DATA 621 Final: Predicting A Mobile Application's Success

Group 3

CUNY SPS Spring 2019

Abstract

In an effort to see what developers can focus on to get more downloads of their mobile application, this project will use various modeling techniques to predict an application's success. These models will we built using data about apps on Apple's and Google's stores. This will provide a methodology to scientifically predict how well an app will do in either store when certain metrics are improved.

Keywords: Apps, Apple, Google, Poisson, Quasi

Introduction

In 2014 Dong Nguyen revealed that his game Flappy Bird was earning an average of $50,000 a day from in-app ads. At that time, Flappy Bird, an addictive and tough game, had been number 1 on the Apple App Store and Google Play Store for almost a month and was gaining more downloads daily. In fact, by January 2014 the app had 50 million downloads, 68,000 reviews, and held the number 1 spot for most downloaded free game in 53 countries.

With millions of apps available for download today, many app developers could only dream of the success that Flappy Bird saw. So, did Nguyen know how to make an app so successful, and is there any way for us use app statistics to predict the success of an app? Kaggle has a couple of datasets with mobile application statistics that can possibly help us answer these questions. The datasets contain information around Apple apps on the App Store and Google apps on the Play Store; information centered around ratings, app size, installs, and price. Our idea is to take these datasets to see if we can use several regression methods to predict the successfulness of an app.

Methodology

Apple

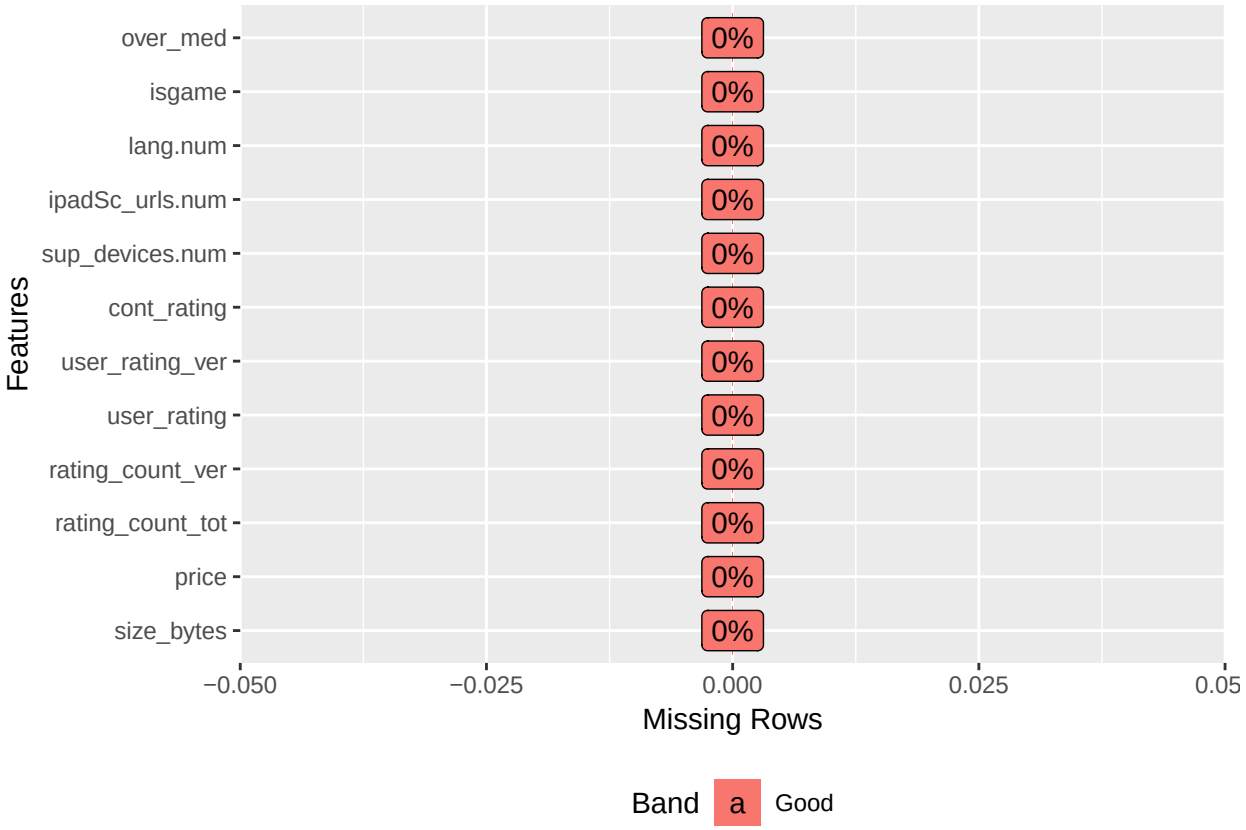
Apple Store Data

For this project, data from the Apple store on 7,197 apps was sourced from Kaggle at this site: https://www.kaggle.com/ramamet4/app-store-apple-data-set-10k-apps. The data content on these apps revolved around the apps' size, price, ratings, genre, and number of supporting devices. However, there is no data around how many times the app was downloaded. As a workaround, this study used the total number of ratings as a measure of how many times the app was downloaded and therefore how successful it is.

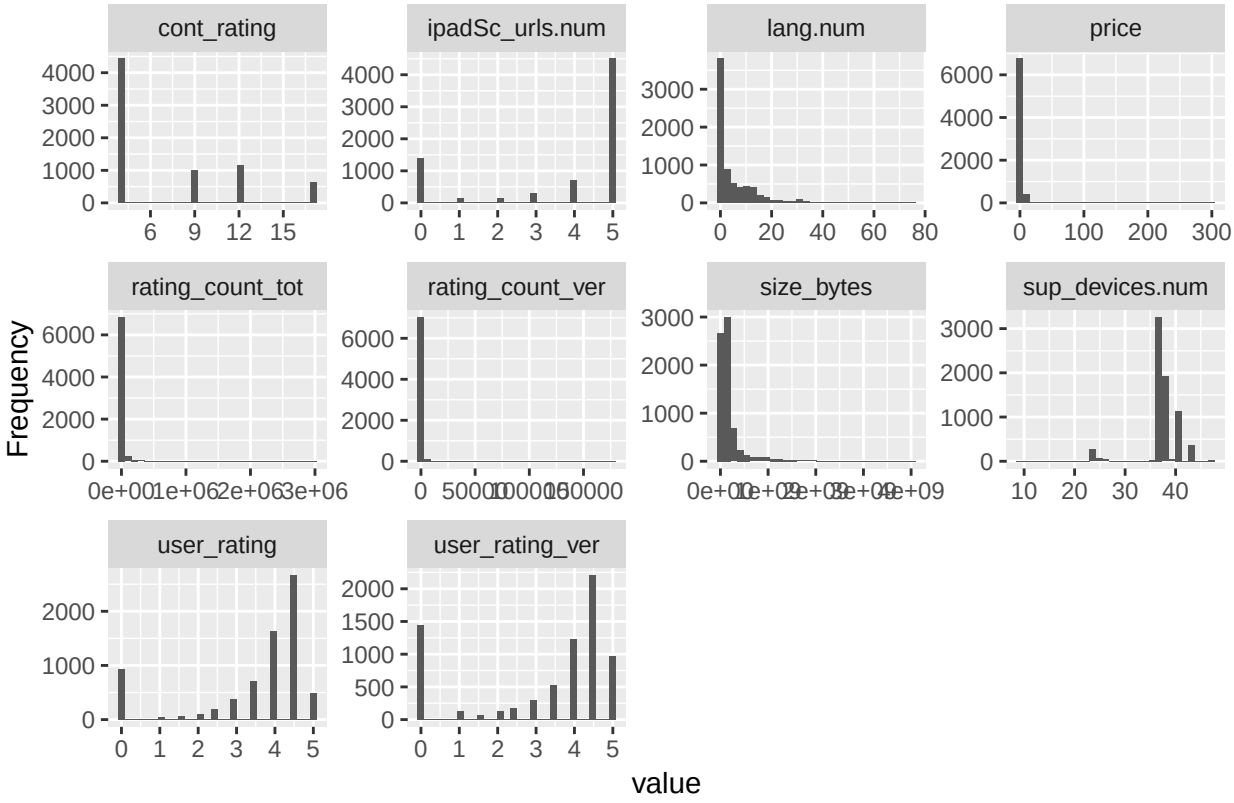
Data Management

Thankfully none of the data in the Apple Store dataset was missing. Two new fields were added to the dataset, one to distinguish if the app was a game or not and another to see if the total ratings count for the

