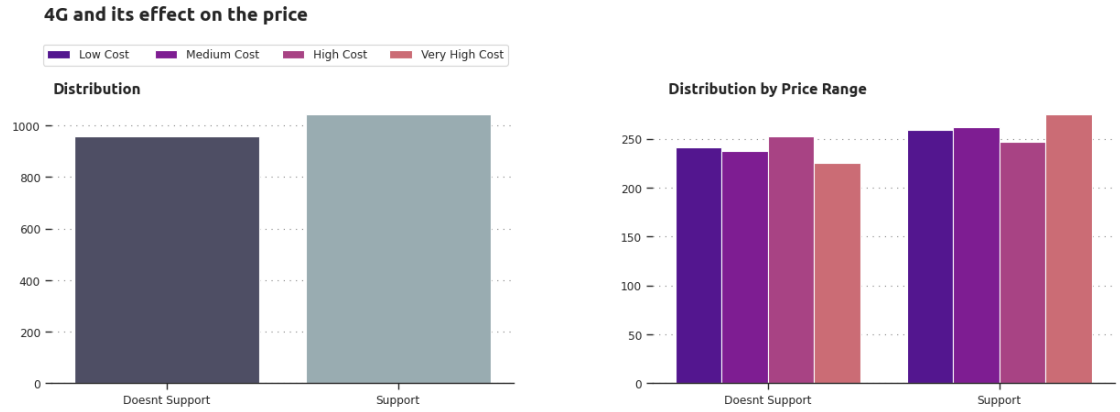
```
fig = plt.figure(figsize=(15,4))
gs = fig.add_gridspec(1, 2)
gs.update(wspace=0.3, hspace=0)
fig.text(0.120,1.1,'Dual-sim and its effect on the price ',
fontfamily='serif',fontsize=15, fontweight='bold')
ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])
```

```
sns.countplot(x='dual_sim',
              data=data,
               palette='bone',
              ax=ax0)
ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0.1,y=1)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)
ax0.set_xticklabels(["Doesnt Support","Support"])
ax0.set_xlabel("")
ax0.set_ylabel("")

sns.countplot(x='dual_sim',
                data=data,
                hue='price_range',
                ax=ax1)
ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.25,y=1)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)
ax1.get_legend().remove()
legend_labels, _= ax1.get_legend_handles_labels()
ax1.legend(legend_labels, ['Low Cost ', 'Medium Cost','High
Cost','Very High Cost'], ncol=4, bbox_to_anchor=(-0.30, 1.22))
ax1.set_xticklabels(["Doesnt Support","Support"])
ax1.set_xlabel("")
ax1.set_ylabel("")

fig.show()
```



4G

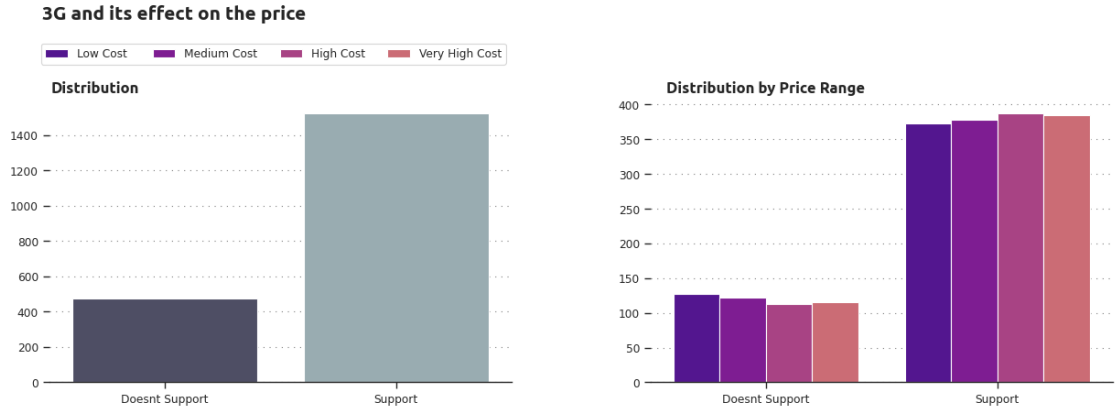
```
fig = plt.figure(figsize=(15,4))
gs = fig.add_gridspec(1, 2)
gs.update(wspace=0.3, hspace=0)
fig.text(0.120,1.1,'4G and its effect on the price ',
fontfamily='serif',fontsize=15, fontweight='bold')
ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])


sns.countplot(x='four_g',
            data=data,
             palette='bone',
            ax=ax0)
ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0.1,y=1)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)
ax0.set_xticklabels(["Doesnt Support","Support"])
ax0.set_xlabel("")
ax0.set_ylabel("")

sns.countplot(x='four_g',
              data=data,
              hue='price_range',
              ax=ax1)
ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.25,y=1)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)
ax1.get_legend().remove()
legend_labels, _= ax1.get_legend_handles_labels()
ax1.legend(legend_labels, ['Low Cost ', 'Medium Cost','High
Cost','Very High Cost'], ncol=4, bbox_to_anchor=(-0.30, 1.22))
ax1.set_xticklabels(["Doesnt Support","Support"])
ax1.set_xlabel("")
ax1.set_ylabel("")

fig.show()
```



3G

```
fig = plt.figure(figsize=(15,4))
gs = fig.add_gridspec(1, 2)
gs.update(wspace=0.3, hspace=0)
fig.text(0.120,1.1,'3G and its effect on the price ',
fontfamily='serif',fontsize=15, fontweight='bold')
ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])


sns.countplot(x='three_g',
           data=data,
            palette='bone',
           ax=ax0)
ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0.1,y=1)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)
ax0.set_xticklabels(["Doesnt Support","Support"])
ax0.set_xlabel("")
ax0.set_ylabel("")

sns.countplot(x='three_g',
             data=data,
             hue='price_range',
             ax=ax1)
ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.25,y=1)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)
ax1.get_legend().remove()
```

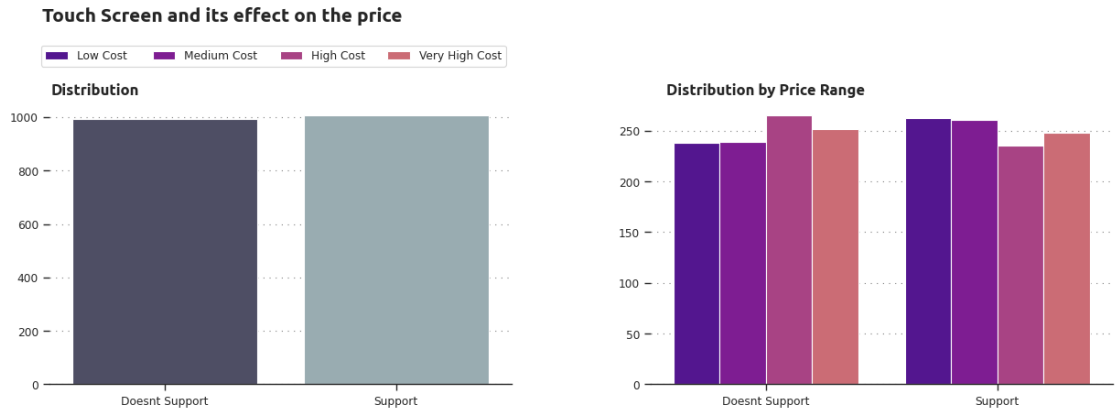
```
legend_labels, _= ax1.get_legend_handles_labels()
ax1.legend(legend_labels, ['Low Cost ', 'Medium Cost','High
Cost','Very High Cost'], ncol=4, bbox_to_anchor=(-0.30, 1.22))
ax1.set_xticklabels(["Doesnt Support","Support"])
ax1.set_xlabel("")
ax1.set_ylabel("")

fig.show()
```



