Analyzing Popular App Categories on Google Play Project

In this project, our goal is to determine the types of apps that are popular on the Google Play Store. We are part of a company that produces free apps and generates revenue through ads. By gaining insights into the app categories in high demand, we aim to assist our developers in creating apps that attract more users and generate increased revenue. Our approach involves analyzing data from the Google Play Store to identify patterns and user preferences. This information will enable us to make more informed decisions about the types of apps we develop.

In [1]:

```
import pandas as pd
import matplotlib.pyplot as plt
```

In [2]:

```
#read the database in pandas dataframe object
android_df=pd.read_csv("googleplaystore.csv")
```

In [3]:

```
#Explore the data using pandas method
android_df.head()
```

Out[3]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Upd
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	Art & Design	Jar 7, .
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	Everyone	Art & Design;Pretend Play	Jar 15, .
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	Art & Design	Au 1, .
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	Art & Design	Ju .
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Art & Design;Creativity	Jun .

In [4]:

```
android_df["Category"].value_counts()
```

Out[4]:

```
FAMILY                 1972
GAME                   1144
TOOLS                   843
MEDICAL                 463
BUSINESS                460
PRODUCTIVITY            424
```

```
PERSONALIZATION        392
COMMUNICATION          387
SPORTS                 384
LIFESTYLE              382
FINANCE                366
HEALTH_AND_FITNESS     341
PHOTOGRAPHY            335
SOCIAL                 295
NEWS_AND_MAGAZINES     283
SHOPPING               260
TRAVEL_AND_LOCAL       258
DATING                 234
BOOKS_AND_REFERENCE    231
VIDEO_PLAYERS          175
EDUCATION              156
ENTERTAINMENT          149
MAPS_AND_NAVIGATION    137
FOOD_AND_DRINK         127
HOUSE_AND_HOME          88
LIBRARIES_AND_DEMO      85
AUTO_AND_VEHICLES       85
WEATHER                 82
ART_AND_DESIGN          65
EVENTS                  64
PARENTING               60
COMICS                  60
BEAUTY                  53
1.9                      1
Name: Category, dtype: int64
```

In [5]:

```
android_df[android_df["Category"]=="1.9"]
```

Out[5]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Cu
10472	Life Made WI-Fi Touchscreen Photo Frame	1.9	19.0	3.0M	1,000+	Free	0	Everyone	NaN	February 11, 2018	1.0.19	4.

In [6]:

```
android_df[android_df["Category"]=="1.9"].values
```

Out[6]:

```
array([['Life Made WI-Fi Touchscreen Photo Frame', '1.9', 19.0, '3.0M',
        '1,000+', 'Free', '0', 'Everyone', nan, 'February 11, 2018',
        '1.0.19', '4.0 and up', nan]], dtype=object)
```

In [7]:

```
clean_1st=['Life Made WI-Fi Touchscreen Photo Frame','LIFESTYLE','1.9', 19.0, '3.0M',
        '1,000+', 'Free', '0', 'Everyone','LIFESTYLE' , 'February 11, 2018',
        '1.0.19', '4.0 and up']
clean_1st
```

Out[7]:

```
['Life Made WI-Fi Touchscreen Photo Frame',
 'LIFESTYLE',
 '1.9',
 19.0,
 '3.0M',
 '1,000+',
 'Free',
 '0',
 'Everyone',
 'LIFESTYLE',
 'February 11, 2018',
 '1.0.19',
 '4.0 and up']
```

In [8]:

```
android_df[android_df["Category"]=="1.9"]=clean_1st
```

In [9]:

```
android_category=android_df["Category"].value_counts()
android_category
```

Out[9]:

```
FAMILY                 1972
GAME                   1144
TOOLS                   843
MEDICAL                 463
BUSINESS                460
PRODUCTIVITY            424
PERSONALIZATION         392
COMMUNICATION           387
SPORTS                  384
LIFESTYLE               383
FINANCE                 366
HEALTH_AND_FITNESS      341
PHOTOGRAPHY             335
SOCIAL                  295
NEWS_AND_MAGAZINES      283
SHOPPING                260
TRAVEL_AND_LOCAL        258
DATING                  234
BOOKS_AND_REFERENCE     231
VIDEO_PLAYERS           175
EDUCATION               156
ENTERTAINMENT           149
MAPS_AND_NAVIGATION     137
FOOD_AND_DRINK          127
HOUSE_AND_HOME           88
AUTO_AND_VEHICLES        85
LIBRARIES_AND_DEMO       85
WEATHER                  82
ART_AND_DESIGN           65
EVENTS                   64
PARENTING                60
COMICS                   60
BEAUTY                   53
Name: Category, dtype: int64
```

In [10]:

```
app_count=android_df["App"].value_counts()
app_count
```

Out[10]:

```
ROBLOX                                                9
CBS Sports App - Scores, News, Stats & Watch Live     8
ESPN                                                  7
Duolingo: Learn Languages Free                        7
Candy Crush Saga                                      7
                                                     ..
Meet U - Get Friends for Snapchat, Kik & Instagram    1
U-Report                                              1
U of I Community Credit Union                         1
Waiting For U Launcher Theme                          1
iHoroscope - 2018 Daily Horoscope & Astrology         1
Name: App, Length: 9660, dtype: int64
```

In [11]:

```
app_count[app_count >1]
```

Out[11]:

```
ROBLOX                                               9
CBS Sports App - Scores, News, Stats & Watch Live    8
ESPN                                                 7
Duolingo: Learn Languages Free                       7
Candy Crush Saga                                     7
                                                    ..
Transenger – Ts Dating and Chat for Free             2
```

```
Random Video Chat                                    2
Clover Dating App                                    2
Docs To Go™ Free Office Suite                        2
English Dictionary - Offline                         2
Name: App, Length: 798, dtype: int64
```

In [12]:

```
"Instagram" in app_count[app_count >1].index
```

Out[12]:

```
True
```

In [13]:

```
android_df[android_df["App"]== "Instagram"]
```

Out[13]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Cur
2545	Instagram	SOCIAL	4.5	66577313	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	V d
2604	Instagram	SOCIAL	4.5	66577446	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	V d
2611	Instagram	SOCIAL	4.5	66577313	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	V d
3909	Instagram	SOCIAL	4.5	66509917	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	V d