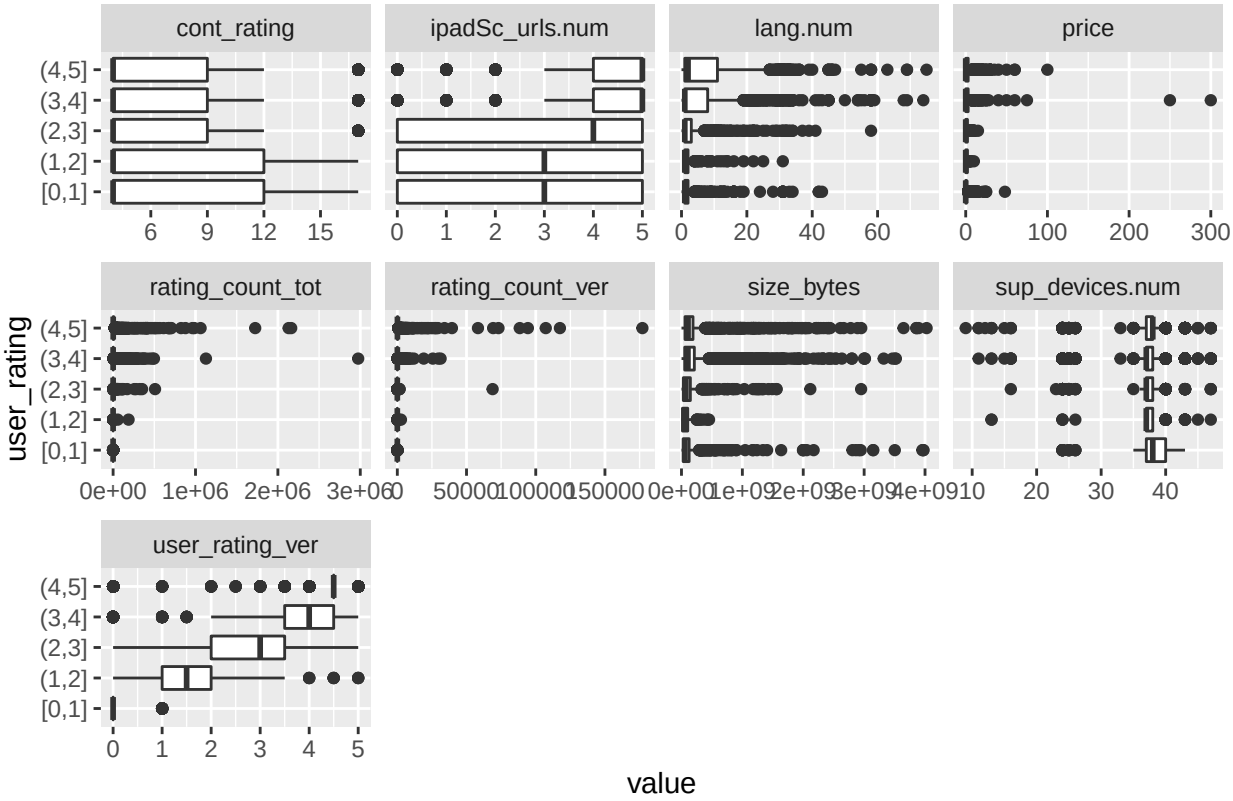
app was over or under the median of the dataset. For the content rating field the '+' symbol was removed and the field was transformed into an integer. Here's a summary of the final dataset.



Histogram of Fields



Boxplot of Fields




```
## NULL
```

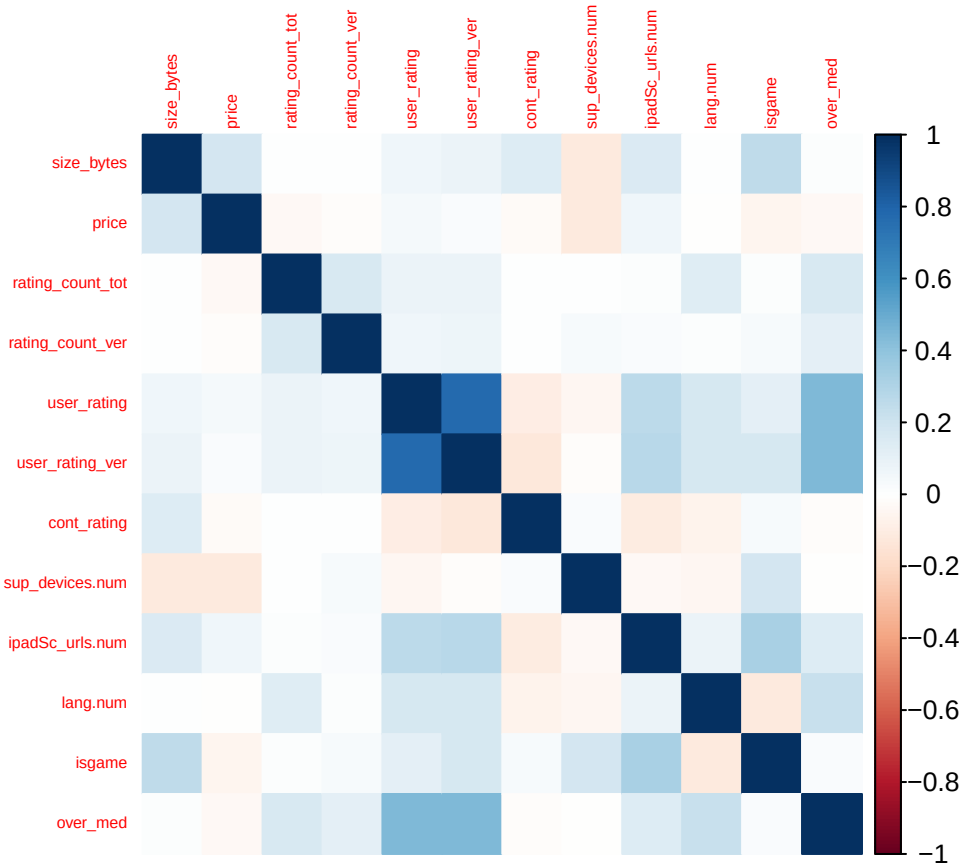
Train – Test Split

Given that the Apple Store dataset is not conveniently split to do model training, it was split by randomly choosing fifty percent of the data to be in the train set and the remaining data to be in the testing set.

Results

Correlation

Before beginning the data analysis, the correlation plot between the metrics was analyzed to see if there was anything worth noting.



Ratings Total Summary

In order to gauge how well the forthcoming models did in predicting the total number of ratings, here's the summary of ratings from the train dataset.

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##       0      26     308   12124    2738 1061624
```

Poisson Model

The first model ran is a Poisson Model.

```
##
## Call:
## glm(formula = rating_count_tot ~ ., family = "poisson", data = train)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -744.94  -122.50    -9.25     2.85  2088.04
##
## Coefficients:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)       3.059e+00  4.270e-03   716.3   <2e-16 ***
## size_bytes        2.904e-10  5.259e-13   552.2   <2e-16 ***
## price            -3.425e-01  1.566e-04 -2187.6   <2e-16 ***
```

```
## rating_count_ver  1.645e-05  6.698e-09  2456.5   <2e-16 ***
## user_rating       5.140e-02  3.837e-04   133.9   <2e-16 ***
## user_rating_ver   1.881e-01  2.353e-04   799.6   <2e-16 ***
## cont_rating       1.494e-02  4.176e-05   357.8   <2e-16 ***
## sup_devices.num   1.529e-02  6.307e-05   242.4   <2e-16 ***
## ipadSc_urls.num  -4.476e-02  1.030e-04  -434.3   <2e-16 ***
## lang.num          3.303e-02  1.268e-05  2605.6   <2e-16 ***
## isgame            6.433e-02  4.194e-04   153.4   <2e-16 ***
## over_med          5.365e+00  3.376e-03  1589.2   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 163175599  on 2878  degrees of freedom
## Residual deviance:  96237216  on 2867  degrees of freedom
## AIC: 96257617
##
## Number of Fisher Scoring iterations: 7
```

```
##   TARGET_FLAG
##  Min.   :     0.00
##  1st Qu.:    49.22
##  Median :   203.49
##  Mean   : 11913.71
##  3rd Qu.: 22609.33
##  Max.   :286323.69
```

Running the Poisson model gave the ouput that every field was statistically significant, so they were all kept for the predictions. The results from this model resembles the train's results.

Zero Inflated

Looking at the data set, we can see that there a large number of zeroes in a lot of fields. A zero inflated count regression should help deal with those.