Touch Screen

```
fig = plt.figure(figsize=(15,4))
gs = fig.add_gridspec(1, 2)
gs.update(wspace=0.3, hspace=0)
fig.text(0.120,1.1,'Touch Screen and its effect on the price ',
fontfamily='serif',fontsize=15, fontweight='bold')
ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])


sns.countplot(x='touch_screen',
            data=data,
             palette='bone',
            ax=ax0)
ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0.1,y=1)
ax0.spines['top'].set_visible(False)
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)
ax0.set_xticklabels(["Doesnt Support","Support"])
ax0.set_xlabel("")
ax0.set_ylabel("")

sns.countplot(x='touch_screen',
              data=data,
              hue='price_range',
```

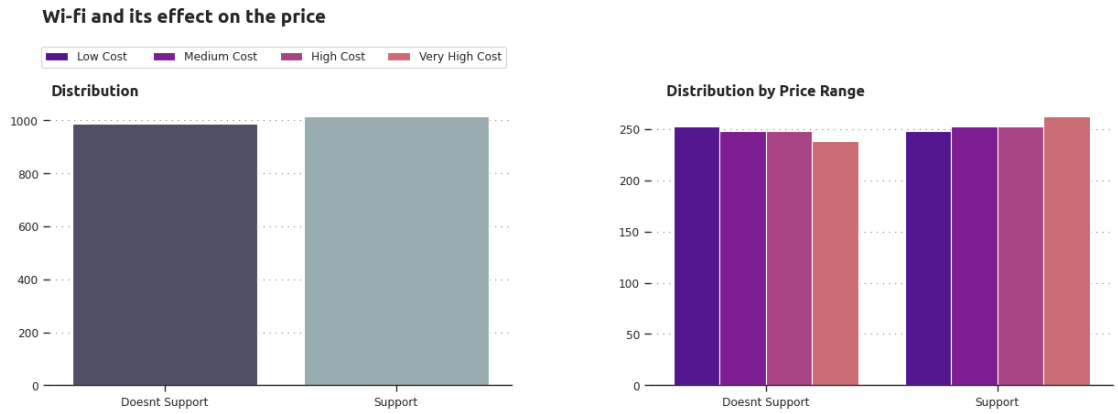
```
            ax=ax1)
ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.25,y=1)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)
ax1.get_legend().remove()
legend_labels, _= ax1.get_legend_handles_labels()
ax1.legend(legend_labels, ['Low Cost ', 'Medium Cost','High
Cost','Very High Cost'], ncol=4, bbox_to_anchor=(-0.30, 1.22))
ax1.set_xticklabels(["Doesnt Support","Support"])
ax1.set_xlabel("")
ax1.set_ylabel("")

fig.show()
```



Wi-fi

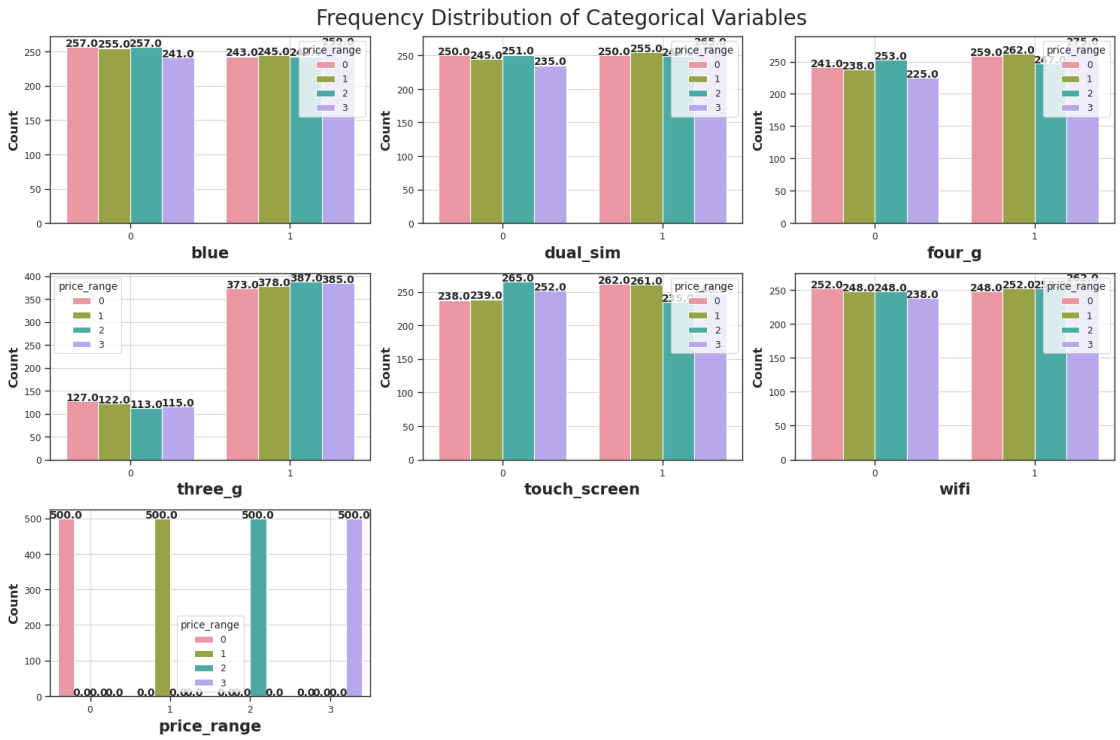
```
fig = plt.figure(figsize=(15,4))
gs = fig.add_gridspec(1, 2)
gs.update(wspace=0.3, hspace=0)
fig.text(0.120,1.1,'Wi-fi and its effect on the price ',
fontfamily='serif',fontsize=15, fontweight='bold')
ax0 = fig.add_subplot(gs[0, 0])
ax1 = fig.add_subplot(gs[0, 1])


sns.countplot(x='wifi',
            data=data,
             palette='bone',
            ax=ax0)
ax0.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax0.set_title('Distribution',fontsize=12,fontfamily='serif',fontweight
='bold',x=0.1,y=1)
ax0.spines['top'].set_visible(False)
```

```
ax0.spines['right'].set_visible(False)
ax0.spines['left'].set_visible(False)
ax0.set_xticklabels(["Doesnt Support","Support"])
ax0.set_xlabel("")
ax0.set_ylabel("")

sns.countplot(x='wifi',
              data=data,
              hue='price_range',
              ax=ax1)
ax1.grid(color='gray', linestyle=':', axis='y', zorder=0,
dashes=(1,5))
ax1.set_title('Distribution by Price
Range',fontsize=12,fontfamily='serif',fontweight='bold',x=0.25,y=1)
ax1.spines['top'].set_visible(False)
ax1.spines['right'].set_visible(False)
ax1.spines['left'].set_visible(False)
ax1.get_legend().remove()
legend_labels, _= ax1.get_legend_handles_labels()
ax1.legend(legend_labels, ['Low Cost ', 'Medium Cost','High
Cost','Very High Cost'], ncol=4, bbox_to_anchor=(-0.30, 1.22))
ax1.set_xticklabels(["Doesnt Support","Support"])
ax1.set_xlabel("")
ax1.set_ylabel("")

fig.show()
```



