Analysis of Google Play Store Apps

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1 INTRODUCTION

With the growing popularity of apps on mobile devices, app stores are growing in popularity and importance. App stores not only provide important data to customers seeking new applications to use, but also to developers to advertise and sell their applications. Between many of the app stores popular today, Apple's App Store is by far the largest and most popular of all. A close second is the Google Play Store, which is the primary destination for Android users for downloading applications.

1.1 Comparing the Apple App Store and the Google Play Store

A big difference between Apple's App Store and the Google Play Store is the App Store only allows top quality apps to be marketed in their store, thus gaining them a higher reputation for better apps. Because of this, customers will only receive the best version of apps they are seeking. The Play Store, on the other hand, has a wide diversity of apps and often does not reject apps from there store. This allows app developers to experiment on a bigger platform while still not having the "perfect" app as the Apple App Store expects. While the Apple App Store has a higher quality of applications on their store, the Google Play Store has a wider variety and range of apps to select from according to a user's needs.

1.2 Overview of the chosen dataset

While there are many publicly available datasets on the web that provide data from the Apple App Store, there are not as many readily available datasets to provide data for the Google Play Store apps. The dataset gathered for analyzation is from Kaggle, an online, public source with over 19,000 public datasets. For this dataset, the information was scraped from the Google Play Store, containing over 10,000 apps for analyzing the Android app market. In all, the dataset has 10,841 rows and 13 columns. The columns consist of:

1) *App (Application name)*

2) *Category (Category the app belongs to)*

3) *Rating (Overall user rating of the app)*

4) *Reviews (Number of user reviews for the app)*

5) *Size (Size of the app)*

6) *Installs (Number of user downloads/installs for the app)*

7) *Type (Paid or Free)*

8) *Price (Price of the app)*

9) *Content Rating (Age group the app is targeted at – Children / Mature 21+ / Adult)*

10) *Genres (An app can belong to multiple genres apart from its main category)*

11) *Last Updated (Date when the app was last updated on Play Store)*

12) *Current Version (Current version of the app)*

13) *Android Version (Minimum required Android version).*

1.3 Initial observations and hypotheses of the data

At first glance it was obvious that the rating of the app was one of the most important sections within this data sets. Ratings directly correlate to the ranking of an app within application store in which it can be downloaded from. When an app has better rankings, it usually means there will be easier discovery for the app, as well as more downloads.

Using the data of over 10,000 Google Play Store apps, this paper sets out to understand the correlation between app price, rating, number of installations and more to discover what makes an app popular. Two direct goals of this paper will be to show the correlation between price and rating of an app, as well as the correlation between the number of reviews, and installs that can affect the rating.

2 LITERARY REVIEW

The rating of an app in any and every app store it is available in is extremely important for its success. Many recent studies have focused on what causes a popular app in an app store and how reviews of an app can make a difference in the success of apps. This information is very relevant to current apps to determine what can make an app successful, which would help app developers improve bad applications and overall improve further development.

As mentioned, current literary work on the topic mainly focuses on what makes a successful app. A lot of importance was weighed on user reviews and feedback in the app store. The key to success for an application mainly depends on the category of app. Game applications often have more focus on attractiveness, stability and cost, while other apps like Lifestyle, Travel or Weather apps more often have complaints to do with connectivity (Fu et al., 2013). All these complaints and reviews are extremely important to the success of an app because these reviews are not only valuable to users, but they are also aiding the developers and software companies in improving their apps with specific customer feedback.

Currently, the ever-increasing demand for various categories of mobile applications has led to an increase in competitive app markets. Within this competitive market, the user's ratings and reviews are what make a huge difference by helping improve software quality and addressing possible missing features (Genc-Nayebi and Abran, 2017). It is even shown directly in one recent study published in 2005 (Palomba et al., 2015) was able to directly trace app store reviews and monitor the extent that developers update their app according to user reactions, and how it affected their ratings.