```
##   TARGET_FLAG
##  Min.   :     0.00
##  1st Qu.:    43.49
##  Median :   202.02
##  Mean   : 11905.23
##  3rd Qu.: 22609.68
##  Max.   :286333.79
```

The zero inflated model also resembles the results of the train's results but underestimates the maximum value. Looking at the distribution of the total ratings count in the overall dataset, we can see that there are only six apps with over one million total ratings, so it can be con be concluded that the zero inflated model's max is acceptable.

The zero inflated model gave the best results in determining a mobile application's success.

Google Play Store

This project also investegated what makes an app successful on the Google Play Store. This data was also taken from Kaggle and has 10,839 apps with 14 fields. This data contains similar information as the Apple

store data but it also includes how many time the app has been downloaded.

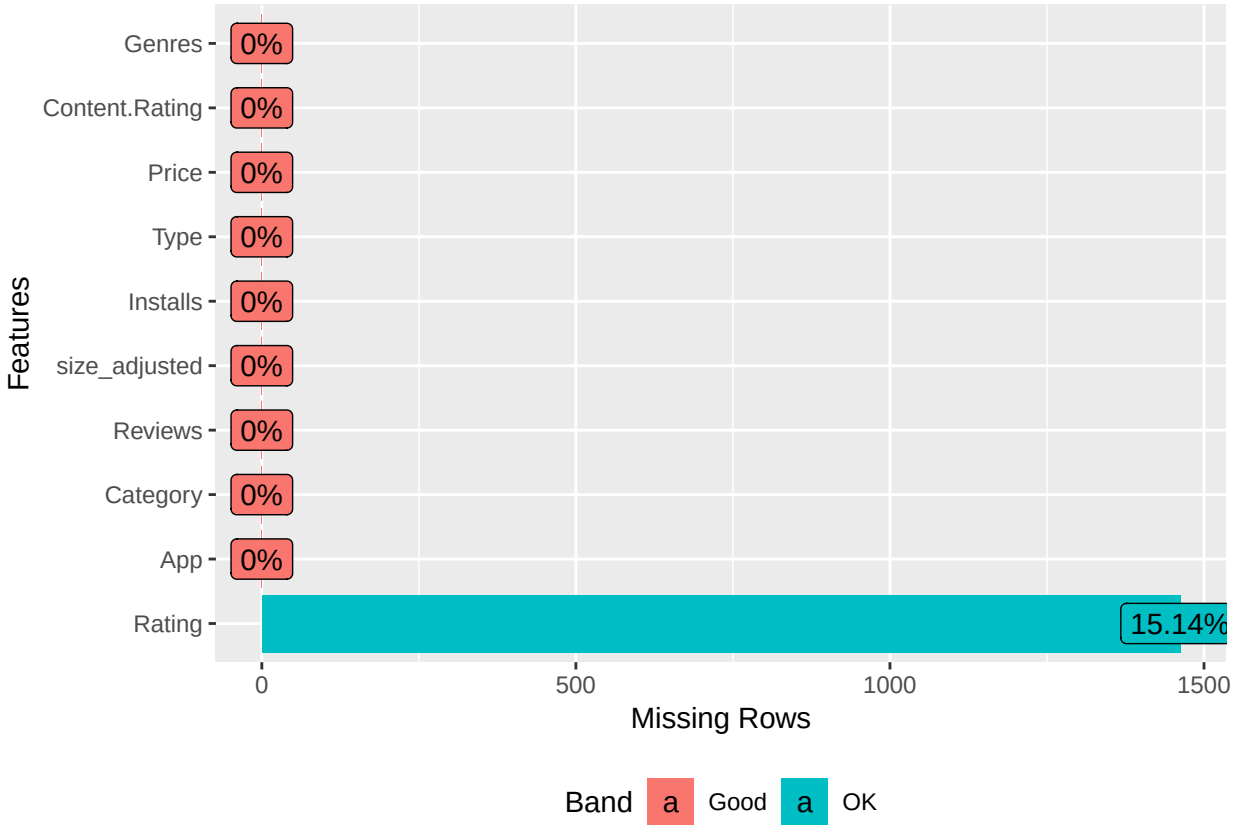
```
##  [1] ART_AND_DESIGN      AUTO_AND_VEHICLES   BEAUTY
##  [4] BOOKS_AND_REFERENCE BUSINESS            COMICS
##  [7] COMMUNICATION       DATING              EDUCATION
## [10] ENTERTAINMENT       EVENTS              FINANCE
## [13] FOOD_AND_DRINK      HEALTH_AND_FITNESS  HOUSE_AND_HOME
## [16] LIBRARIES_AND_DEMO  LIFESTYLE            GAME
## [19] FAMILY              MEDICAL             SOCIAL
## [22] SHOPPING            PHOTOGRAPHY         SPORTS
## [25] TRAVEL_AND_LOCAL    TOOLS               PERSONALIZATION
## [28] PRODUCTIVITY        PARENTING           WEATHER
## [31] VIDEO_PLAYERS       NEWS_AND_MAGAZINES  MAPS_AND_NAVIGATION
## 33 Levels: ART_AND_DESIGN AUTO_AND_VEHICLES BEAUTY ... WEATHER
```

```
##                                                App
##  ROBLOX                                          :    9
##  CBS Sports App - Scores, News, Stats & Watch Live:    8
##  8 Ball Pool                                     :    7
##  Candy Crush Saga                                :    7
##  Duolingo: Learn Languages Free                  :    7
##  ESPN                                            :    7
##  (Other)                                         :10794
##          Category        Rating          Reviews
##  FAMILY      :1971   Min.   :1.000   Min.   :       0
##  GAME        :1144   1st Qu.:4.000   1st Qu.:      38
##  TOOLS       : 843   Median :4.300   Median :    2094
##  MEDICAL     : 463   Mean   :4.192   Mean   :  444194
##  BUSINESS    : 460   3rd Qu.:4.500   3rd Qu.:   54783
##  PRODUCTIVITY: 424   Max.   :5.000   Max.   :78158306
##  (Other)     :5534   NA's   :1473
##                  Size      size_adjusted         Installs
##  Varies with device:1694   Min.   :     8.5   Min.   :0.000e+00
##  11M               : 198   1st Qu.:  5900.0   1st Qu.:3.000e+03
##  12M               : 196   Median : 18000.0   Median :1.000e+05
##  14M               : 194   Mean   : 20991.0   Mean   :1.547e+07
##  13M               : 191   3rd Qu.: 26000.0   3rd Qu.:5.000e+06
##  15M               : 184   Max.   :100000.0   Max.   :1.000e+09
##  (Other)           :8182
##    Type           Price               Content.Rating           Genres
##  Free:10039   0      :10039   Adults only 18+:   3   Tools        : 842
##  Paid:  800   $0.99  :  148   Everyone       :8714   Entertainment: 623
##               $2.99  :  129   Everyone 10+   : 413   Education    : 549
##               $1.99  :   73   Mature 17+     : 499   Medical      : 463
##               $4.99  :   72   Teen           :1208   Business     : 460
##               $3.99  :   63   Unrated        :   2   Productivity : 424
##               (Other):  315                           (Other)      :7478
##     Last.Updated              Current.Ver               Android.Ver
##  8/3/2018 : 326   Varies with device:1458   4.1 and up        :2451
##  8/2/2018 : 304   1                 : 842   4.0.3 and up      :1501
##  7/31/2018: 294   1.1               : 276   4.0 and up        :1375
##  8/1/2018 : 285   1.2               : 185   Varies with device:1361
##  7/30/2018: 211   2                 : 165   4.4 and up        : 980
##  7/25/2018: 164   1.3               : 145   2.3 and up        : 652
##  (Other)  :9255   (Other)           :7768   (Other)           :2519
```

Data Management

There's a lot of missing Rating data and the $ sign has to be removed from the Price field.