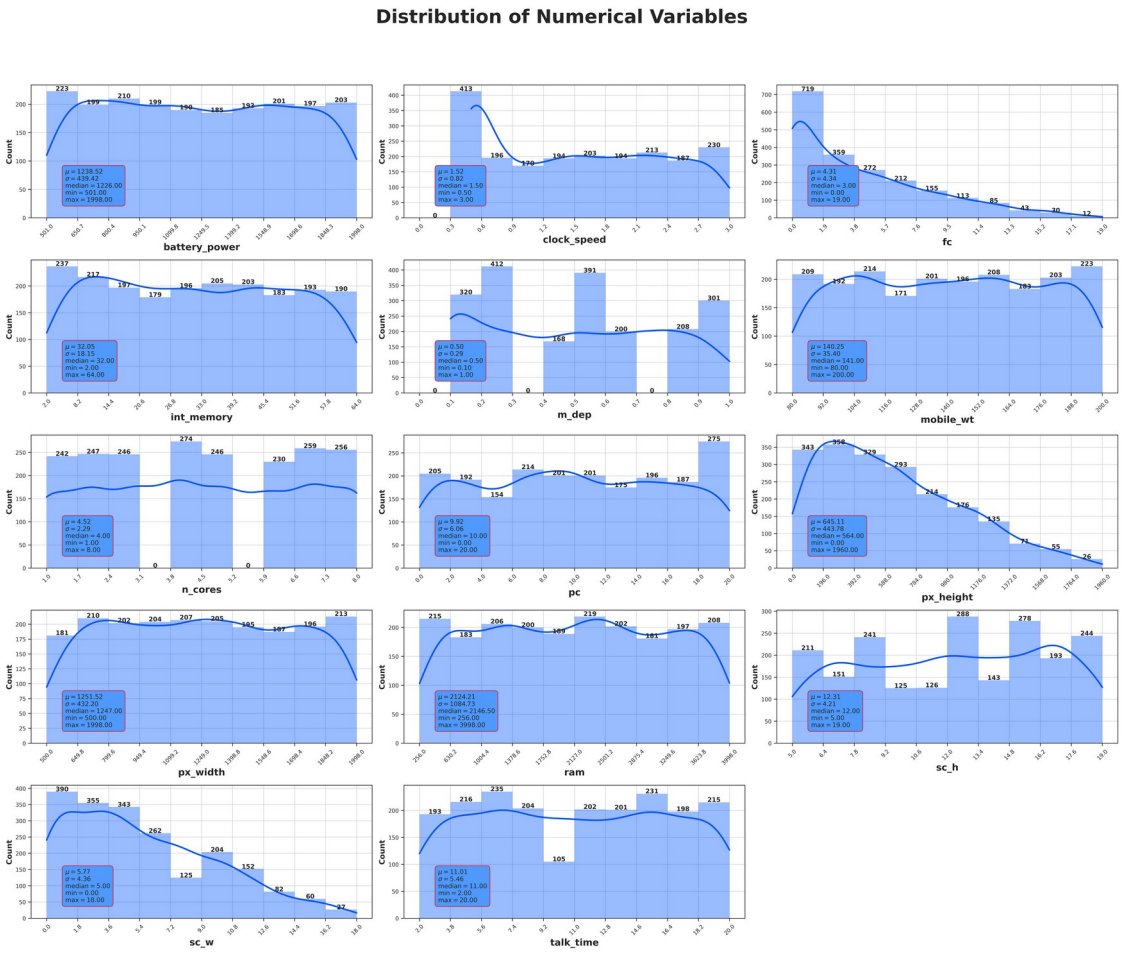

```
CatCols=
['blue','dual_sim','four_g','three_g','touch_screen','wifi','price_ran
ge']

fig, ax = plt.subplots(nrows=3, ncols=3, figsize=(15,10), dpi=100)
colors = ['#0055ff', '#ff7000', '#23bf00']
CustomPalette = sns.set_palette(sns.color_palette(colors))

for i in range(len(CatCols)):
    row = i//3
```

```
    col = i%3
    graph =
sns.countplot(x=CatCols[i],hue=data['price_range'],data=data,
ax=ax[row,col])
    ax[row,col].set_xlabel(CatCols[i], fontsize=15)
    ax[row,col].set_ylabel('Count', fontsize=12)
    ax[row,col].set_xticklabels(ax[row,col].get_xticks())
    ax[row,col].grid(color='lightgrey')
    for j,p in enumerate(graph.patches):
        ax[row,col].annotate('{}'.format(p.get_height()), (p.get_x()
+p.get_width()/2, p.get_height()+1),
                             ha='center',
fontsize=10 ,fontweight="bold")

plt.suptitle('Frequency Distribution of Categorical Variables',
fontsize=20)
ax[-1,2].axis('off')
ax[-1,1].axis('off')
plt.tight_layout()
plt.show()
```




```
NumCols =
['battery_power','clock_speed','fc','int_memory','m_dep','mobile_wt',

'n_cores','pc','px_height','px_width','ram','sc_h','sc_w','talk_time']

fig, ax = plt.subplots(nrows=5, ncols=3, figsize=(18,12), dpi=550)
c = '#0055ff'
```

```
fig.set_size_inches(25, 20)
for i in range(len(NumCols)):
    row = i//3
    col = i%3
    values, bin_edges = np.histogram(data[NumCols[i]],

range=(np.floor(data[NumCols[i]].min()),
np.ceil(data[NumCols[i]].max())))
    graph = sns.histplot(data=data, x=NumCols[i], bins=bin_edges,
kde=True, ax=ax[row,col],
                         edgecolor='none', color=c, alpha=0.4,
line_kws={'lw': 2.5})
    ax[row,col].set_xlabel(NumCols[i], fontsize=15)
    ax[row,col].set_ylabel('Count', fontsize=12)
    ax[row,col].set_xticks(np.round(bin_edges,1))
    ax[row,col].set_xticklabels(ax[row,col].get_xticks(), rotation =
45)
    ax[row,col].grid(color='lightgrey')
    for j,p in enumerate(graph.patches):
        ax[row,col].annotate('{}'.format(p.get_height()), (p.get_x()
+p.get_width()/2, p.get_height()+1),
                             ha='center',
fontsize=10 ,fontweight="bold")

    textstr = '\n'.join((
    r'$\mu=%.2f$' %data[NumCols[i]].mean(),
    r'$\sigma=%.2f$' %data[NumCols[i]].std(),
    r'$\mathrm{median}=%.2f$' %np.median(data[NumCols[i]]),
    r'$\mathrm{min}=%.2f$' %data[NumCols[i]].min(),
    r'$\mathrm{max}=%.2f$' %data[NumCols[i]].max()
    ))
    ax[row,col].text(0.1, 0.37, textstr,
transform=ax[row,col].transAxes, fontsize=10, verticalalignment='top',
                     bbox=dict(boxstyle='round',facecolor='#509aff',
edgecolor='red', pad=0.5))


ax[-1,2].axis('off')
plt.suptitle('Distribution of Numerical Variables',
fontsize=30,fontweight='bold',y=1.05)
plt.tight_layout()
plt.show()
```



Now here we decided to drop some rows and a column...

Let's check out!

```
data['m_dep'].value_counts()
```

```
0.1    320
0.2    213
0.8    208
0.5    205
0.7    200
0.3    199
0.9    195
0.6    186
0.4    168
1.0    106
Name: m_dep, dtype: int64
```

- Here we know mobile depth can't be less than 0.6 cm, So we this column

```
data.drop('m_dep',axis=1,inplace=True)
data
```

```
      battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0               842     0          2.2         0   1       0
7
1              1021     1          0.5         1   0       1
53
2               563     1          0.5         1   2       1
41
3               615     1          2.5         0   0       0
10
4              1821     1          1.2         0  13       1
44
...             ...   ...          ...       ...  ..     ...         .
..
1995            794     1          0.5         1   0       1
2
1996           1965     1          2.6         1   0       0
39
1997           1911     0          0.9         1   1       1
36
1998           1512     0          0.9         0   4       1
46
1999            510     1          2.0         1   5       1
45

      mobile_wt  n_cores  pc  px_height  px_width   ram  sc_h  sc_w  \
0           188        2   2         20       756  2549     9     7
1           136        3   6        905      1988  2631    17     3
2           145        5   6       1263      1716  2603    11     2
3           131        6   9       1216      1786  2769    16     8
4           141        2  14       1208      1212  1411     8     2
...         ...      ...  ..        ...       ...   ...   ...   ...
1995        106        6  14       1222      1890   668    13     4
1996        187        4   3        915      1965  2032    11    10
1997        108        8   3        868      1632  3057     9     1
1998        145        5   5        336       670   869    18    10
1999        168        6  16        483       754  3919    19     4

      talk_time  three_g  touch_screen  wifi  price_range
0            19        0             0     1            1
1             7        1             1     0            2
2             9        1             1     0            2
3            11        1             0     0            2
4            15        1             1     0            1
...         ...      ...           ...   ...          ...
1995         19        1             1     0            0
1996         16        1             1     1            2
1997          5        1             1     0            3
1998         19        1             1     1            0
1999          2        1             1     1            3
```

```
[2000 rows x 20 columns]
```

```
data.loc[data['px_height']==0]
```

```
      battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
1481           1834     0          2.1         0   7       1
40
1933            897     1          2.0         0   3       1
2

      mobile_wt  n_cores  pc  px_height  px_width   ram  sc_h  sc_w  \
1481         99        4  11          0      1987  3692    13     0
1933        154        8  10          0       994  1958     7     5

      talk_time  three_g  touch_screen  wifi  price_range
1481         16        1             1     0            3
1933          7        1             1     0            1
```

- Pixel Resolution Height can't be 0 !!!