In [14]:

```
# check for duplicate rows based on "App" column marking all duplicates as True
duplicate_apps_df=android_df[android_df.duplicated(subset=["App"],keep=False)]
#keep=false means show all duplicates
duplicate_apps_df[duplicate_apps_df["App"]=="Instagram"]
```

Out[14]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Cur
2545	Instagram	SOCIAL	4.5	66577313	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	V d
2604	Instagram	SOCIAL	4.5	66577446	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	V d
2611	Instagram	SOCIAL	4.5	66577313	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	V d
3909	Instagram	SOCIAL	4.5	66509917	Varies with device	1,000,000,000+	Free	0	Teen	Social	July 31, 2018	V d

In [15]:

```
#number of duplicate app
num_duplicate_apps=duplicate_apps_df["App"].nunique()
num_duplicate_apps
```

Out[15]:

```
798
```

In [16]:

```
duplicate_apps_df.shape
```

Out[16]:

```
(1979, 13)
```

In [17]:
```
android_df.shape
```

Out[17]:
```
(10841, 13)
```

In [18]:
```
10841-1181
```

Out[18]:
```
9660
```

Part two

In [19]:
```
#Group by "App" and get the maximum number of reviews for each app
reviews_max=android_df.groupby("App")["Reviews"].max()
reviews_max["Instagram"]
```

Out[19]:
```
'66577446'
```

In [20]:
```
reviews_max
```

Out[20]:
```
App
"i DT" Fútbol. Todos Somos Técnicos.                 27
+Download 4 Instagram Twitter                     40467
- Free Comics - Comic Apps                          115
.R                                                  259
/u/app                                              573
                                                  ...
뽕티비 - 개인방송, 인터넷방송, BJ방송                          414
💎 I'm rich                                          718
💘 WhatsLov: Smileys of love, stickers and GIF     22098
📏 Smart Ruler ↔ cm/inch measuring for homework!     19
🔥 Football Wallpapers 4K | Full HD Backgrounds 😍    11661
Name: Reviews, Length: 9660, dtype: object
```

In [21]:
```
#create an empty list to store clean data
android_clean = []
#create an empty list to keep track of  already added app
already_added = []
#iterate through each row in the dataframe
for index, row in android_df.iterrows():
    name = row['App']
    n_reviews = row['Reviews']

    #check if the current app has the maximum number of reviews and has not been added b
    if (reviews_max[name] == n_reviews) and (name not in already_added):
        android_clean.append(row) #add the app tothe clean list
        already_added.append(name) #add the app name to the list of already added apps
```

In [22]:
```
android_clean = pd.DataFrame(android_clean)
```

In [23]:
```
android_clean.shape
```

Out[23]:
```
(9660, 13)
```

Removing Non-Engliish Apps

Part one

If you thoroughly examine the datasets, you'll observe that certain app names indicate they are not intended for an English-speaking audience. Here are a few examples from both datasets.

In [24]:
```python
ord("A")
```

Out[24]:
```
65
```

In [25]:
```python
ord("a")
```

Out[25]:
```
97
```

In [26]:
```python
chr(125)
```

Out[26]:
```
'}'
```

In [27]:
```python
def is_english(app_name):
    lst = []
    for i in app_name:
        if ord(i) > 127:
            lst.append(False)
        else:
            lst.append(True)
    check = set(lst)
    if False in check:
        return False
    else:
        return True
```

In [28]:
```python
for i in "sania":
    print(i)
```

```
s
a
n
i
a
```

In [29]:
```python
is_english("Instagram😍")
```

Out[29]:
```
False
```

In [30]:
```python
is_english("Instagram")
```

Out[30]:
```
True
```

Part Two

In [31]:
```python
def is_english(app_name):
    lst = []
    for i in app_name:
        if ord(i) > 127:
            lst.append(False)
        else:
            lst.append(True)
    non_ascii = 0
    for j in lst:
        if j == False:
            non_ascii += 1
    if non_ascii > 3:
        return False
    else:
        return True
```

In [32]:
```
is_english("english jokes 😊😊 😊😊 ")
```

Out[32]:
```
False
```

In [33]:
```
is_english("insta")
```

Out[33]:
```
True
```

In [34]:
```
android_clean["App"].apply(is_english)
```

Out[34]:
```
0        True
2        True
3        True
4        True
5        True
         ...
10836    True
10837    True
10838    True
10839    True
10840    True
Name: App, Length: 9660, dtype: bool
```

In [35]:
```
android_english = android_clean[android_clean["App"].apply(is_english)]
```

In [36]:
```
android_english.shape
```

Out[36]:
```
(9615, 13)
```

In [37]:
```
android_english.head()
```

Out[37]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Up
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	Art & Design	Ja 7,
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	Art & Design	A 1,
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	Art & Design	Ju
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Art & Design;Creativity	Ju
5	Paper flowers instructions	ART_AND_DESIGN	4.4	167	5.6M	50,000+	Free	0	Everyone	Art & Design	N 26,

Isolating the Free Apps

As stated in the introduction, our focus is on developing apps that are free to download and install. Our primary revenue comes from in-app advertisements. The dataset we are working with includes both free and non-free apps. To conduct our analysis, we need to separate and isolate only the free apps from both datasets. The following section outlines how we achieve this isolation for both datasets.

In [38]:

```
android_english["Price"].unique()
```

Out[38]:

```
array(['0', '$4.99', '$3.99', '$6.99', '$1.49', '$2.99', '$7.99', '$5.99',
       '$3.49', '$1.99', '$9.99', '$7.49', '$0.99', '$9.00', '$5.49',
       '$10.00', '$11.99', '$79.99', '$16.99', '$14.99', '$1.00',
       '$29.99', '$12.99', '$2.49', '$24.99', '$10.99', '$1.50', '$19.99',
       '$15.99', '$33.99', '$74.99', '$39.99', '$3.95', '$4.49', '$1.70',
       '$8.99', '$2.00', '$3.88', '$25.99', '$399.99', '$17.99',
       '$400.00', '$3.02', '$1.76', '$4.84', '$4.77', '$1.61', '$2.50',
       '$1.59', '$6.49', '$1.29', '$5.00', '$13.99', '$299.99', '$379.99',
       '$37.99', '$18.99', '$389.99', '$19.90', '$8.49', '$1.75',
       '$14.00', '$4.85', '$46.99', '$109.99', '$154.99', '$3.08',
       '$2.59', '$4.80', '$1.96', '$19.40', '$3.90', '$4.59', '$15.46',
       '$3.04', '$4.29', '$2.60', '$3.28', '$4.60', '$28.99', '$2.95',
       '$2.90', '$1.97', '$200.00', '$89.99', '$2.56', '$30.99', '$3.61',
       '$394.99', '$1.26', '$1.20', '$1.04'], dtype=object)
```