```
##                                                 App       Category Rating
## 1     Photo Editor & Candy Camera & Grid & ScrapBook ART_AND_DESIGN    4.1
## 2                                Coloring book moana ART_AND_DESIGN    3.9
## 3 U Launcher Lite - FREE Live Cool Themes, Hide Apps ART_AND_DESIGN    4.7
## 4                               Sketch - Draw & Paint ART_AND_DESIGN    4.5
## 5              Pixel Draw - Number Art Coloring Book ART_AND_DESIGN    4.3
## 6                         Paper flowers instructions ART_AND_DESIGN    4.4
##   Reviews size_adjusted Installs Type Price Content.Rating
## 1     159         19000    10000 Free     0       Everyone
## 2     967         14000   500000 Free     0       Everyone
## 3   87510          8700  5000000 Free     0       Everyone
## 4  215644         25000 50000000 Free     0           Teen
## 5     967          2800   100000 Free     0       Everyone
## 6     167          5600    50000 Free     0       Everyone
##                      Genres
## 1              Art & Design
## 2 Art & Design;Pretend Play
## 3              Art & Design
## 4              Art & Design
## 5   Art & Design;Creativity
## 6              Art & Design
```



Target Flag

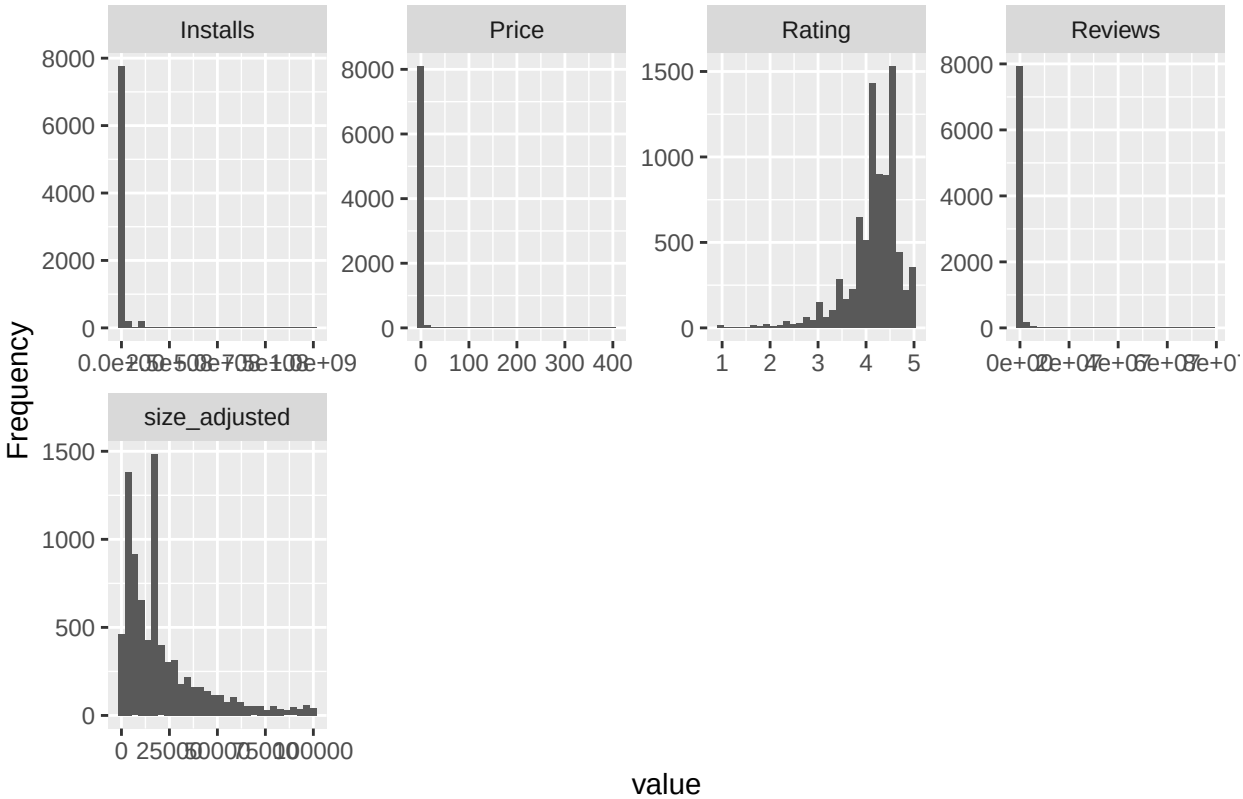
For the analysis of how succesfull an app is on the Google Play store a target falg was put in place to see if an app was downloaded more times than the average of all the apps.

```
##                  vars    n       mean          sd   median    trimmed
## App*                1 8196    4940.51     2798.56   5062.5    4964.47
## Category*           2 8196      17.85        8.32     15.0      17.89
## Rating              3 8196       4.17        0.54      4.3       4.24
## Reviews             4 8196  255251.47  1985593.85   3004.0   28416.47
## size_adjusted       5 8196   21240.86    21080.86  18000.0   17348.68
## Installs            6 8196 9165089.72 58250865.45 100000.0 1580781.03
## Type*               7 8196       1.07        0.26      1.0       1.00
## Price               8 8196       1.04       16.86      0.0       0.00
## Content.Rating*     9 8196       2.46        1.00      2.0       2.20
## Genres*            10 8196      65.81       33.04     68.0      67.46
## above_avg          11 8196       0.63        0.48      1.0       0.66
##                       mad min        max       range  skew kurtosis
## App*              3589.37 2.0       9658      9656.0 -0.07    -1.20
## Category*            8.90 1.0         33        32.0  0.14    -1.09
## Rating               0.44 1.0          5         4.0 -1.74     5.11
## Reviews           4443.35 1.0   78158306  78158305.0 24.50   771.07
## size_adjusted    17049.90 8.5     100000     99991.5  1.70     2.71
## Installs        148111.74 1.0 1000000000 999999999.0 13.85   216.18
## Type*                0.00 1.0          2         1.0  3.26     8.65
## Price                0.00 0.0        400       400.0 22.99   534.13
## Content.Rating*      0.00 1.0          6         5.0  1.90     1.90
## Genres*             43.00 1.0        119       118.0 -0.29    -0.96
## above_avg            0.00 0.0          1         1.0 -0.53    -1.72
##                        se
## App*                30.91
## Category*            0.09
## Rating               0.01
## Reviews          21932.57
## size_adjusted      232.86
## Installs        643430.15
## Type*                0.00
## Price                0.19
## Content.Rating*      0.01
## Genres*              0.36
## above_avg            0.01
```

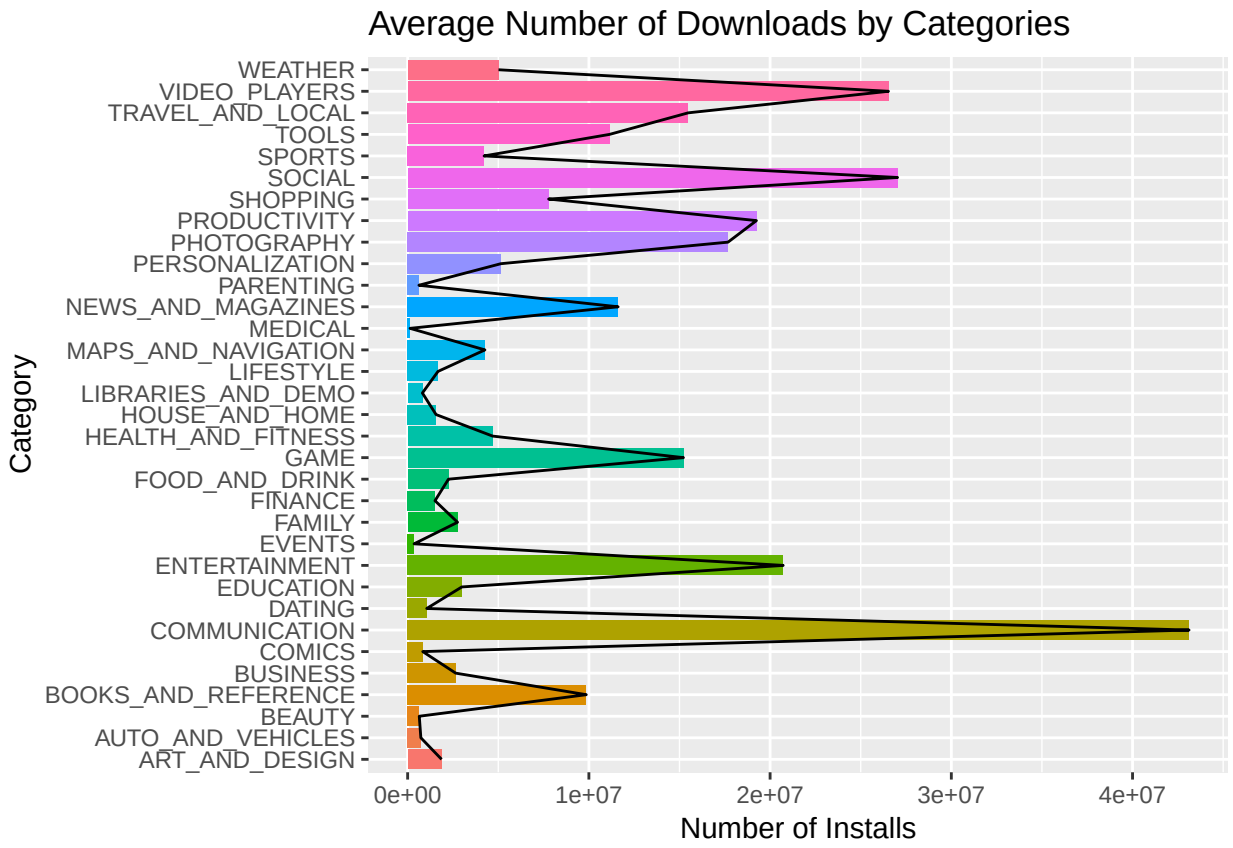
Histogram