So drop this two rows

```
data.drop(index=[1481,1933],inplace=True)
data.reset_index(inplace=True)
```

```
data.drop('index',axis=1,inplace=True)
```

```
data
```

```
      battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0               842     0          2.2         0   1       0
7
1              1021     1          0.5         1   0       1
53
2               563     1          0.5         1   2       1
41
3               615     1          2.5         0   0       0
10
4              1821     1          1.2         0  13       1
44
...             ...   ...          ...       ...  ..     ...         .
..
1993            794     1          0.5         1   0       1
2
1994           1965     1          2.6         1   0       0
39
1995           1911     0          0.9         1   1       1
36
1996           1512     0          0.9         0   4       1
```

```
46
1997            510     1          2.0         1   5       1
45

      mobile_wt  n_cores  pc  px_height  px_width   ram  sc_h  sc_w  \
0           188        2   2         20       756  2549     9     7
1           136        3   6        905      1988  2631    17     3
2           145        5   6       1263      1716  2603    11     2
3           131        6   9       1216      1786  2769    16     8
4           141        2  14       1208      1212  1411     8     2
...         ...      ...  ..        ...       ...   ...   ...   ...
1993        106        6  14       1222      1890   668    13     4
1994        187        4   3        915      1965  2032    11    10
1995        108        8   3        868      1632  3057     9     1
1996        145        5   5        336       670   869    18    10
1997        168        6  16        483       754  3919    19     4

      talk_time  three_g  touch_screen  wifi  price_range
0            19        0             0     1            1
1             7        1             1     0            2
2             9        1             1     0            2
3            11        1             0     0            2
4            15        1             1     0            1
...         ...      ...           ...   ...          ...
1993         19        1             1     0            0
1994         16        1             1     1            2
1995          5        1             1     0            3
1996         19        1             1     1            0
1997          2        1             1     1            3

[1998 rows x 20 columns]
```

Now creat Final dataframe

```
#data.drop(['mobile_wt','px_width','sc_h'],axis=1,inplace=True)
Final_df = pd.DataFrame(data)
Final_df
```

```
      battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0               842     0          2.2         0   1       0
7
1              1021     1          0.5         1   0       1
53
2               563     1          0.5         1   2       1
41
3               615     1          2.5         0   0       0
10
4              1821     1          1.2         0  13       1
44
...             ...   ...          ...       ...  ..     ...         .
```

```
..
1993            794     1          0.5         1   0       1
2
1994           1965     1          2.6         1   0       0
39
1995           1911     0          0.9         1   1       1
36
1996           1512     0          0.9         0   4       1
46
1997            510     1          2.0         1   5       1
45

      mobile_wt  n_cores  pc  px_height  px_width   ram  sc_h  sc_w  \
0           188        2   2         20       756  2549     9     7
1           136        3   6        905      1988  2631    17     3
2           145        5   6       1263      1716  2603    11     2
3           131        6   9       1216      1786  2769    16     8
4           141        2  14       1208      1212  1411     8     2
...         ...      ...  ..        ...       ...   ...   ...   ...
1993        106        6  14       1222      1890   668    13     4
1994        187        4   3        915      1965  2032    11    10
1995        108        8   3        868      1632  3057     9     1
1996        145        5   5        336       670   869    18    10
1997        168        6  16        483       754  3919    19     4

      talk_time  three_g  touch_screen  wifi  price_range
0            19        0             0     1            1
1             7        1             1     0            2
2             9        1             1     0            2
3            11        1             0     0            2
4            15        1             1     0            1
...         ...      ...           ...   ...          ...
1993         19        1             1     0            0
1994         16        1             1     1            2
1995          5        1             1     0            3
1996         19        1             1     1            0
1997          2        1             1     1            3

[1998 rows x 20 columns]
```

Now creat Final dataframe:

```
X = Final_df.drop('price_range',axis=1)
y = Final_df['price_range']
```

Decision Tree

```
from sklearn.tree import DecisionTreeClassifier
```

```
from sklearn.model_selection import GridSearchCV

X_train,X_test,y_train,y_test =
train_test_split(X,y,test_size=0.2,random_state=42)

# 'criterion': The function to measure the quality of split
# 'max_depth': The maximum depth of the tree
# 'max_leaf_nodes': The maximum number of leaf nodes required
# 'min_samples_leaf': The minimum number of samples required to be at
a leaf node
# 'min_samples_split': The minimum number of samples required to split
an internal node

max_depth = np.arange(1,5,1)
min_samples_leaf = np.arange(0,50,10)
max_leaf_nodes = np.arange(10,20,1)

# set of parameters to test
param_grid = {"criterion": ["gini", "entropy"],
              "max_depth": max_depth,
              "min_samples_leaf":min_samples_leaf,
              "max_leaf_nodes": max_leaf_nodes}

decision_tree_Gridsearch = DecisionTreeClassifier()
decision_tree_Gridsearch = GridSearchCV(decision_tree_Gridsearch,
param_grid, cv=10)
decision_tree_Gridsearch.fit(X_train, y_train)

GridSearchCV(cv=10, estimator=DecisionTreeClassifier(),
             param_grid={'criterion': ['gini', 'entropy'],
                         'max_depth': array([1, 2, 3, 4]),
                         'max_leaf_nodes': array([10, 11, 12, 13, 14,
15, 16, 17, 18, 19]),
                         'min_samples_leaf': array([ 0, 10, 20, 30,
40])})

decision_tree_Gridsearch.best_params_

{'criterion': 'gini',
 'max_depth': 4,
 'max_leaf_nodes': 14,
 'min_samples_leaf': 10}
```

- Instantiate the 'DecisionTreeClassifier' object using 'entropy' criterion

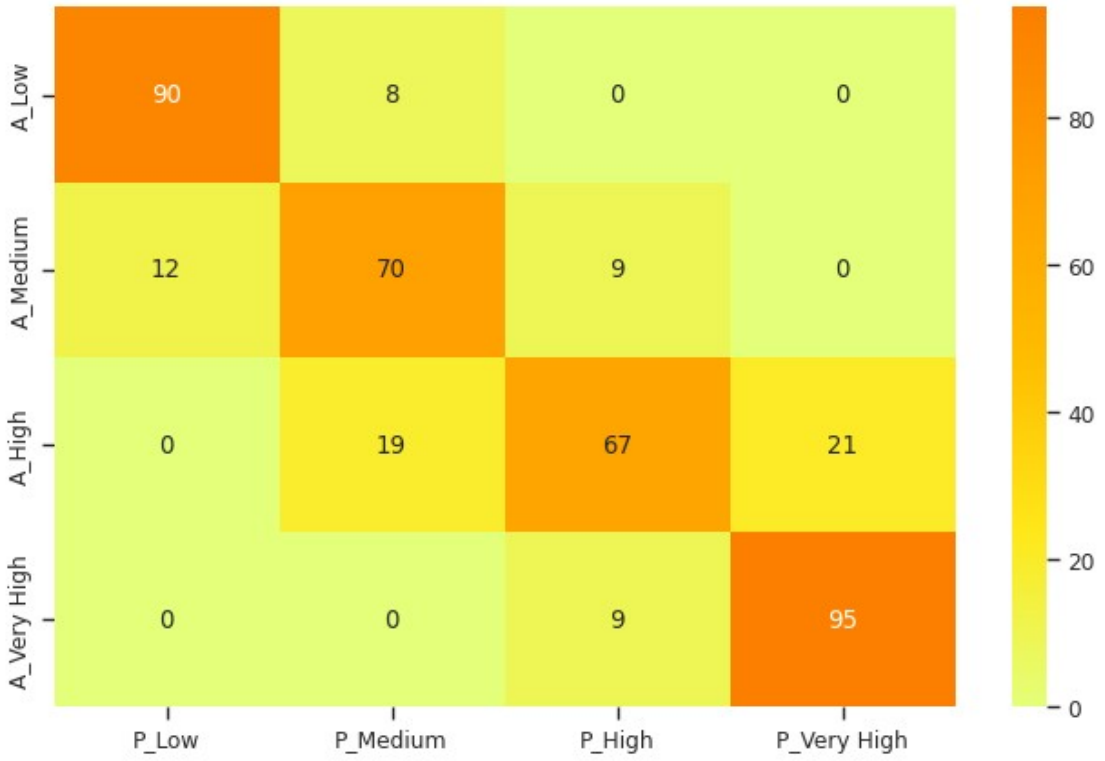
```
decision_tree_classification =
DecisionTreeClassifier(criterion='gini',
 max_depth=4,
 max_leaf_nodes=14,
 min_samples_leaf=10)
```

```
decision_tree_Grid = decision_tree_classification.fit(X_train,
y_train)

# predict the model using 'X_test'
y_pred = decision_tree_Grid.predict(X_test)

print("Accuracy:",metrics.accuracy_score(y_test,y_pred))
```

```
Accuracy: 0.805
```