Reading reviews and analyzing ratings assist development teams to improve their apps by fixing bugs or adding requested features that are common among reviewers. As well, reviews can also help development teams identify issues that are not caught during testing or to clarify problems that a user might have. This article investigated the extent in which development teams used these reviews to affect their ratings. They found that in most cases, developers definitely consider user reviews when updating an app, and those that implement a higher percentage of informative user reviews are often regarded with a higher rating after a new release.

Recent research has further been done on this topic that highlights the power of electronic word of mouth. Typically, it has been discovered that positive feedback and reviews of an app increase sales and that depends on the volume and the attitude of the feedback (Hyrynsalmi et al., 2015). Furthermore, the results of the study showed that better feedback and higher customer ratings correlate directly with higher sales.

How these reviews and ratings affect sales of an app is somewhat new in our society in terms of applications and app stores specifically. Such systems are not uncommon in other reviews, for example restaurant, store and hotel reviews. In these systems, the more the understanding of online review impact have resulted in better business intelligence and higher sales (Hoon et al., 2013). The difference with apps is that generally they are low in price so there must be a high volume of sales in order to make a decent profit and deem an app successful. Which means each update and feature added to an app can directly affect the success of an app, and the competition it faces within the app market.

To use these reviews and ratings to change their app in the right direction, developers must know the characteristics of high-rated apps as well as the feedback of their app. It is shown that various values could indicate an apps success. For this study rating is their sole measure of determining success (Tian et al., 2015). To affect this rating many high-rated apps might have a larger volume of downloads, but this can not be controlled by the developers. So other factors are considered to help the developers of an app in particular. Generally, high-rated apps are larger, more complex, have more requirements for users and more marketing for their apps. But overall developers must work toward more downloads as a prime goal, as that is the strongest correlation for a better customer rating (Finkelstein at el., 2017).

Specifically, for the Google Play Store, there was a study in 2012 that showed that a high average rating correlates with higher sales as well as the number of installations (Hyrynsalmi et al., 2013). With all the recent research done on this topic it is prevalent that an apps success is very important to developers to succeed in todays competitive market. To succeed, these developers must take into account the many reviews and ratings given for their app, to hopefully increase their number of installations of their app to make it even better and earn a better profit.

3 METHODS

The data for this paper was based on data collected from the Google Play Store. Initially the data consisted of over 10,000 rows and 13 columns. The first step was to clean the data, so the results are more specific to the goal of the project.

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	Art & Design	7-Jan-18	1.0.0	4.0.3 and up
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	Everyone	Art & Design;Pretend Play	15-Jan-18	2.0.0	4.0.3 and up
2	U Launcher Lite ‚Äì FREE Live Cool Themes, Hid...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	Art & Design	1-Aug-18	1.2.4	4.0.3 and up
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	Art & Design	8-Jun-18	Varies with device	4.2 and up
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Art & Design;Creativity	20-Jun-18	1.1	4.4 and up

Figure 1: The initial unclean data (first 5 rows).

For the first step of data cleaning, it was necessary to identify the columns or traits of an app that did not relate to the research questions. With the research questions relating to predicting the rating of an app using the number of installation and reviews, as well as how price relates to rating, not all columns of data were needed. Because of this, 5 columns were deleted from the data, so that 8 columns were left for a clearer insight of the data. The columns deleted were *Content Rating, Genres, Last Updated, Current Version and Android Version.* Content Rating was not needed because for this specific analyzation of the data set there was no need for specifying the content. But, if there were further analyzation for if the content rating affected the rating of an app, this would be used. The columns of Genres were not used because it was a subset within Categories. Categories had less variables and a better overview, so that was chosen over Genres. Last Updated, Current Version, and Android Version can all differ widely for each app and so it was determined that these columns would not be needed for this analyzation.

Next, the raw data had random sorting and incorrect types for the data within the chart. For this, the columns of Installs, Size and Price had to have symbols included in the data removed. As well, the columns of Installs, Size, Price and Reviews had to be converted to numeric so the visualizations could be properly represented. There was also one row that had null data, which didn't fit into the data and stood out, because there were over 10,000 rows of data, this row was removed.