```
##                                                 App      Category Rating
## 1           Messenger - Text and Video Chat for Free COMMUNICATION    4.0
## 2                                WhatsApp Messenger COMMUNICATION    4.4
## 3                                    Subway Surfers          GAME    4.5
## 4                                  Candy Crush Saga          GAME    4.4
## 5                                      Clash Royale          GAME    4.6
## 6                                    Clash of Clans          GAME    4.6
## 7                                          Facebook        SOCIAL    4.1
## 8                                         Instagram        SOCIAL    4.5
## 9                                           YouTube VIDEO_PLAYERS    4.3
```

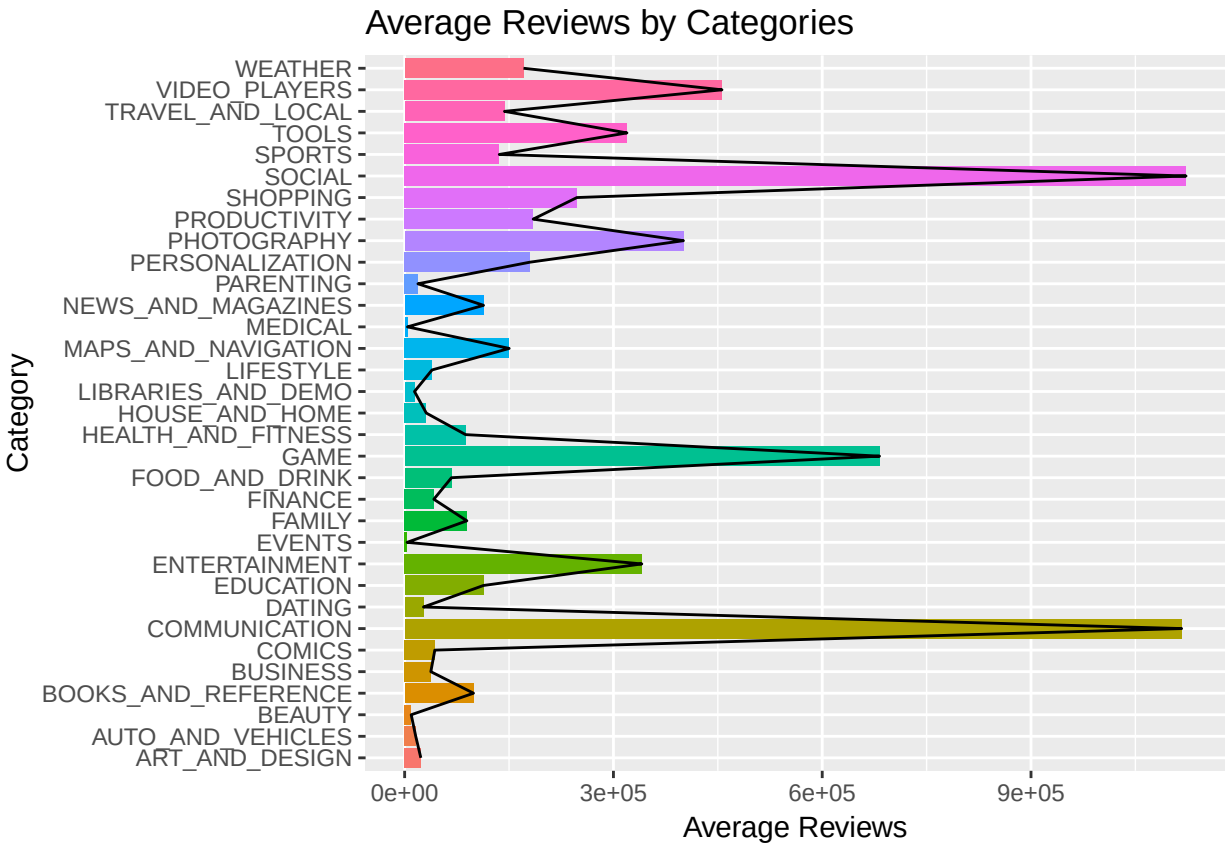
```
## 10            Clean Master- Space Cleaner & Antivirus         TOOLS    4.7
## 11 Security Master - Antivirus, VPN, AppLock, Booster         TOOLS    4.7
##     Reviews size_adjusted   Installs Type Price Content.Rating
## 1  56642847      18153.77 1000000000 Free     0       Everyone
## 2  69119316      18153.77 1000000000 Free     0       Everyone
## 3  27722264      76000.00 1000000000 Free     0   Everyone 10+
## 4  22426677      74000.00  500000000 Free     0       Everyone
## 5  23133508      97000.00  100000000 Free     0   Everyone 10+
## 6  44891723      98000.00  100000000 Free     0   Everyone 10+
## 7  78158306      18153.77 1000000000 Free     0          Teen
## 8  66577313      18153.77 1000000000 Free     0          Teen
## 9  25655305      18153.77 1000000000 Free     