compute the confusion matrix

```
cm = confusion_matrix(y_test, y_pred)

# label the confusion matrix
conf_matrix=pd.DataFrame(data=cm,columns=['P_Low','P_Medium','P_High',
'P_Very High'],index=['A_Low','A_Medium','A_High','A_Very High'])

# set size of the plot
plt.figure(figsize = (8,5))

# plot a heatmap
sns.heatmap(conf_matrix, annot=True,fmt='d',cmap="Wistia")
plt.show()
```



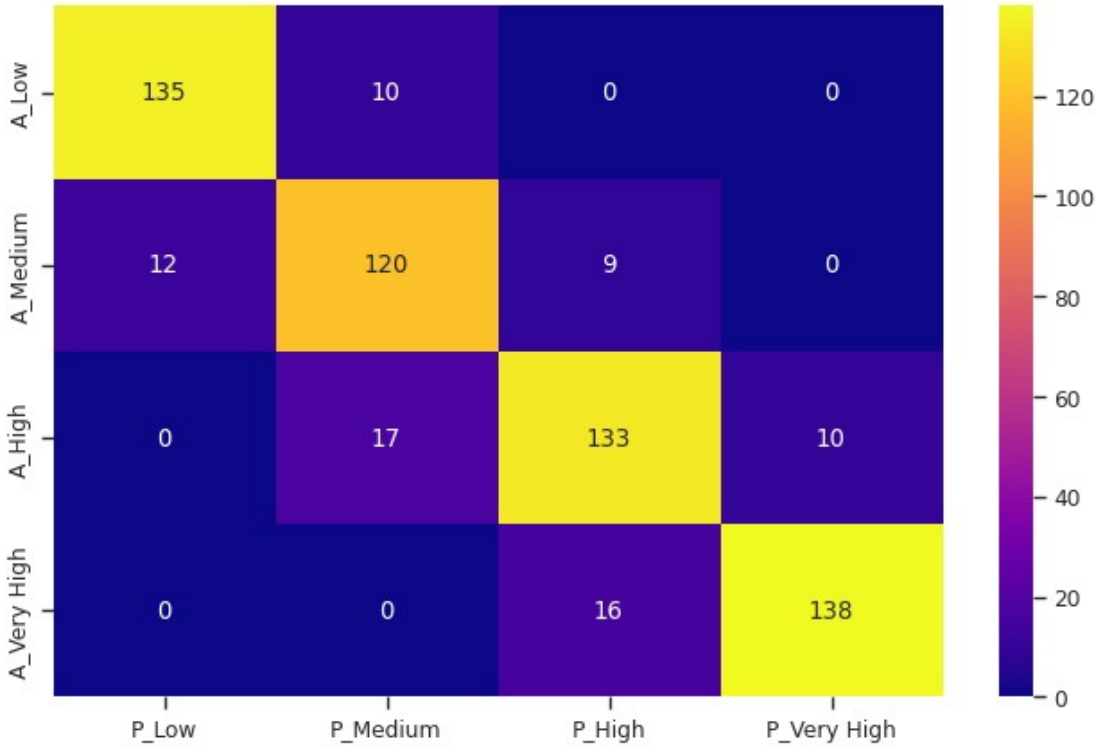

```
reporDTree = classification_report(y_test, y_pred, output_dict = True)
CDTree = pd.DataFrame(reporDTree).transpose()
CDTree
```

```
              precision    recall  f1-score  support
0              0.882353  0.918367  0.900000   98.000
1              0.721649  0.769231  0.744681   91.000
2              0.788235  0.626168  0.697917  107.000
3              0.818966  0.913462  0.863636  104.000
accuracy       0.805000  0.805000  0.805000    0.805
macro avg      0.802801  0.806807  0.801558  400.000
weighted avg   0.804136  0.805000  0.801153  400.000
```

It's not good result at all.

Random Forest

```
from sklearn.ensemble import RandomForestClassifier

X_train,X_test,y_train,y_test =
train_test_split(X,y,test_size=0.3,random_state=42)

# instantiate the 'DecisionTreeClassifier' object using 'entropy'
criterion
random_forest =
RandomForestClassifier(n_estimators=50,criterion='entropy',max_feature
s=4)

# train model
random_forest.fit(X_train, y_train)

# predict the model using 'X_test'
y_pred = random_forest.predict(X_test)

print("Accuracy:",metrics.accuracy_score(y_test,y_pred))

Accuracy: 0.8766666666666667

# compute the confusion matrix
cm = confusion_matrix(y_test, y_pred)

# label the confusion matrix
conf_matrix=pd.DataFrame(data=cm,columns=['P_Low','P_Medium','P_High',
'P_Very High'],index=['A_Low','A_Medium','A_High','A_Very High'])

# set size of the plot
plt.figure(figsize = (8,5))

# plot a heatmap
sns.heatmap(conf_matrix, annot=True,fmt='d',cmap="plasma")
plt.show()
```




```
reportRF = classification_report(y_test, y_pred)
print(reportRF)
```

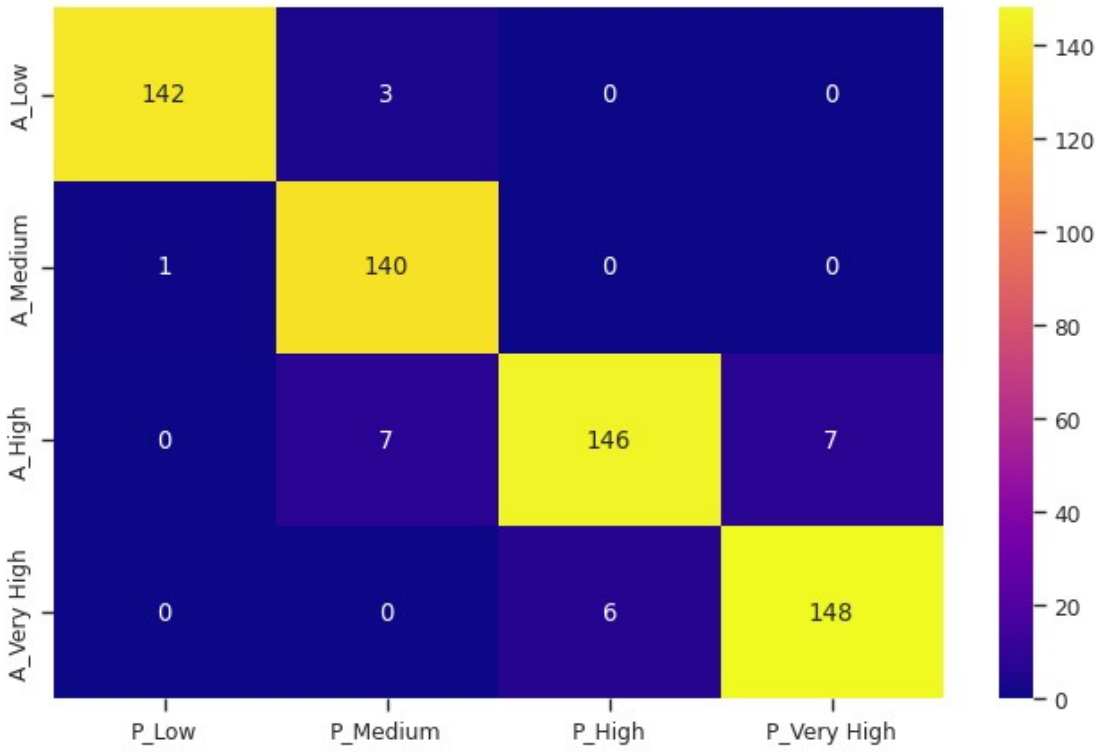
```
              precision    recall  f1-score   support

           0       0.92      0.93      0.92       145
           1       0.82      0.85      0.83       141
           2       0.84      0.83      0.84       160
           3       0.93      0.90      0.91       154

    accuracy                           0.88       600
   macro avg       0.88      0.88      0.88       600
weighted avg       0.88      0.88      0.88       600
```

Accuracy is 88% and f1 for 1 and 2 it's not good result.