Since, one of the main focuses on a better app rating is the number of installations, the data was then sorted by number of installations to be able to see a trend easier for the visualizations.

	App	Category	Rating	Reviews	Size	Installs	Type	Price
10697	Mu.F.O.	GAME	5.0	2.0	16.0	1.0	Paid	0.99
2454	KBA-EZ Health Guide	MEDICAL	5.0	4.0	25.0	1.0	Free	0.00
5917	Ra Ga Ba	GAME	5.0	2.0	20.0	1.0	Paid	1.49
7147	CB Heroes	SOCIAL	5.0	5.0	1.8	5.0	Free	0.00
2484	Clinic Doctor EHr	MEDICAL	5.0	2.0	7.1	5.0	Free	0.00

Figure 2: The clean data (first 5 rows).

Now, the data is narrowed down to 8 columns for better observation: *App Name, Category, Rating, Reviews, Size, Installs, Type and Price.* App Name is unique to each app and is needed to differentiate between each app. The category column is needed as it may be easier to view some analyzation aspects by narrowing it down to each category of apps. Rating is obviously needed as that is the basis of success for an app for this project. The reviews column is also very important as reviews of an app are also very important to an apps success and is also a part of one of the research questions. Installs is another extremely important set of data to have as this is what is being compared to rating to test the success of an app. As well, Type is an important column so data can be distinguished between what is free and what is not and how that can affect app performance in the app store. Lastly, price is important as well to detect how price relates to the rating of an app.

4 RESULTS

The dataset contains 10, 841 apps and the only way to accurately view trends within this large set of data is to create some visualizations. These glimpses of trends within the app market can help businesses in many ways. Apps can be targeted to a particular category that has certain trends compared to others, also a business could consider entering a market that has fewer competitors or even how their apps compare to others within similar categories.

For the first observation show in Figure 3, the rating of an app is shown on the x-axis with the y-axis showing how many times that rating has been recorded. Furthermore, the visualization is split into two types, paid and free, to accurately observe the difference in size and distribution between the types. As well as splitting into different types, the histogram changes in color according to how many installations have been recorded for each rating.
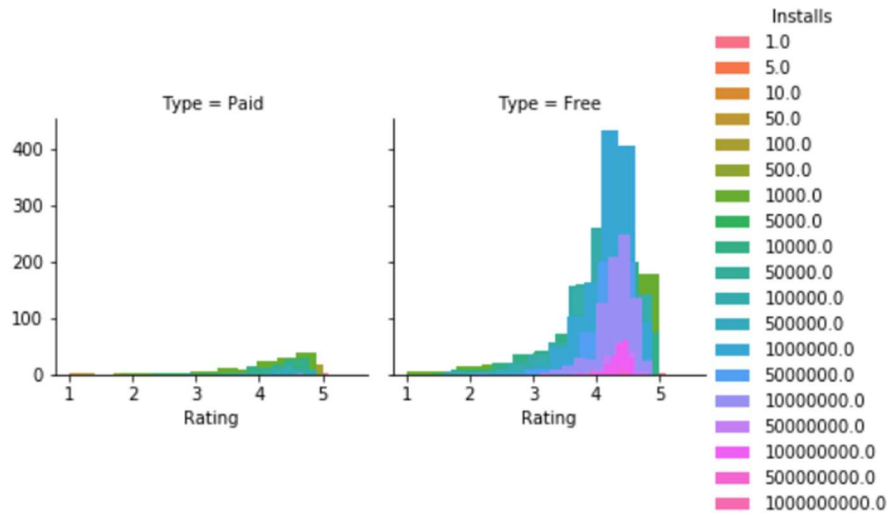
Figure 4: Comparison of Number of Installations per amount of Ratings.

This figure above is an important representation of the correlation between number of installs and average rating for apps. As one can see by observing the figure, it is much clearer for the free applications. Because of this, the first aspect to focus on is how the price of an app relates to the rating of an application. Since free apps obviously are not paid for, this has a much smaller set of data than the whole dataset.