0          Teen
## 10 42916526      18153.77  500000000 Free     0       Everyone
## 11 24900999      18153.77  500000000 Free     0       Everyone
##                     Genres above_avg
## 1            Communication         0
## 2            Communication         1
## 3                   Arcade         1
## 4                   Casual         1
## 5                 Strategy         1
## 6                 Strategy         1
## 7                   Social         0
## 8                   Social         1
## 9  Video Players & Editors         1
## 10                  Tools         1
## 11                  Tools         1
```



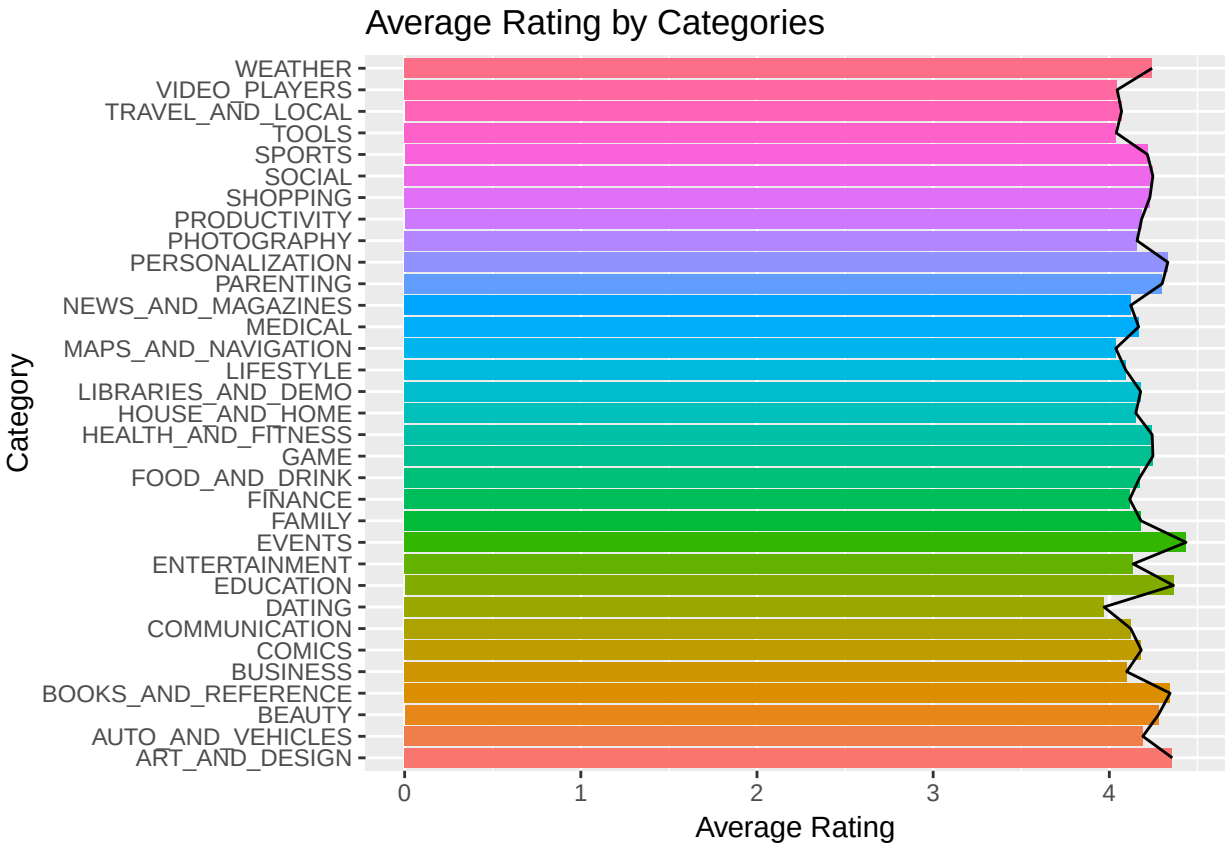
##Downloads by Categories


Average Number of Downloads by Categories
Category
WEATHER
VIDEO_PLAYERS
TRAVEL_AND_LOCAL
TOOLS
SPORTS
SOCIAL
SHOPPING
PRODUCTIVITY
PHOTOGRAPHY
PERSONALIZATION
PARENTING
NEWS_AND_MAGAZINES
MEDICAL
MAPS_AND_NAVIGATION
LIFESTYLE
LIBRARIES_AND_DEMO
HOUSE_AND_HOME
HEALTH_AND_FITNESS
GAME
FOOD_AND_DRINK
FINANCE
FAMILY
EVENTS
ENTERTAINMENT
EDUCATION
DATING
COMMUNICATION
COMICS
BUSINESS
BOOKS_AND_REFERENCE
BEAUTY
AUTO_AND_VEHICLES
ART_AND_DESIGN
0e+00
1e+07
2e+07
3e+07
4e+07
Number of Installs

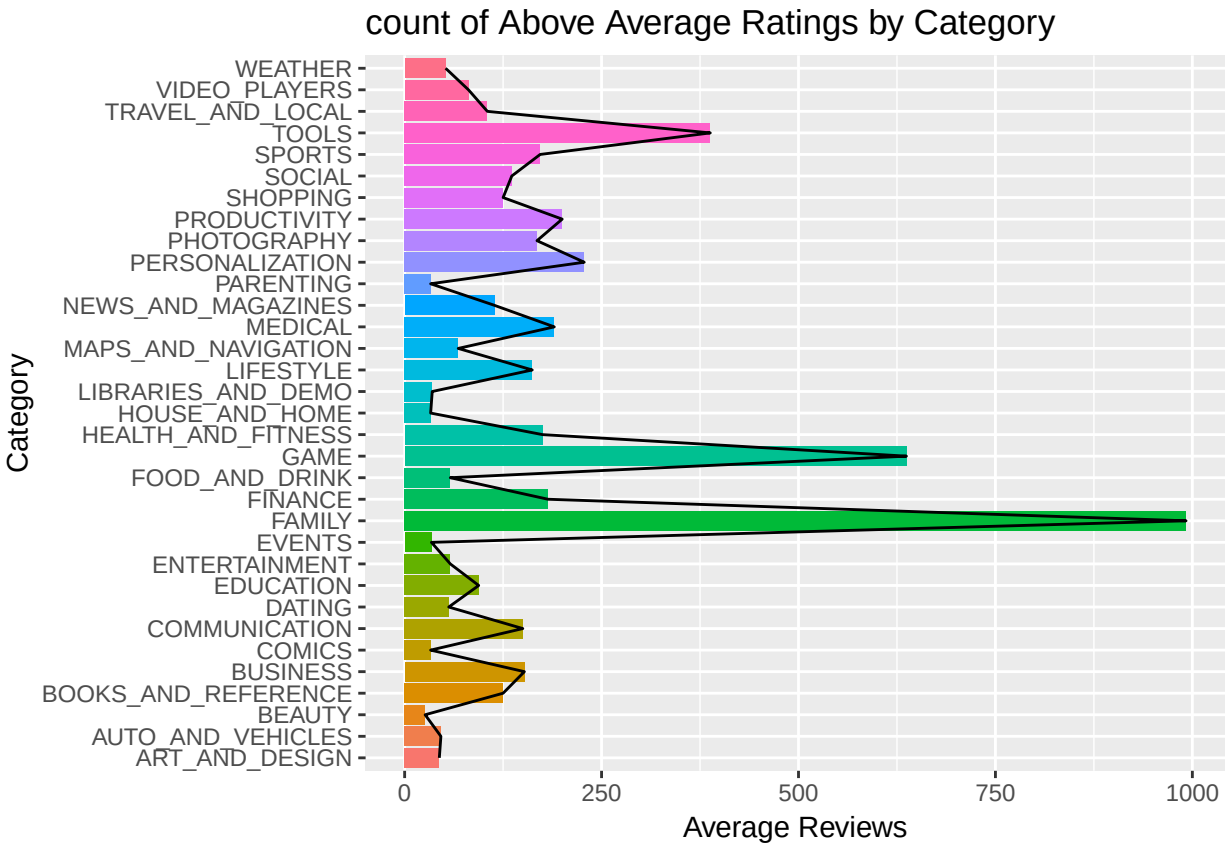
Reviews by Categories



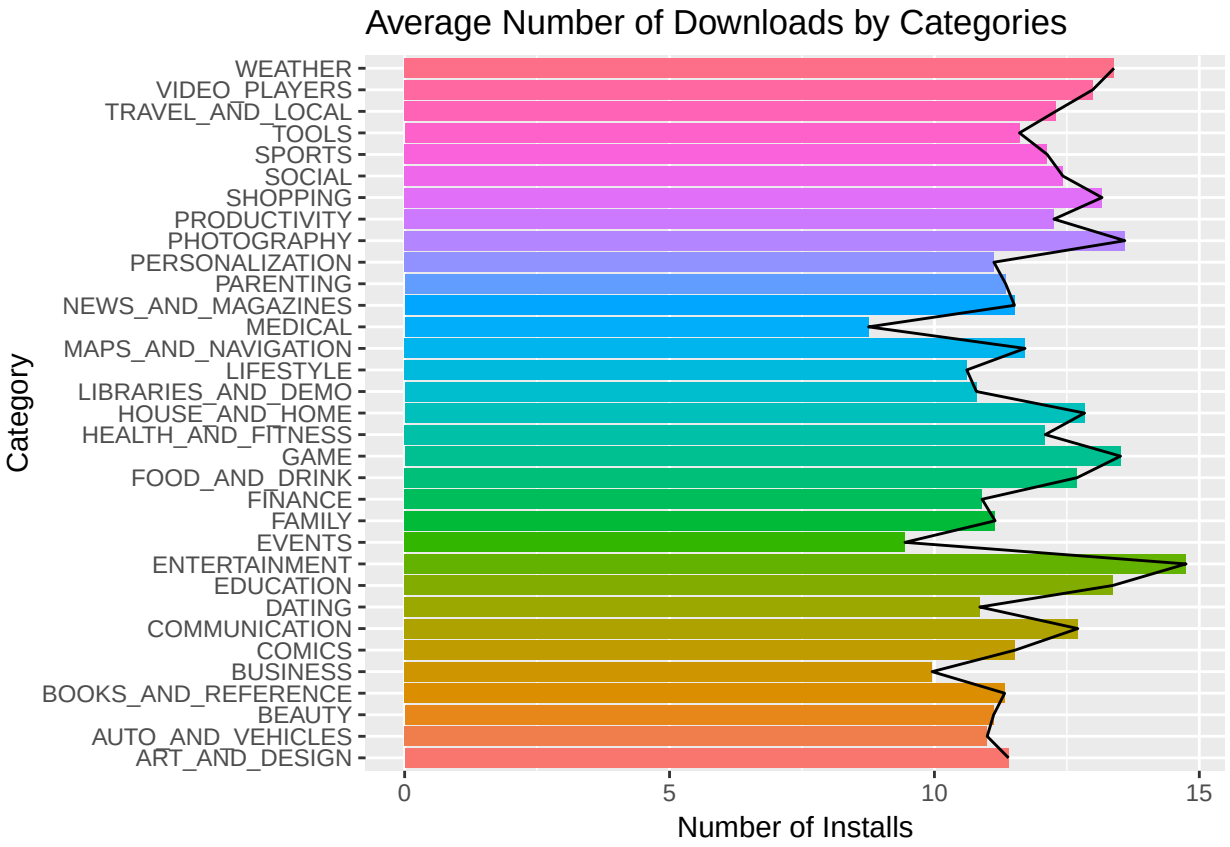
Ratings by Categories



Number Above Average by Categories



Log View of Downloads by Categories



Train-Test Split

Just like the Apple data, the Google data did not come in a training and testing datasets. So this was done by splitting up the total datset.

Poisson

The first model ran was Poisson.