SVM

```
from sklearn.svm import SVC

X_train,X_test,y_train,y_test =
train_test_split(X,y,test_size=0.3,random_state=42)

SVM = SVC()

SVM.fit(X_train,y_train)
```

```
y_pred = SVM.predict(X_test)
y_pred_train = SVM.predict(X_train)

print("Accuracy:",metrics.accuracy_score(y_test,y_pred))

Accuracy: 0.96

print("Accuracy:",metrics.accuracy_score(y_train,y_pred_train))

Accuracy: 0.9456366237482118

# compute the confusion matrix
cm = confusion_matrix(y_test, y_pred)

# label the confusion matrix
conf_matrix=pd.DataFrame(data=cm,columns=['P_Low','P_Medium','P_High',
'P_Very High'],index=['A_Low','A_Medium','A_High','A_Very High'])

# set size of the plot
plt.figure(figsize = (8,5))

# plot a heatmap
sns.heatmap(conf_matrix, annot=True,fmt='d',cmap="plasma")
plt.show()
```




```
result = classification_report(y_test, y_pred)
print(result)
```

```
              precision    recall  f1-score   support

           0       0.99      0.98      0.99       145
           1       0.93      0.99      0.96       141
           2       0.96      0.91      0.94       160
           3       0.95      0.96      0.96       154

    accuracy                           0.96       600
   macro avg       0.96      0.96      0.96       600
weighted avg       0.96      0.96      0.96       600
```

```
result = classification_report(y_train, y_pred_train)
print(result)
```

```
              precision    recall  f1-score   support

           0       0.96      0.99      0.97       355
           1       0.93      0.94      0.93       358
           2       0.95      0.88      0.91       340
           3       0.94      0.98      0.96       345

    accuracy                           0.95      1398
   macro avg       0.95      0.95      0.94      1398
weighted avg       0.95      0.95      0.95      1398
```

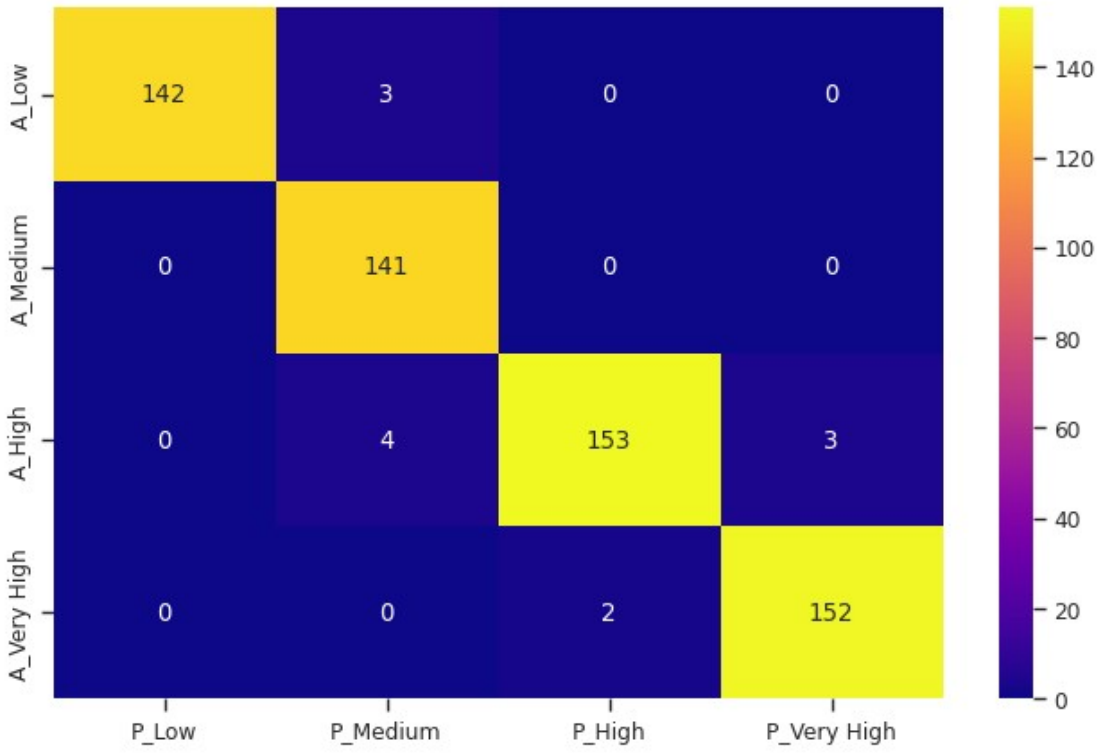
Improving SVM Model

```
svm1 =
SVC(C=0.2,decision_function_shape='ovo',gamma='auto',kernel='linear',r
andom_state=1)
svm1.fit(X_train,y_train)
y_pred = svm1.predict(X_test)

print("Accuracy:",metrics.accuracy_score(y_test,y_pred))
```

```
Accuracy: 0.98
```

```
# compute the confusion matrix
cm = confusion_matrix(y_test, y_pred)

# label the confusion matrix
conf_matrix=pd.DataFrame(data=cm,columns=['P_Low','P_Medium','P_High',
'P_Very High'],index=['A_Low','A_Medium','A_High','A_Very High'])

# set size of the plot
plt.figure(figsize = (8,5))

# plot a heatmap
```

```
sns.heatmap(conf_matrix, annot=True,fmt='d',cmap="plasma")
plt.show()
```




```
result = classification_report(y_test, y_pred)
print(result)
```

```
              precision    recall  f1-score   support

           0       1.00      0.98      0.99       145
           1       0.95      1.00      0.98       141
           2       0.99      0.96      0.97       160
           3       0.98      0.99      0.98       154

    accuracy                           0.98       600
   macro avg       0.98      0.98      0.98       600
weighted avg       0.98      0.98      0.98       600
```

Accuracy for train

```
y_pred_train = svm1.predict(X_train)

print("Accuracy:",metrics.accuracy_score(y_train,y_pred_train))
```

```
Accuracy: 0.9921316165951359
```

```
result = classification_report(y_train, y_pred_train)
print(result)
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00       355
           1       0.99      0.99      0.99       358
           2       0.98      0.99      0.98       340
           3       1.00      0.99      0.99       345

    accuracy                           0.99      1398
   macro avg       0.99      0.99      0.99      1398
weighted avg       0.99      0.99      0.99      1398
```

Great! We got a high accuracy 98% resul from SVM Model...