Shown in Figure 5, the x-axis represents the rating of an app, from 0.0 to 5.0, while the y-axis represents the Price of an app in dollars ($). For a clearer representation of the data, the axis size was changed from default setting. Because of this adjustment, the overall trend can be seen clearer but categories like Finance and Lifestyle are cropped out from their full version.
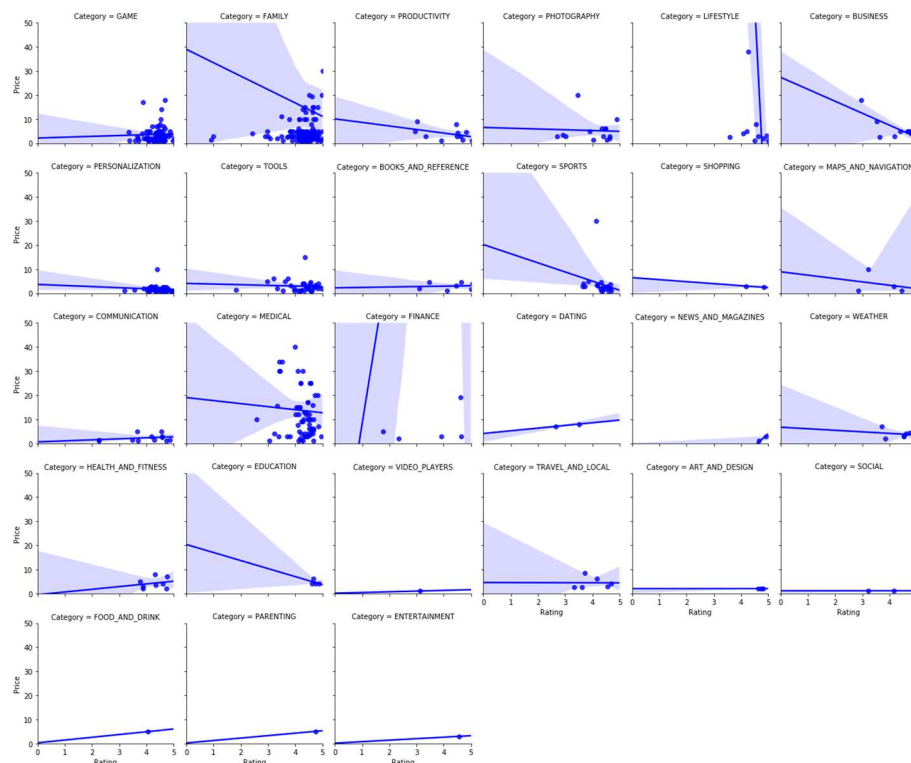
Figure 5: Relation of Rating to Price for each category.

The overall representation of Rating versus Price for every single category put together is shown in Figure 6. As seen in the figure, the x-axis is rating, and the y-axis is price in dollars. The regression line for this graph is decreasing, which shows a correlation between lower price and higher rating.
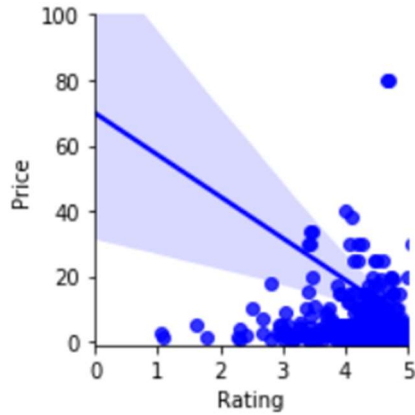

Figure 6: Average comparison of Rating to Price for every category.