In [39]:

```
android_final = android_english[android_english["Price"]=="0"]
```

In [40]:

```
android_final.shape
```

Out[40]:

```
(8863, 13)
```

Most Common Apps by Genre

In [41]:

```
#Analysis
```

In [42]:

```
android_final["Category"].value_counts(normalize=True)*True
```

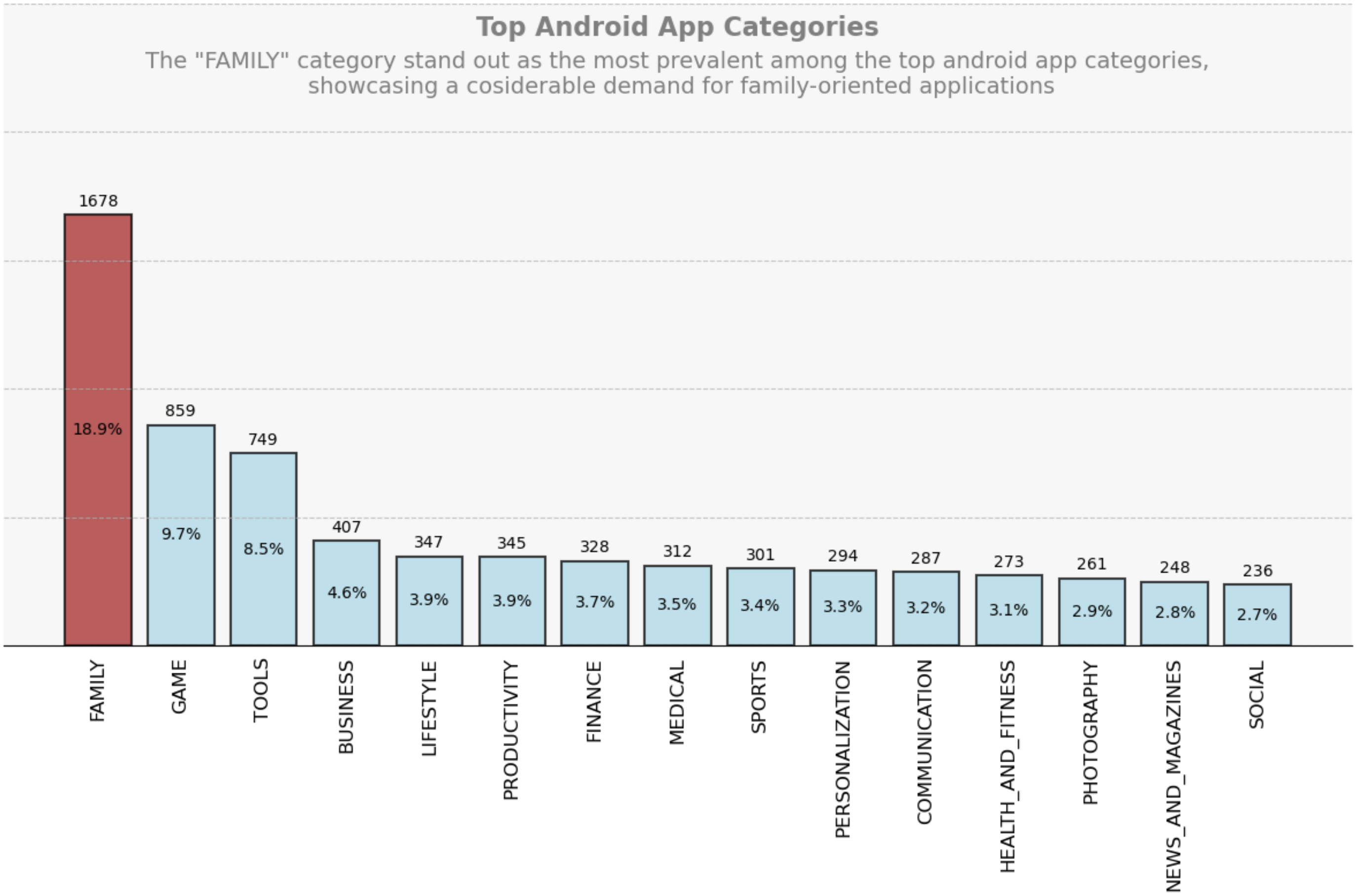
Out[42]:

```
FAMILY                 0.189326
GAME                   0.096920
TOOLS                  0.084509
BUSINESS               0.045921
LIFESTYLE              0.039152
PRODUCTIVITY           0.038926
FINANCE                0.037008
MEDICAL                0.035203
SPORTS                 0.033961
PERSONALIZATION        0.033172
COMMUNICATION          0.032382
HEALTH_AND_FITNESS     0.030802
PHOTOGRAPHY            0.029448
NEWS_AND_MAGAZINES     0.027981
SOCIAL                 0.026628
TRAVEL_AND_LOCAL       0.023356
SHOPPING               0.022453
BOOKS_AND_REFERENCE    0.021437
DATING                 0.018617
VIDEO_PLAYERS          0.017940
MAPS_AND_NAVIGATION    0.013991
```

```
FOOD_AND_DRINK         0.012411
EDUCATION              0.011734
ENTERTAINMENT          0.009590
LIBRARIES_AND_DEMO     0.009365
AUTO_AND_VEHICLES      0.009252
HOUSE_AND_HOME         0.008236
WEATHER                0.008011
EVENTS                 0.007108
PARENTING              0.006544
ART_AND_DESIGN         0.006431
COMICS                 0.006206
BEAUTY                 0.005980
Name: Category, dtype: float64
```