```
##
## Call:
## glm(formula = above_avg ~ install_log + review_log + Type + Category +
##     Price + Content.Rating, family = "poisson", data = train)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.5287  -0.9704   0.1794   0.4534   1.3642
##
## Coefficients:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                  0.526822   0.736588   0.715   0.4745
## install_log                 -0.201796   0.015176 -13.297   <2e-16 ***
## review_log                   0.238084   0.015220  15.643   <2e-16 ***
```

```
## TypePaid                     -0.043230   0.063892  -0.677   0.4987
## CategoryAUTO_AND_VEHICLES    -0.188760   0.225266  -0.838   0.4021
## CategoryBEAUTY               -0.081959   0.264353  -0.310   0.7565
## CategoryBOOKS_AND_REFERENCE  -0.109440   0.187340  -0.584   0.5591
## CategoryBUSINESS             -0.307656   0.182282  -1.688   0.0914 .
## CategoryCOMICS               -0.317223   0.263483  -1.204   0.2286
## CategoryCOMMUNICATION        -0.382773   0.181457  -2.109   0.0349 *
## CategoryDATING               -0.537897   0.231774  -2.321   0.0203 *
## CategoryEDUCATION            -0.094283   0.197590  -0.477   0.6332
## CategoryENTERTAINMENT        -0.385009   0.216125  -1.781   0.0748 .
## CategoryEVENTS               -0.004081   0.254367  -0.016   0.9872
## CategoryFAMILY               -0.268331   0.160640  -1.670   0.0948 .
## CategoryFINANCE              -0.289409   0.177648  -1.629   0.1033
## CategoryFOOD_AND_DRINK       -0.357987   0.219755  -1.629   0.1033
## CategoryGAME                 -0.303702   0.164400  -1.847   0.0647 .
## CategoryHEALTH_AND_FITNESS   -0.154521   0.177088  -0.873   0.3829
## CategoryHOUSE_AND_HOME       -0.321196   0.247950  -1.295   0.1952
## CategoryLIBRARIES_AND_DEMO   -0.263189   0.242740  -1.084   0.2783
## CategoryLIFESTYLE            -0.342862   0.180578  -1.899   0.0576 .
## CategoryMAPS_AND_NAVIGATION  -0.337532   0.208104  -1.622   0.1048
## CategoryMEDICAL              -0.119987   0.176356  -0.680   0.4963
## CategoryNEWS_AND_MAGAZINES   -0.376348   0.189447  -1.987   0.0470 *
## CategoryPARENTING            -0.064951   0.253775  -0.256   0.7980
## CategoryPERSONALIZATION      -0.080809   0.172810  -0.468   0.6401
## CategoryPHOTOGRAPHY          -0.278518   0.178493  -1.560   0.1187
## CategoryPRODUCTIVITY         -0.198151   0.174806  -1.134   0.2570
## CategorySHOPPING             -0.190029   0.184886  -1.028   0.3040
## CategorySOCIAL               -0.252979   0.185921  -1.361   0.1736
## CategorySPORTS               -0.279221   0.177801  -1.570   0.1163
## CategoryTOOLS                -0.350636   0.165839  -2.114   0.0345 *
## CategoryTRAVEL_AND_LOCAL     -0.317909   0.191332  -1.662   0.0966 .
## CategoryVIDEO_PLAYERS        -0.397690   0.201496  -1.974   0.0484 *
## CategoryWEATHER              -0.236281   0.227204  -1.040   0.2984
## Price                        -0.003187   0.001777  -1.794   0.0729 .
## Content.RatingEveryone       -0.230735   0.716044  -0.322   0.7473
## Content.RatingEveryone 10+   -0.331805   0.720595  -0.460   0.6452
## Content.RatingMature 17+     -0.335825   0.721327  -0.466   0.6415
## Content.RatingTeen           -0.329695   0.717058  -0.460   0.6457
## Content.RatingUnrated       -11.980819 284.660069  -0.042   0.9664
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 3848.0  on 6555  degrees of freedom
## Residual deviance: 3507.4  on 6514  degrees of freedom
## AIC: 11793
##
## Number of Fisher Scoring iterations: 10
```

Poisson Reduced

We removed some fields from the Poisson model that were not significant.

```
##
## Call:
## glm(formula = above_avg ~ install_log + review_log + Category +
##     Price, family = "poisson", data = train)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.5180  -0.9722   0.1775   0.4555   1.4117
##
## Coefficients:
##                               Estimate Std. Error z value Pr(>|z|)
## (Intercept)                   0.266695   0.171236   1.557  0.11936
## install_log                  -0.196522   0.014117 -13.920  < 2e-16 ***
## review_log                    0.232379   0.014490  16.037  < 2e-16 ***
## CategoryAUTO_AND_VEHICLES    -0.179794   0.225195  -0.798  0.42464
## CategoryBEAUTY               -0.078985   0.264303  -0.299  0.76506
## CategoryBOOKS_AND_REFERENCE -0.115132   0.187260  -0.615  0.53867
## CategoryBUSINESS             -0.299099   0.182154  -1.642  0.10059
## CategoryCOMICS               -0.352785   0.260585  -1.354  0.17579
## CategoryCOMMUNICATION        -0.383493   0.181418  -2.114  0.03453 *
## CategoryDATING               -0.625897   0.213800  -2.927  0.00342 **
## CategoryEDUCATION            -0.084923   0.197505  -0.430  0.66721
## CategoryENTERTAINMENT        -0.434700   0.214407  -2.027  0.04262 *
## CategoryEVENTS               -0.013152   0.254059  -0.052  0.95871
## CategoryFAMILY               -0.283297   0.160468  -1.765  0.07749 .
## CategoryFINANCE              -0.277496   0.177487  -1.563  0.11794
## CategoryFOOD_AND_DRINK       -0.355768   0.219736  -1.619  0.10543
## CategoryGAME                 -0.341006   0.163475  -2.086  0.03698 *
## CategoryHEALTH_AND_FITNESS   -0.150412   0.177032  -0.850  0.39553
## CategoryHOUSE_AND_HOME       -0.313647   0.247909  -1.265  0.20581
## CategoryLIBRARIES_AND_DEMO   -0.253356   0.242658  -1.044  0.29645
## CategoryLIFESTYLE            -0.344016   0.180498  -1.906  0.05666 .
## CategoryMAPS_AND_NAVIGATION -0.330195   0.208058  -1.587  0.11251
## CategoryMEDICAL              -0.120258   0.176334  -0.682  0.49525
## CategoryNEWS_AND_MAGAZINES   -0.402546   0.188513  -2.135  0.03273 *
## CategoryPARENTING            -0.062416   0.253753  -0.246  0.80571
## CategoryPERSONALIZATION      -0.087079   0.172641  -0.504  0.61399
## CategoryPHOTOGRAPHY          -0.272968   0.178449  -1.530  0.12610
## CategoryPRODUCTIVITY         -0.188451   0.174746  -1.078  0.28084
## CategorySHOPPING             -0.196019   0.184755  -1.061  0.28870
## CategorySOCIAL               -0.306576   0.183050  -1.675  0.09397 .
## CategorySPORTS               -0.273830   0.177705  -1.541  0.12334
## CategoryTOOLS                -0.345782   0.165799  -2.086  0.03702 *
## CategoryTRAVEL_AND_LOCAL     -0.313885   0.191308  -1.641  0.10085
## CategoryVIDEO_PLAYERS        -0.401416   0.201454  -1.993  0.04631 *
## CategoryWEATHER              -0.231947   0.227160  -1.021  0.30722
## Price                        -0.003415   0.001796  -1.901  0.05728 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 3848.0  on 6555  degrees of freedom
## Residual deviance: 3513.7  on 6520  degrees of freedom
```

```
## AIC: 11788
##
## Number of Fisher Scoring iterations: 5
```

Quasi

Next a Quasi model was used.