So let's doing to test_samples prediction

```
data_test =
pd.read_csv('/kaggle/input/mobile-price-classification/test.csv')
data_test = pd.DataFrame(data_test)
data_test
```

```
       id  battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0       1           1043     1          1.8         1  14       0
5
1       2            841     1          0.5         1   4       1
61
2       3           1807     1          2.8         0   1       0
27
3       4           1546     0          0.5         1  18       1
25
4       5           1434     0          1.4         0  11       1
49
..    ...            ...   ...          ...       ...  ..     ...
...
995   996           1700     1          1.9         0   0       1
54
996   997            609     0          1.8         1   0       0
13
997   998           1185     0          1.4         0   1       1
8
998   999           1533     1          0.5         1   0       0
50
999  1000           1270     1          0.5         0   4       1
35

     m_dep  mobile_wt  ...  pc  px_height  px_width   ram  sc_h  sc_w
\
0      0.1        193  ...  16        226      1412  3476    12     7

1      0.8        191  ...  12        746       857  3895     6     0
```

```
2      0.9        186  ...   4       1270      1366  2396    17    10

3      0.5         96  ...  20        295      1752  3893    10     0

4      0.5        108  ...  18        749       810  1773    15     8

..     ...        ...  ...  ..        ...       ...   ...   ...   ...

995    0.5        170  ...  17        644       913  2121    14     8

996    0.9        186  ...   2       1152      1632  1933     8     1

997    0.5         80  ...  12        477       825  1223     5     0

998    0.4        171  ...  12         38       832  2509    15    11

999    0.1        140  ...  19        457       608  2828     9     2
```

```
     talk_time  three_g  touch_screen  wifi
0            2        0             1     0
1            7        1             0     0
2           10        0             1     1
3            7        1             1     0
4            7        1             0     1
..         ...      ...           ...   ...
995         15        1             1     0
996         19        0             1     1
997         14        1             0     0
998          6        0             1     0
999          3        1             0     1

[1000 rows x 21 columns]
```

a quick and general look at the data_test

```
data_test.describe(include='all').T
```

```
                count       mean          std    min      25%     50%
\
id             1000.0   500.5000   288.819436    1.0   250.75   500.5

battery_power  1000.0  1248.5100   432.458227  500.0   895.00  1246.5

blue           1000.0     0.5160     0.499994    0.0     0.00     1.0

clock_speed    1000.0     1.5409     0.829268    0.5     0.70     1.5

dual_sim       1000.0     0.5170     0.499961    0.0     0.00     1.0
```

fc	1000.0	4.5930	4.463325	0.0	1.00	3.0
four_g	1000.0	0.4870	0.500081	0.0	0.00	0.0
int_memory	1000.0	33.6520	18.128694	2.0	18.00	34.5
m_dep	1000.0	0.5175	0.280861	0.1	0.30	0.5
mobile_wt	1000.0	139.5110	34.851550	80.0	109.75	139.0
n_cores	1000.0	4.3280	2.288155	1.0	2.00	4.0
pc	1000.0	10.0540	6.095099	0.0	5.00	10.0
px_height	1000.0	627.1210	432.929699	0.0	263.75	564.5
px_width	1000.0	1239.7740	439.670981	501.0	831.75	1250.0
ram	1000.0	2138.9980	1088.092278	263.0	1237.25	2153.5
sc_h	1000.0	11.9950	4.320607	5.0	8.00	12.0
sc_w	1000.0	5.3160	4.240062	0.0	2.00	5.0
talk_time	1000.0	11.0850	5.497636	2.0	6.75	11.0
three_g	1000.0	0.7560	0.429708	0.0	1.00	1.0
touch_screen	1000.0	0.5000	0.500250	0.0	0.00	0.5
wifi	1000.0	0.5070	0.500201	0.0	0.00	1.0

	75%	max
id	750.25	1000.0
battery_power	1629.25	1999.0
blue	1.00	1.0
clock_speed	2.30	3.0
dual_sim	1.00	1.0
fc	7.00	19.0
four_g	1.00	1.0
int_memory	49.00	64.0
m_dep	0.80	1.0
mobile_wt	170.00	200.0
n_cores	6.00	8.0
pc	16.00	20.0
px_height	903.00	1907.0

```
px_width       1637.75  1998.0
ram            3065.50  3989.0
sc_h             16.00    19.0
sc_w              8.00    18.0
talk_time        16.00    20.0
three_g           1.00     1.0
touch_screen      1.00     1.0
wifi              1.00     1.0
```

```
data_test.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   id             1000 non-null   int64  
 1   battery_power  1000 non-null   int64  
 2   blue           1000 non-null   int64  
 3   clock_speed    1000 non-null   float64
 4   dual_sim       1000 non-null   int64  
 5   fc             1000 non-null   int64  
 6   four_g         1000 non-null   int64  
 7   int_memory     1000 non-null   int64  
 8   m_dep          1000 non-null   float64
 9   mobile_wt      1000 non-null   int64  
 10  n_cores        1000 non-null   int64  
 11  pc             1000 non-null   int64  
 12  px_height      1000 non-null   int64  
 13  px_width       1000 non-null   int64  
 14  ram            1000 non-null   int64  
 15  sc_h           1000 non-null   int64  
 16  sc_w           1000 non-null   int64  
 17  talk_time      1000 non-null   int64  
 18  three_g        1000 non-null   int64  
 19  touch_screen   1000 non-null   int64  
 20  wifi           1000 non-null   int64  
dtypes: float64(2), int64(19)
memory usage: 164.2 KB
```

```
## Here drop the "id " and "'m_dep"
```

```
data_test.drop(['id','m_dep'],axis=1,inplace=True)
data_test
```

```
     battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0             1043     1          1.8         1  14       0
5
1              841     1          0.5         1   4       1
61
```

```
2            1807     1          2.8         0   1       0
27
3            1546     0          0.5         1  18       1
25
4            1434     0          1.4         0  11       1
49
..            ...   ...          ...       ...  ..     ...         ..
.
995          1700     1          1.9         0   0       1
54
996           609     0          1.8         1   0       0
13
997          1185     0          1.4         0   1       1
8
998          1533     1          0.5         1   0       0
50
999          1270     1          0.5         0   4       1
35

     mobile_wt  n_cores  pc  px_height  px_width   ram  sc_h  sc_w
talk_time  \
0          193        3  16        226      1412  3476    12     7
2
1          191        5  12        746       857  3895     6     0
7
2          186        3   4       1270      1366  2396    17    10
10
3           96        8  20        295      1752  3893    10     0
7
4          108        6  18        749       810  1773    15     8
7
..         ...      ...  ..        ...       ...   ...   ...   ...
...
995        170        7  17        644       913  2121    14     8
15
996        186        4   2       1152      1632  1933     8     1
19
997         80        1  12        477       825  1223     5     0
14
998        171        2  12         38       832  2509    15    11
6
999        140        6  19        457       608  2828     9     2
3

     three_g  touch_screen  wifi
0          0             1     0
1          1             0     0
2          0             1     1
3          1             1     0
4          1             0     1
```

```
..       ...           ...   ...
995        1             1     0
996        0             1     1
997        1             0     0
998        0             1     0
999        1             0     1

[1000 rows x 19 columns]
```

- checked ['px_height']==0

```
data_test.loc[data_test['px_height']==0]
```

```
     battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
420            986     0          2.8         0   0       1
26
819           1992     1          1.3         1   8       1
43

     mobile_wt  n_cores  pc  px_height  px_width   ram  sc_h  sc_w
talk_time  \
420         80        8   9          0      1214  1316     7     5
8
819        153        5  15          0       883  2179     7     6
20

     three_g  touch_screen  wifi
420        1             0     0
819        1             1     0
```

```
data_test.drop(index=[420,819],inplace=True)
data_test.reset_index(inplace=True)
```

```
data_test.drop('index',axis=1,inplace=True)
```

```
data_test
```

```
     battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0             1043     1          1.8         1  14       0
5
1              841     1          0.5         1   4       1
61
2             1807     1          2.8         0   1       0
27
3             1546     0          0.5         1  18       1
25
4             1434     0          1.4         0  11       1
49
..             ...   ...          ...       ...  ..     ...         ..
.
```

```
993          1700     1          1.9         0   0       1
54
994           609     0          1.8         1   0       0
13
995          1185     0          1.4         0   1       1
8
996          1533     1          0.5         1   0       0
50
997          1270     1          0.5         0   4       1
35

     mobile_wt  n_cores  pc  px_height  px_width   ram  sc_h  sc_w
talk_time  \
0          193        3  16        226      1412  3476    12     7
2
1          191        5  12        746       857  3895     6     0
7
2          186        3   4       1270      1366  2396    17    10
10
3           96        8  20        295      1752  3893    10     0
7
4          108        6  18        749       810  1773    15     8
7
..         ...      ...  ..        ...       ...   ...   ...   ...
...
993        170        7  17        644       913  2121    14     8
15
994        186        4   2       1152      1632  1933     8     1
19
995         80        1  12        477       825  1223     5     0
14
996        171        2  12         38       832  2509    15    11
6
997        140        6  19        457       608  2828     9     2
3

     three_g  touch_screen  wifi
0          0             1     0
1          1             0     0
2          0             1     1
3          1             1     0
4          1             0     1
..       ...           ...   ...
993        1             1     0
994        0             1     1
995        1             0     0
996        0             1     0
997        1             0     1

[998 rows x 19 columns]
```