In [43]:

```
#Data
categories = android_final["Category"].value_counts().index[:15]
counts = android_final["Category"].value_counts().values[:15]
percentage = round(android_final["Category"].value_counts(normalize = True)*100,1)[:15]

#create stylish bar chart
plt.figure(figsize=(12, 8))
bars = plt.bar(categories,counts,color="lightblue", alpha=0.75, edgecolor="black", linew
plt.xticks(rotation=90, fontsize=12)
plt.yticks(fontsize=12)
plt.grid(axis="y", linestyle= '--', alpha=0.7)
plt.grid(axis="x", linestyle= '')
plt.xticks(fontsize=12) #customized tick tables
plt.yticks(range(0,3000,500),[],fontsize=12) # customized tick table and customized y_ti
plt.tick_params(bottom=0, left=0)

#find the category with the highest count
max_count_category = categories[counts.argmax()]

#highlight the bar for the category with the highest count
max_count_index = list(categories).index(max_count_category)
bars[max_count_index].set_color('brown')
bars[max_count_index].set_edgecolor('black')

#adding data labels and percentage inside each bar
for bar, perc in zip(bars,percentage):
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, height + 20, '%d' % int(height), ha= 'cent
    plt.text(bar.get_x() + bar.get_width()/2, height/2, f'{perc}%', ha= 'center', va='ce

#adding a background color
ax = plt.gca()
ax.set_facecolor('#f7f7f7')

#adding chart title inside the chart
plt.text(0.5,0.95,'Top Android App Categories',horizontalalignment='center',fontsize=16,
         color='gray',fontweight='bold')

#adding conclusion inside the chart
plt.text(0.5,0.86,'The "FAMILY" category stand out as the most prevalent among the top a
         color='gray')

#remove spines
for i in ["top","right","left",]:
    plt.gca().spines[i].set_visible(False)

plt.tight_layout() #adjust layout to prevent clipping
plt.show()
```



In [44]:
```
android_final[android_final["Category"]=="FAMILY"]
```

Out[44]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Up
2017	Jewels Crush- Match 3 Puzzle	FAMILY	4.4	14774	19M	1,000,000+	Free	0	Everyone	Casual;Brain Games	Ju
2018	Coloring & Learn	FAMILY	4.4	12753	51M	5,000,000+	Free	0	Everyone	Educational;Creativity	Ju
2019	Mahjong	FAMILY	4.5	33983	22M	5,000,000+	Free	0	Everyone	Puzzle;Brain Games	A 2,
2020	Super ABC! Learning games for kids! Preschool ...	FAMILY	4.6	20267	46M	1,000,000+	Free	0	Everyone	Educational;Education	Ju
2021	Toy Pop Cubes	FAMILY	4.5	5761	21M	1,000,000+	Free	0	Everyone	Casual;Brain Games	
...	...	...	...	...	...	...	...	...	...	...	
10821	Poop FR	FAMILY	NaN	6	2.5M	50+	Free	0	Everyone	Entertainment	M
10827	Fr Agnel Ambarnath	FAMILY	4.2	117	13M	5,000+	Free	0	Everyone	Education	Ju
10834	FR Calculator	FAMILY	4.0	7	2.6M	500+	Free	0	Everyone	Education	Ju
10836	Sya9a	FAMILY	4.5	38	53M	5,000+	Free	0	Everyone	Education	Ju

	Maroc - FR										
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6M	100+	Free	0	Everyone	Education	.

1678 rows × 13 columns

Most Popular App by genre on Google Play Store

For the google play market, we actually have data baout the number of install, so we should be able to get a clearer picture genre popularity. However the install number don't seem precise enough--we can see the most values are open ended (100,+1000,+5000 etc).

In [45]:
```
android_final["Installs"].value_counts(normalize = True)*100
```

Out[45]:
```
1,000,000+        15.739592
100,000+          11.553650
10,000,000+       10.515627
10,000+           10.199707
1,000+             8.405732
100+               6.916394
5,000,000+         6.837414
500,000+           5.573733
50,000+            4.772650
5,000+             4.513145
10+                3.542818
500+               3.249464
50,000,000+        2.290421
100,000,000+       2.121178
50+                1.918086
5+                 0.789800
1+                 0.507729
500,000,000+       0.270789
1,000,000,000+     0.225657
0+                 0.045131
0                  0.011283
Name: Installs, dtype: float64
```

In [46]:
```
android_final["Installs_int"] = android_final["Installs"].str.replace(",","").str.replac
```

```
C:\Users\Kunal\AppData\Local\Temp\ipykernel_10588\3840374705.py:1: FutureWarning: The de
fault value of regex will change from True to False in a future version. In addition, si
ngle character regular expressions will *not* be treated as literal strings when regex=T
rue.
  android_final["Installs_int"] = android_final["Installs"].str.replace(",","").str.repl
ace("+","").astype(int)
C:\Users\Kunal\AppData\Local\Temp\ipykernel_10588\3840374705.py:1: SettingWithCopyWarnin
g:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  android_final["Installs_int"] = android_final["Installs"].str.replace(",","").str.repl
ace("+","").astype(int)
```

In [47]:
```
install_frq = android_final["Installs_int"].value_counts().sort_index()
install_frq = install_frq[install_frq.index > 500]
install_frq
```

```
Out[47]: 1000           745
         5000           400
         10000          904
         50000          423
         100000        1024
         500000         494
         1000000       1395
         5000000        606
         10000000       932
         50000000       203
         100000000      188
         500000000       24
         1000000000      20
         Name: Installs_int, dtype: int64
```

```
In [48]: install_frq_per = round(android_final["Installs_int"].value_counts(normalize = True)*100
         install_frq_per = install_frq_per[install_frq_per.index > 500]
         install_frq_per
```

```
Out[48]: 1000            8.41
         5000            4.51
         10000          10.20
         50000           4.77
         100000         11.55
         500000          5.57
         1000000        15.74
         5000000         6.84
         10000000       10.52
         50000000        2.29
         100000000       2.12
         500000000       0.27
         1000000000      0.23
         Name: Installs_int, dtype: float64
```

```
In [49]: #alphanumeric_units
         def alphanumeric_units(value):
             if value >= 1e9:
                 return f'{value / 1e9:.0f}B'
             elif value >= 1e6:
                 return f'{value / 1e6:.0f}M'
             elif value >= 1e3:
                 return f'{value / 1e3:.0f}K'
             else:
                 return f'{value:.0f}'
```

```
In [50]: alphanumeric_units(1000000000)
```

```
Out[50]: '1B'
```

```
In [51]: install_frq.index
```

```
Out[51]: Int64Index([      1000,       5000,      10000,      50000,     100000,
                         500000,    1000000,    5000000,   10000000,   50000000,
                      100000000,  500000000, 1000000000],
                    dtype='int64')
```

```
In [52]: install_frq.index = install_frq.index.map(alphanumeric_units)
         install_frq.index
```