The next sets of data that were compared were review count and rating for free and paid apps. As expected from previous research on the subject, there should be a correlation between higher review count and higher rating. As seen in Figure 7 the regression line for each category is clearly increasing. With Figure 8 showing the trend with every category on the same axes. So, there is a strong correlation between higher review count and higher rating for each category of app, as well as the average trend of all apps.
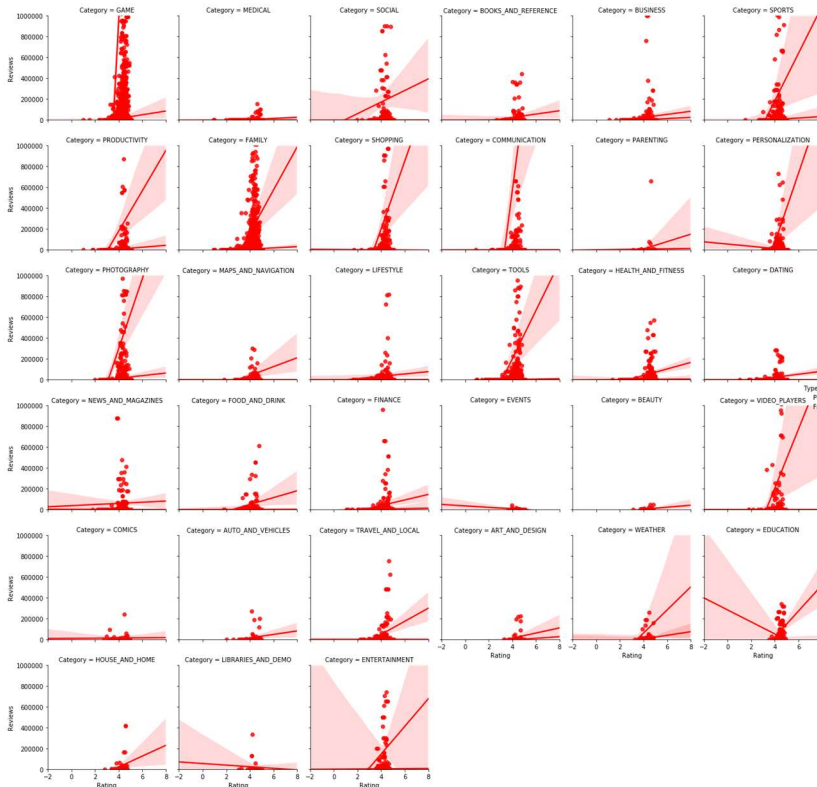

Figure 7: Comparison of Rating to number of Reviews for each category.
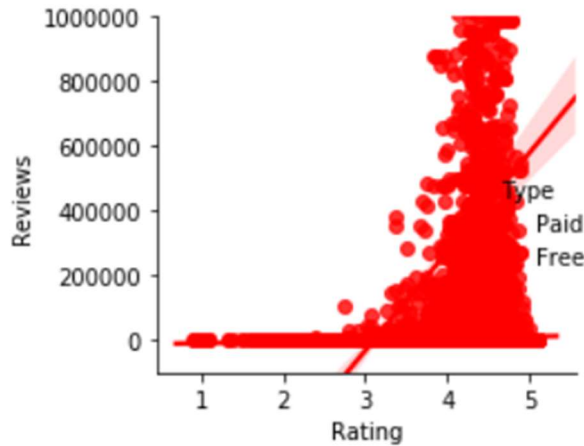
Figure 8: Average relationship for Rating and number of Reviews.