Now our data_test is ready for predict the price_range ✓

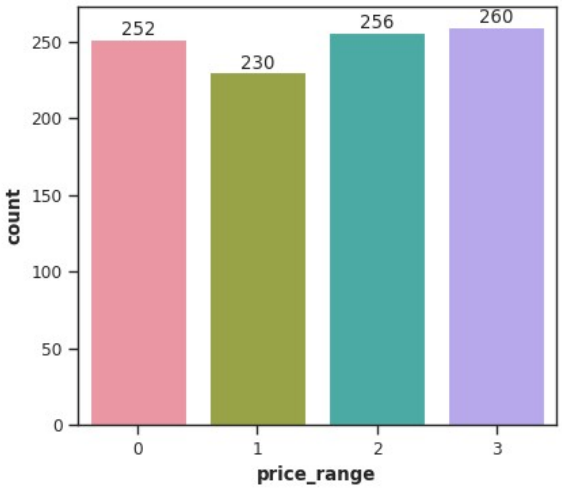
```
data_test['price_range'] = svm1.predict(data_test)
data_test
```

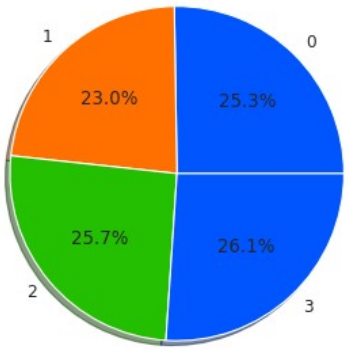
```
     battery_power  blue  clock_speed  dual_sim  fc  four_g
int_memory  \
0             1043     1          1.8         1  14       0
5
1              841     1          0.5         1   4       1
61
2             1807     1          2.8         0   1       0
27
3             1546     0          0.5         1  18       1
25
4             1434     0          1.4         0  11       1
49
..             ...   ...          ...       ...  ..     ...         ..
.
993           1700     1          1.9         0   0       1
54
994            609     0          1.8         1   0       0
13
995           1185     0          1.4         0   1       1
8
996           1533     1          0.5         1   0       0
50
997           1270     1          0.5         0   4       1
35

     mobile_wt  n_cores  pc  px_height  px_width   ram  sc_h  sc_w
talk_time  \
0          193        3  16        226      1412  3476    12     7
2
1          191        5  12        746       857  3895     6     0
7
2          186        3   4       1270      1366  2396    17    10
10
3           96        8  20        295      1752  3893    10     0
7
4          108        6  18        749       810  1773    15     8
7
..         ...      ...  ..        ...       ...   ...   ...   ...
...
993        170        7  17        644       913  2121    14     8
15
994        186        4   2       1152      1632  1933     8     1
19
995         80        1  12        477       825  1223     5     0
14
996        171        2  12         38       832  2509    15    11
```

```
6
997        140        6  19        457       608  2828     9     2
3

     three_g  touch_screen  wifi  price_range
0          0             1     0            3
1          1             0     0            3
2          0             1     1            2
3          1             1     0            3
4          1             0     1            1
..       ...           ...   ...          ...
993        1             1     0            2
994        0             1     1            1
995        1             0     0            0
996        0             1     0            2
997        1             0     1            2

[998 rows x 20 columns]
```

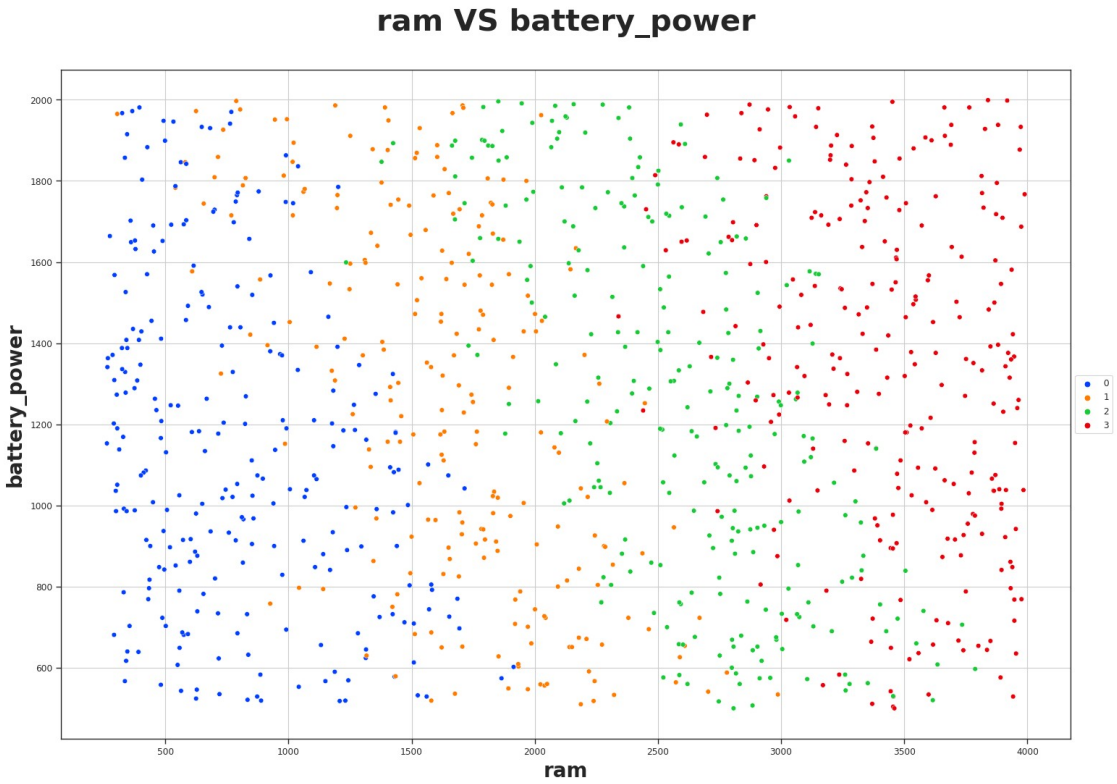
```python
fig,axes = plt.subplots(1,2,figsize=(10,4))

sns.countplot(data=data_test,x='price_range',ax=axes[0])

for container in axes[0].containers:
    axes[0].bar_label(container)

slices = data_test['price_range'].value_counts().sort_index().values
activities = [var for var in
data_test['price_range'].value_counts().sort_index().index]
axes[1].pie(slices,labels=activities,shadow=True, autopct='%1.1f%%')

plt.suptitle(f'count of unique value in each price range',y=1.09)
plt.show()
```

count of unique value in each price range






```
sns.set_palette('bright')
sns.scatterplot(data=data_test,x='ram',y='battery_power',hue='price_ra
nge',palette='bright')
plt.legend(loc='center left',bbox_to_anchor=(1,0.5))
plt.title("ram VS battery_power",fontsize=30,fontweight='bold',y=1.05)
plt.xlabel("ram",fontsize=20,fontweight='bold')
plt.ylabel('battery_power',fontsize=20,fontweight='bold')
plt.grid()
plt.show()
```


ram VS battery_power
battery_power
ram
2000
1800
1600
1400
1200
1000
800
600
500
1000
1500
2000
2500
3000
3500
4000
0
1
2
3