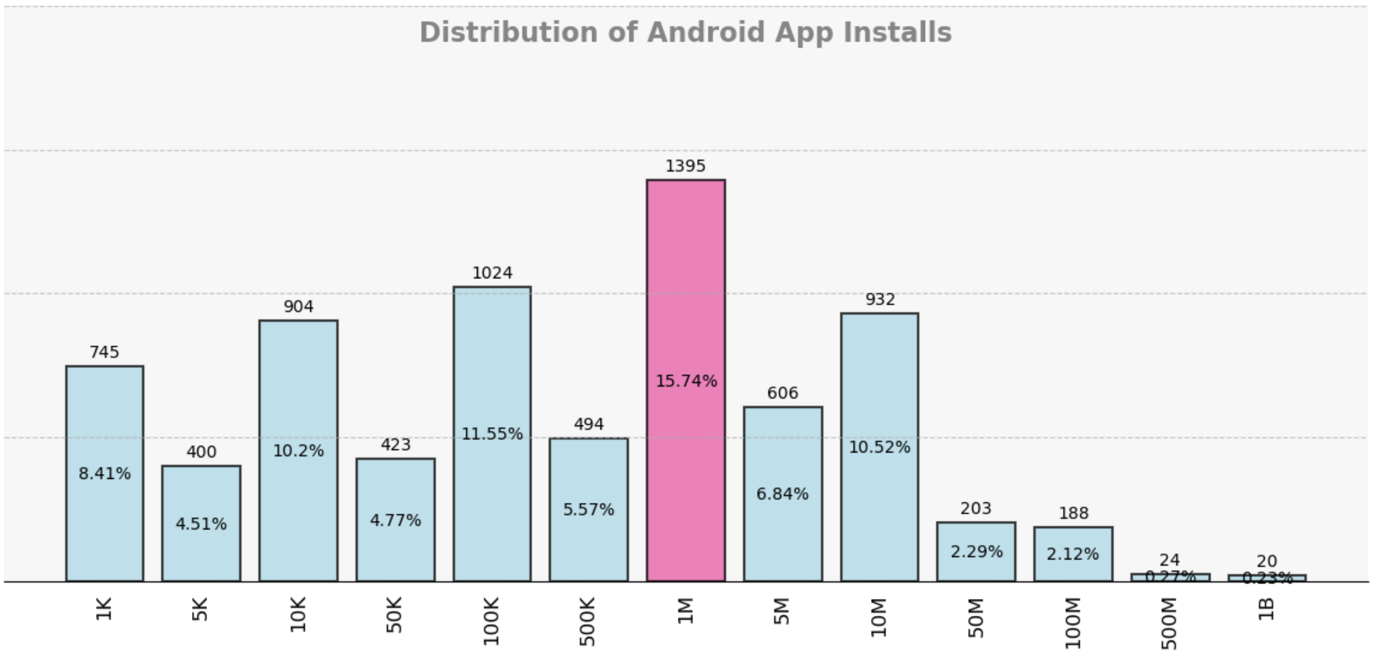
```
Out[52]: Index(['1K', '5K', '10K', '50K', '100K', '500K', '1M', '5M', '10M', '50M',
                '100M', '500M', '1B'],
               dtype='object')
```

```
In [53]: install_frq
```

```
         1K         745
```

Out[53]:
```
5K       400
10K      904
50K      423
100K    1024
500K     494
1M      1395
5M       606
10M      932
50M      203
100M     188
500M      24
1B        20
Name: Installs_int, dtype: int64
```

In [54]:
```
# Data
categories = install_frq.index
counts = install_frq.values
percentage = install_frq_per.values

#create stylish bar chart
plt.figure(figsize=(12,7))
bars = plt.bar(categories,counts,color='lightblue',alpha=0.75, edgecolor='black', linewi
plt.xticks(rotation=90,fontsize=12)
plt.yticks(fontsize=12)
plt.grid(axis='y',linestyle='--',alpha=0.7)
plt.grid(axis='x',linestyle='')
plt.xticks(fontsize=12) #customized tick table
plt.yticks(range(0,2500,500),[],fontsize=12) #customized tick label and customized y tic
plt.tick_params(bottom=0,left=0)

#find the category with the highest count
max_count_category = categories[counts.argmax()]

#highlight the bar for the category with the highest count
max_count_index = list( categories).index(max_count_category)
bars[max_count_index].set_color('#E65BA5')
bars[max_count_index].set_edgecolor('black')

#adding data labels and percentage inside each bar
for bar,perc in zip(bars,percentage):
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, height + 20, '%d' % int(height), ha='cente
    plt.text(bar.get_x() + bar.get_width()/2, height/2, f'{perc}%' ,ha='center',va='cent

#adding a background color
ax = plt.gca()
ax.set_facecolor('#f7f7f7')

#adding chart title inside the chart
plt.text(0.5,0.94,'Distribution of Android App Installs',horizontalalignment='center', f
        color='#858585',fontweight='bold')

#adding conclusion inside the chart
plt.text(0.5,-0.35,'From the data provided it is evident that the majority of Android Ap
        horizontalalignment='center',fontsize=11,transform=plt.gca().transAxes, color =

# remove spines
for i in ["top","right","left"]:
    plt.gca().spines[i].set_visible(False)

plt.tight_layout() #adjust layout to prevent clipping
plt.show()
```



**From the data provided it is evident that the majority of Android App installs fall within the lower range,
with th highest number of installs being in the 1k to 10M range.
Specifically,1M install range stand out with 1395 app, indicating a significant of apps falling into this category
As the number of install increases,the count of app decreases,
with only a few app reaching install counts of 500M and 1B**

In [55]:
```
categories_android = android_final["Category"].unique()
categories_android
```