Finally, the last visualization (Figure 9) includes a comparison of rating, review count and installation count. The expectation from earlier research is that higher review count and higher installation count will correlate with higher ratings.
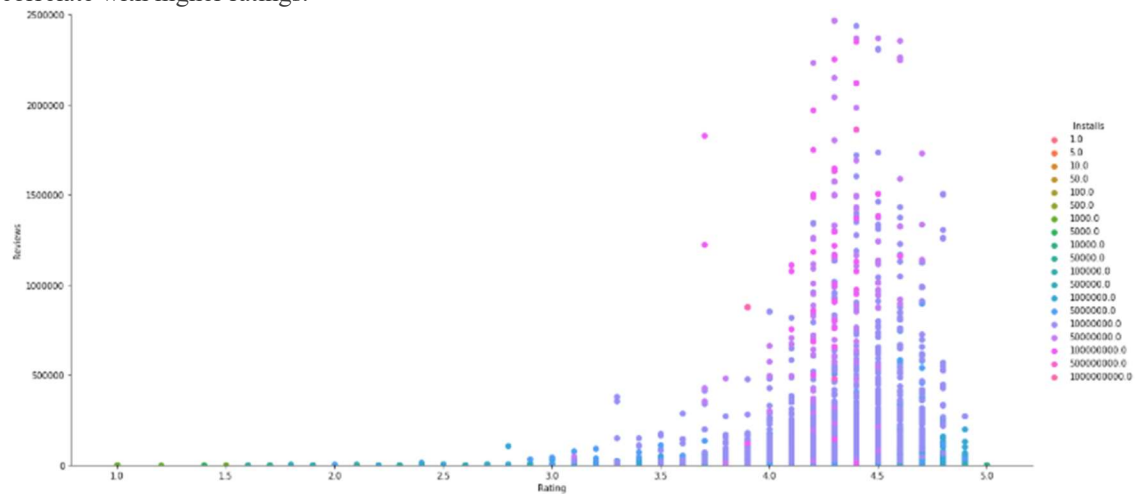

Figure 9: Comparison of Ratings to number of Reviews, sorted in color by number of Installs.

As can be seen in Figure 9, the higher the installation count, shown by the hues represented in the table, relates directly to higher number of reviews, shown on the y-axis. Both relate to a higher rating as well.

5 DISCUSSION

The dataset showing strong correlations between review count, installation count and rating, as well as a higher price of an app with a lower rating, contains many possibilities to improve business and software development and have a positive impact.

There is a very strong correlation between the rating of an app and its review count. This result proves how important reviews are to the success of an app. Most people tend to check a rating before downloading a new app so there is a very strong influence on app ranks. To get higher app ranks, the best way to do it is to get more reviews. The developers must then find the best way to get reviews for their apps to get that best rating. Not only must they try to get more reviews for their app, they need to try to get more positive reviews. To do this they often need to find the right timing to ask the user for a review of their app,

in order to receive a higher rating from said user. There are many other options as well for ways to get users to give more feedback to developers, but this is a simple way that most developers get the review count up, currently.

Also, there is a correlation between higher app price and lower rating of the app. It is true that when an app is priced too high, users may give negative feedback in the app store. Often, the lower price of an app even brings a broader audience of customers which may even benefit, or hurt an app. Generally, a lower price will attract more people towards an app and therefore cause more installations which often averages out to a higher review of the app.

As one might be able to tell in the data, there are no zero ratings. As well as no zero rating scores there are some apps that have very few reviews, which means that they probably lack sufficient evidence for the mean of the app, or are possibly a newer app that would average out to a different rating in the future.

6 CONCLUSION AND FUTURE WORK

This paper analyzed over 10,000 Google Play Store apps on what specifics and details of an app can create a better rating. This dataset included both free and non-free apps in the Google Play Store as well as many varying categories of apps.

It was found that the number of reviews and installation for an app directly correlate to the average rating an app receives in the Play Store. It was also found that higher price of a paid app can cause a lower rating for an app.

A key observation to remember about this dataset, though, is that most of the apps are very positively rated. With the average rating resulting somewhere around 4.4 on a 5.0 scale. Most of the ratings occupy the higher and more appreciated side of the rating's axis.

Using results from this data contain many possibilities to improve businesses' and developer's work to make more popular and higher revenue generating applications available with app stores. Findings may help developers consider features to include when designing and updating apps as well as give insight to what makes an app more popular.

Further possibilities for work include comparing features to price of an app to see if a higher price relates to the more features an app has. As well, the authenticity of reviews could be evaluated to see how many reviews are in-depth and accurate enough to be considered a valid review. Also, this data could be used to develop a model that predicts how well an app will rate in the app store, based off its properties like installation count, number of features, or price.

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