Out[55]:
```
array(['ART_AND_DESIGN', 'AUTO_AND_VEHICLES', 'BEAUTY',
       'BOOKS_AND_REFERENCE', 'BUSINESS', 'COMICS', 'COMMUNICATION',
       'DATING', 'EDUCATION', 'ENTERTAINMENT', 'EVENTS', 'FINANCE',
       'FOOD_AND_DRINK', 'HEALTH_AND_FITNESS', 'HOUSE_AND_HOME',
       'LIBRARIES_AND_DEMO', 'LIFESTYLE', 'GAME', 'FAMILY', 'MEDICAL',
       'SOCIAL', 'SHOPPING', 'PHOTOGRAPHY', 'SPORTS', 'TRAVEL_AND_LOCAL',
       'TOOLS', 'PERSONALIZATION', 'PRODUCTIVITY', 'PARENTING', 'WEATHER',
       'VIDEO_PLAYERS', 'NEWS_AND_MAGAZINES', 'MAPS_AND_NAVIGATION'],
      dtype=object)
```

In [56]:
```
pd.pivot_table(android_final, values="Installs_int",index="Category",aggfunc="mean")
```

Out[56]:

	Installs_int
Category	
ART_AND_DESIGN	1.986335e+06
AUTO_AND_VEHICLES	6.473178e+05
BEAUTY	5.131519e+05
BOOKS_AND_REFERENCE	8.767812e+06
BUSINESS	1.712290e+06
COMICS	8.176573e+05
COMMUNICATION	3.845612e+07
DATING	8.540288e+05
EDUCATION	1.820673e+06
ENTERTAINMENT	1.164071e+07
EVENTS	2.535422e+05
FAMILY	3.694276e+06

FINANCE	1.387692e+06
FOOD_AND_DRINK	1.924898e+06
GAME	1.556097e+07
HEALTH_AND_FITNESS	4.188822e+06
HOUSE_AND_HOME	1.331541e+06
LIBRARIES_AND_DEMO	6.385037e+05
LIFESTYLE	1.433676e+06
MAPS_AND_NAVIGATION	4.056942e+06
MEDICAL	1.206165e+05
NEWS_AND_MAGAZINES	9.549178e+06
PARENTING	5.426036e+05
PERSONALIZATION	5.201483e+06
PHOTOGRAPHY	1.780563e+07
PRODUCTIVITY	1.678733e+07
SHOPPING	7.036877e+06
SOCIAL	2.325365e+07
SPORTS	3.638640e+06
TOOLS	1.068230e+07
TRAVEL_AND_LOCAL	1.398408e+07
VIDEO_PLAYERS	2.472787e+07
WEATHER	5.074486e+06

In [57]:

```python
#display DataFrame without scientific notation
pd.options.display.float_format = '{:.0f}'.format
```

In [58]:

```python
categories_installs = pd.pivot_table(android_final, values="Installs_int",index="Categor
categories_installs = categories_installs.sort_values(by="Installs_int", ascending=False
categories_installs = categories_installs["Installs_int"]
categories_installs
```

Out[58]:

```
Category
COMMUNICATION         38456119
VIDEO_PLAYERS         24727872
SOCIAL                23253652
PHOTOGRAPHY           17805628
PRODUCTIVITY          16787331
GAME                  15560966
TRAVEL_AND_LOCAL      13984078
ENTERTAINMENT         11640706
TOOLS                 10682301
NEWS_AND_MAGAZINES     9549178
BOOKS_AND_REFERENCE    8767812
SHOPPING               7036877
PERSONALIZATION        5201483
WEATHER                5074486
HEALTH_AND_FITNESS     4188822
MAPS_AND_NAVIGATION    4056942
FAMILY                 3694276
SPORTS                 3638640
```

```
ART_AND_DESIGN           1986335
FOOD_AND_DRINK           1924898
EDUCATION                1820673
BUSINESS                 1712290
LIFESTYLE                1433676
FINANCE                  1387692
HOUSE_AND_HOME           1331541
DATING                    854029
COMICS                    817657
AUTO_AND_VEHICLES         647318
LIBRARIES_AND_DEMO        638504
PARENTING                 542604
BEAUTY                    513152
EVENTS                    253542
MEDICAL                   120616
Name: Installs_int, dtype: float64
```

In [59]:

```python
#alphanumeric_units
def alphanumeric_units(value):
    if value >= 1e9:
        return f'{value / 1e9:.1f}B'
    elif value >= 1e6:
        return f'{value / 1e6:.1f}M'
    elif value >= 1e3:
        return f'{value / 1e3:.1f}K'
    else:
        return f'{value:.1f}'
```

In [60]:

```python
categories_installs_units = categories_installs.map(alphanumeric_units)
categories_installs_units
```

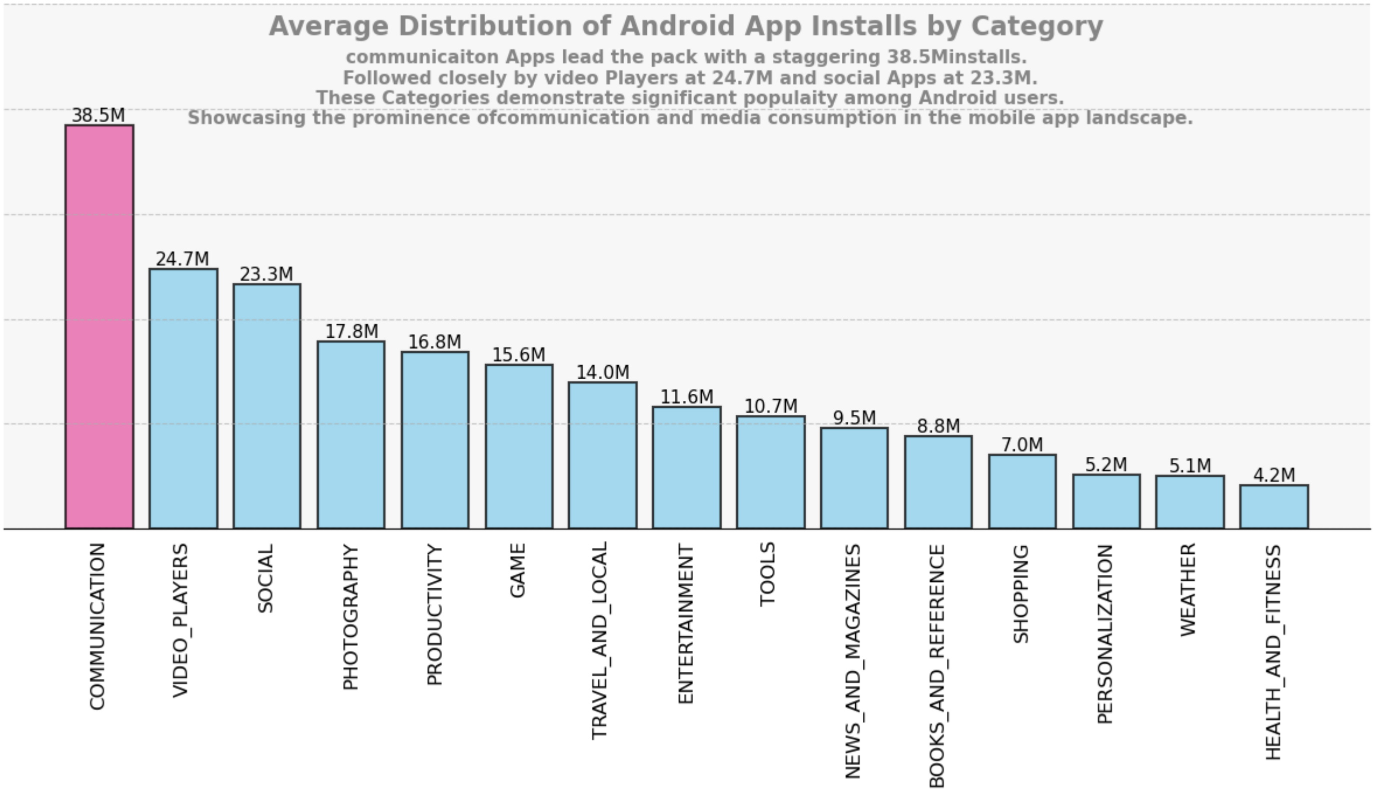
Out[60]:

```
Category
COMMUNICATION             38.5M
VIDEO_PLAYERS             24.7M
SOCIAL                    23.3M
PHOTOGRAPHY               17.8M
PRODUCTIVITY              16.8M
GAME                      15.6M
TRAVEL_AND_LOCAL          14.0M
ENTERTAINMENT             11.6M
TOOLS                     10.7M
NEWS_AND_MAGAZINES         9.5M
BOOKS_AND_REFERENCE        8.8M
SHOPPING                   7.0M
PERSONALIZATION            5.2M
WEATHER                    5.1M
HEALTH_AND_FITNESS         4.2M
MAPS_AND_NAVIGATION        4.1M
FAMILY                     3.7M
SPORTS                     3.6M
ART_AND_DESIGN             2.0M
FOOD_AND_DRINK             1.9M
EDUCATION                  1.8M
BUSINESS                   1.7M
LIFESTYLE                  1.4M
FINANCE                    1.4M
HOUSE_AND_HOME             1.3M
DATING                   854.0K
COMICS                   817.7K
AUTO_AND_VEHICLES        647.3K
LIBRARIES_AND_DEMO       638.5K
PARENTING                542.6K
BEAUTY                   513.2K
EVENTS                   253.5K
```

```
MEDICAL                    120.6K
Name: Installs_int, dtype: object
```

In [61]:

```python
# Data
categories = categories_installs.index[:15]
counts = categories_installs.values[:15]

# create stylish bar
plt.figure(figsize=(12,7))
bars = plt.bar(categories,counts,color="skyblue",alpha=0.75,edgecolor="black",linewidth=
plt.xticks(rotation=90,fontsize=12)
plt.yticks(fontsize=12)
plt.grid(axis='y',linestyle='--',alpha=0.7)
plt.grid(axis='x',linestyle='')
plt.xticks(fontsize=12) #customized tick table
plt.yticks(range(0,60000000,10000000),[],fontsize=12) #customized tick label and customi
plt.tick_params(bottom=0,left=0)

#find the category with the highest count
max_count_category = categories[counts.argmax()]

#highlight the bar for the category with the highest count
max_count_index = list( categories).index(max_count_category)
bars[max_count_index].set_color('#E65BA5')
bars[max_count_index].set_edgecolor('black')

#adding data labels and percentage inside each bar
for bar,units in zip(bars,categories_installs_units.values):
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, height + 25, units , ha='center',va='botto

#adding a background color
ax = plt.gca()
ax.set_facecolor('#f7f7f7')

#adding chart title inside the chart
plt.text(0.5,0.94,'Average Distribution of Android App Installs by Category',horizontala
        color='#858585',fontweight='bold')

#adding conclusion inside the chart
plt.text(0.5,0.77,'communicaiton Apps lead the pack with a staggering 38.5Minstalls.\n F
        horizontalalignment='center',fontsize=11,transform=plt.gca().transAxes, color =

# remove spines
for i in ["top","right","left"]:
    plt.gca().spines[i].set_visible(False)

plt.tight_layout() #adjust layout to prevent clipping
plt.show()
```



In [62]:
```
category_group = android_final.groupby("Category")
```

In [63]:
```
communication = category_group.get_group('COMMUNICATION').sort_values(by="Installs_int",
communication.head()
```

Out[63]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genre
336	WhatsApp Messenger	COMMUNICATION	4	69119316	Varies with device	1,000,000,000+	Free	0	Everyone	Communicatio
382	Messenger – Text and Video Chat for Free	COMMUNICATION	4	56646578	Varies with device	1,000,000,000+	Free	0	Everyone	Communicatio
464	Hangouts	COMMUNICATION	4	3419513	Varies with device	1,000,000,000+	Free	0	Everyone	Communicatio
411	Google Chrome: Fast & Secure	COMMUNICATION	4	9643041	Varies with device	1,000,000,000+	Free	0	Everyone	Communicatio
391	Skype - free IM & video calls	COMMUNICATION	4	10484169	Varies with device	1,000,000,000+	Free	0	Everyone	Communicatio

In [64]:
```
#alphanumeric_units
def alphanumeric_units(value):
    if value >= 1e9:
        return f'{value / 1e9:.0f}B'
    elif value >= 1e6:
        return f'{value / 1e6:.0f}M'
    elif value >= 1e3:
        return f'{value / 1e3:.0f}K'
    else:
        return f'{value:.1f}'
```

In [65]:

```
categories_installs.index[:15]
```

Out[65]:

```
Index(['COMMUNICATION', 'VIDEO_PLAYERS', 'SOCIAL', 'PHOTOGRAPHY',
       'PRODUCTIVITY', 'GAME', 'TRAVEL_AND_LOCAL', 'ENTERTAINMENT', 'TOOLS',
       'NEWS_AND_MAGAZINES', 'BOOKS_AND_REFERENCE', 'SHOPPING',
       'PERSONALIZATION', 'WEATHER', 'HEALTH_AND_FITNESS'],
      dtype='object', name='Category')
```

In [66]:

```
df=communication[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[66]:

	App	Installs_int	(App, Installs_int_unit)
336	WhatsApp Messenger	1000000000	1B
382	Messenger – Text and Video Chat for Free	1000000000	1B
464	Hangouts	1000000000	1B
411	Google Chrome: Fast & Secure	1000000000	1B
391	Skype - free IM & video calls	1000000000	1B
451	Gmail	1000000000	1B
403	LINE: Free Calls & Messages	500000000	500M
4676	Viber Messenger	500000000	500M
420	UC Browser - Fast Download Private & Secure	500000000	500M
371	Google Duo - High Quality Video Calls	500000000	500M
383	imo free video calls and chat	500000000	500M
393	Who	100000000	100M
4633	UC Browser Mini -Tiny Fast Private & Secure	100000000	100M
4602	Truecaller: Caller ID, SMS spam blocking & Dialer	100000000	100M
4592	Telegram	100000000	100M

In [67]:

```
df = category_group.get_group('VIDEO_PLAYERS').sort_values(by="Installs_int",ascending=F
df = df[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[67]:

	App	Installs_int	(App, Installs_int_unit)
3665	YouTube	1000000000	1B
3687	Google Play Movies & TV	1000000000	1B
3711	MX Player	500000000	500M
3675	VLC for Android	100000000	100M
4688	VivaVideo - Video Editor & Photo Movie	100000000	100M
4032	Dubsmash	100000000	100M
10647	Motorola FM Radio	100000000	100M
4696	VideoShow-Video Editor, Video Maker, Beauty Ca...	100000000	100M

3672	Motorola Gallery	100000000	100M
3691	Samsung Video Library	50000000	50M
4038	DU Recorder – Screen Recorder, Video Editor, Live	50000000	50M
3693	LIKE – Magic Video Maker & Community	50000000	50M
3686	Vigo Video	50000000	50M
4049	KineMaster – Pro Video Editor	50000000	50M
5612	Ringdroid	50000000	50M

In [68]:

```
df = category_group.get_group('SOCIAL').sort_values(by="Installs_int",ascending=False)
df = df[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[68]:

	App	Installs_int	(App, Installs_int_unit)
2544	Facebook	1000000000	1B
2554	Google+	1000000000	1B
2604	Instagram	1000000000	1B
2610	Snapchat	500000000	500M
2546	Facebook Lite	500000000	500M
3945	Tik Tok - including musical.ly	100000000	100M
2592	Tango - Live Video Broadcast	100000000	100M
6373	VK	100000000	100M
2552	Pinterest	100000000	100M
3951	BIGO LIVE - Live Stream	100000000	100M
2621	LinkedIn	100000000	100M
2548	Tumblr	100000000	100M
2588	Badoo - Free Chat & Dating App	100000000	100M
2636	Zello PTT Walkie Talkie	50000000	50M
2595	ooVoo Video Calls, Messaging & Stories	50000000	50M

In [69]:

```
df = category_group.get_group('PHOTOGRAPHY').sort_values(by="Installs_int",ascending=Fal
df = df[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[69]:

	App	Installs_int	(App, Installs_int_unit)
2884	Google Photos	1000000000	1B
4574	S Photo Editor - Collage Maker , Photo Collage	100000000	100M
2949	Camera360: Selfie Photo Editor with Funny Sticker	100000000	100M
2908	Retrica	100000000	100M
8307	LINE Camera - Photo editor	100000000	100M
2921	Photo Editor Pro	100000000	100M

2847	Sweet Selfie - selfie camera, beauty cam, phot...	100000000	100M
2937	BeautyPlus - Easy Photo Editor & Selfie Camera	100000000	100M
2938	PicsArt Photo Studio: Collage Maker & Pic Editor	100000000	100M
5057	AR effect	100000000	100M
2833	YouCam Makeup - Magic Selfie Makeovers	100000000	100M
2942	Z Camera - Photo Editor, Beauty Selfie, Collage	100000000	100M
2943	PhotoGrid: Video & Pic Collage Maker, Photo Ed...	100000000	100M
2944	Candy Camera - selfie, beauty camera, photo ed...	100000000	100M
2945	YouCam Perfect - Selfie Photo Editor	100000000	100M

In [70]:

```
df = category_group.get_group('TOOLS').sort_values(by="Installs_int",ascending=False)
df = df[['App','Installs_int']].head(15)
df['App','Installs_int_unit']= df['Installs_int'].map(alphanumeric_units)
df
```

Out[70]:

	App	Installs_int	(App, Installs_int_unit)
3234	Google	1000000000	1B
3265	Gboard - the Google Keyboard	500000000	500M
3255	SHAREit - Transfer & Share	500000000	500M
4005	Clean Master- Space Cleaner & Antivirus	500000000	500M
3235	Google Translate	500000000	500M
7536	Security Master - Antivirus, VPN, AppLock, Boo...	500000000	500M
8452	Automatic Call Recorder	100000000	100M
3266	Google Korean Input	100000000	100M
7550	Battery Doctor-Battery Life Saver & Battery Co...	100000000	100M
3272	Share Music & Transfer Files - Xender	100000000	100M
4578	Samsung Smart Switch Mobile	100000000	100M
4568	360 Security - Free Antivirus, Booster, Cleaner	100000000	100M
3289	Tiny Flashlight + LED	100000000	100M
4151	Google Now Launcher	100000000	100M
8758	Anti-virus Dr.Web Light	100000000	100M

Analysis of the Photography Category and Potential for Photo Generation in 2024

Conclusion

Upon analyzing the photography sector, a clear trend emerges – a rising interest in photo editing and collage-making applications. These apps have gained substantial popularity, boasting installations exceeding 100 million on various platforms. This surge underscores a strong demand for photo-related functionalities among users.

Based on this observation, there appears to be significant potential for the creation of a photo generation application in 2024. Such an app, providing quick and free picture and photo generation, could leverage the existing user enthusiasm for photography apps. It has the potential to stand out in the competitive market and attract a large user base.

Considering the success of current photography apps and the evolving preferences of users, investing in the development of a photography app seems promising for tapping into this lucrative market segment in 2024.

```
In [ ]:
```