```
##
## Call:
## glm(formula = above_avg ~ install_log + review_log + Type + Category +
##     Price + Content.Rating, family = "quasi", data = train)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.0407  -0.4740   0.1722   0.3630   1.1298
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  1.3290074  0.3278915   4.053 5.11e-05 ***
## install_log                 -0.1244676  0.0053764 -23.151  < 2e-16 ***
## review_log                   0.1473643  0.0053727  27.429  < 2e-16 ***
## TypePaid                    -0.0266636  0.0241019  -1.106 0.268644
## CategoryAUTO_AND_VEHICLES   -0.1198587  0.0827697  -1.448 0.147638
## CategoryBEAUTY              -0.0577980  0.0968598  -0.597 0.550716
## CategoryBOOKS_AND_REFERENCE -0.0644103  0.0713522  -0.903 0.366713
## CategoryBUSINESS            -0.1921510  0.0675259  -2.846 0.004447 **
## CategoryCOMICS              -0.2041415  0.0930805  -2.193 0.028330 *
## CategoryCOMMUNICATION       -0.2422059  0.0675999  -3.583 0.000342 ***
## CategoryDATING              -0.3006443  0.0800058  -3.758 0.000173 ***
## CategoryEDUCATION           -0.0464675  0.0766299  -0.606 0.544278
## CategoryENTERTAINMENT       -0.2521986  0.0788436  -3.199 0.001387 **
## CategoryEVENTS              -0.0061205  0.0979021  -0.063 0.950153
## CategoryFAMILY              -0.1711697  0.0611704  -2.798 0.005153 **
## CategoryFINANCE             -0.1878347  0.0667537  -2.814 0.004910 **
## CategoryFOOD_AND_DRINK      -0.2291565  0.0797794  -2.872 0.004087 **
## CategoryGAME                -0.1914263  0.0626816  -3.054 0.002268 **
## CategoryHEALTH_AND_FITNESS  -0.0946400  0.0678565  -1.395 0.163152
## CategoryHOUSE_AND_HOME      -0.2062797  0.0878837  -2.347 0.018945 *
## CategoryLIBRARIES_AND_DEMO  -0.1733311  0.0860830  -2.014 0.044099 *
## CategoryLIFESTYLE           -0.2128633  0.0667918  -3.187 0.001445 **
## CategoryMAPS_AND_NAVIGATION -0.2180708  0.0759020  -2.873 0.004078 **
## CategoryMEDICAL             -0.0773091  0.0668120  -1.157 0.247268
## CategoryNEWS_AND_MAGAZINES  -0.2416977  0.0694793  -3.479 0.000507 ***
## CategoryPARENTING           -0.0400977  0.0952118  -0.421 0.673665
## CategoryPERSONALIZATION     -0.0440051  0.0665140  -0.662 0.508257
## CategoryPHOTOGRAPHY         -0.1804969  0.0673954  -2.678 0.007421 **
## CategoryPRODUCTIVITY        -0.1246795  0.0665660  -1.873 0.061110 .
## CategorySHOPPING            -0.1232857  0.0703921  -1.751 0.079922 .
## CategorySOCIAL              -0.1585884  0.0701604  -2.260 0.023831 *
## CategorySPORTS              -0.1818067  0.0674896  -2.694 0.007081 **
## CategoryTOOLS               -0.2173114  0.0626083  -3.471 0.000522 ***
## CategoryTRAVEL_AND_LOCAL    -0.2040144  0.0702513  -2.904 0.003696 **
## CategoryVIDEO_PLAYERS       -0.2430203  0.0730053  -3.329 0.000877 ***
```

```
## CategoryWEATHER             -0.1498150  0.0862034  -1.738 0.082271 .
## Price                       -0.0012202  0.0003499  -3.488 0.000491 ***
## Content.RatingEveryone      -0.2064333  0.3213268  -0.642 0.520610
## Content.RatingEveryone 10+  -0.2710388  0.3226508  -0.840 0.400918
## Content.RatingMature 17+    -0.2770713  0.3227721  -0.858 0.390697
## Content.RatingTeen          -0.2692742  0.3216229  -0.837 0.402491
## Content.RatingUnrated       -0.8082005  0.5540253  -1.459 0.144674
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for quasi family taken to be 0.2033567)
##
##     Null deviance: 1535.7  on 6555  degrees of freedom
## Residual deviance: 1324.7  on 6514  degrees of freedom
## AIC: NA
##
## Number of Fisher Scoring iterations: 2
```

Quasi Reduced

Quasi with removed fields

```
##
## Call:
## glm(formula = above_avg ~ install_log + review_log + Category +
##     Price, family = "quasi", data = train)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -1.0313  -0.4768   0.1716   0.3639   1.1213
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  1.1049726  0.0652814  16.926  < 2e-16 ***
## install_log                 -0.1213513  0.0050251 -24.149  < 2e-16 ***
## review_log                   0.1439350  0.0051270  28.074  < 2e-16 ***
## CategoryAUTO_AND_VEHICLES   -0.1151980  0.0828304  -1.391 0.164343
## CategoryBEAUTY              -0.0565079  0.0969364  -0.583 0.559955
## CategoryBOOKS_AND_REFERENCE -0.0681120  0.0714019  -0.954 0.340158
## CategoryBUSINESS            -0.1873830  0.0675576  -2.774 0.005558 **
## CategoryCOMICS              -0.2264302  0.0924609  -2.449 0.014354 *
## CategoryCOMMUNICATION       -0.2430465  0.0676505  -3.593 0.000330 ***
## CategoryDATING              -0.3605153  0.0736022  -4.898 9.91e-07 ***
## CategoryEDUCATION           -0.0419855  0.0766772  -0.548 0.584012
## CategoryENTERTAINMENT       -0.2836527  0.0783184  -3.622 0.000295 ***
## CategoryEVENTS              -0.0120991  0.0979108  -0.124 0.901657
## CategoryFAMILY              -0.1800392  0.0611793  -2.943 0.003264 **
## CategoryFINANCE             -0.1812574  0.0667764  -2.714 0.006657 **
## CategoryFOOD_AND_DRINK      -0.2275939  0.0798502  -2.850 0.004382 **
## CategoryGAME                -0.2158595  0.0624129  -3.459 0.000547 ***
## CategoryHEALTH_AND_FITNESS  -0.0932919  0.0679096  -1.374 0.169562
## CategoryHOUSE_AND_HOME      -0.2024667  0.0879557  -2.302 0.021371 *
## CategoryLIBRARIES_AND_DEMO  -0.1674376  0.0861381  -1.944 0.051959 .
## CategoryLIFESTYLE           -0.2139836  0.0668353  -3.202 0.001373 **
```

```
## CategoryMAPS_AND_NAVIGATION -0.2139951  0.0759599  -2.817 0.004859 **
## CategoryMEDICAL             -0.0788151  0.0668464  -1.179 0.238422
## CategoryNEWS_AND_MAGAZINES  -0.2573843  0.0692395  -3.717 0.000203 ***
## CategoryPARENTING           -0.0394365  0.0952929  -0.414 0.679001
## CategoryPERSONALIZATION     -0.0488123  0.0665071  -0.734 0.463011
## CategoryPHOTOGRAPHY         -0.1779518  0.0674468  -2.638 0.008350 **
## CategoryPRODUCTIVITY        -0.1189880  0.0666098  -1.786 0.074090 .
## CategorySHOPPING            -0.1276319  0.0704160  -1.813 0.069948 .
## CategorySOCIAL              -0.1937799  0.0692961  -2.796 0.005183 **
## CategorySPORTS              -0.1788403  0.0675322  -2.648 0.008111 **
## CategoryTOOLS               -0.2144281  0.0626456  -3.423 0.000623 ***
## CategoryTRAVEL_AND_LOCAL    -0.2010319  0.0703095  -2.859 0.004260 **
## CategoryVIDEO_PLAYERS       -0.2459982  0.0730576  -3.367 0.000764 ***
## CategoryWEATHER             -0.1476231  0.0862686  -1.711 0.087091 .
## Price                       -0.0012856  0.0003426  -3.752 0.000177 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for quasi family taken to be 0.2037328)
##
##     Null deviance: 1535.7  on 6555  degrees of freedom
## Residual deviance: 1328.3  on 6520  degrees of freedom
## AIC: NA
##
## Number of Fisher Scoring iterations: 2
```

Bionmial

```
##
## Call:
## glm(formula = above_avg ~ install_log + review_log + Type + Category +
##     Price + Content.Rating, family = "binomial", data = train)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.3296  -1.1146   0.6071   0.9153   2.5195
##
## Coefficients:
##                               Estimate Std. Error z value Pr(>|z|)
## (Intercept)                 14.237464 229.205535   0.062 0.950470
## install_log                 -0.617035   0.029084 -21.216  < 2e-16 ***
## review_log                   0.728709   0.029665  24.564  < 2e-16 ***
## TypePaid                    -0.141471   0.125563  -1.127 0.259872
## CategoryAUTO_AND_VEHICLES   -0.591843   0.419383  -1.411 0.158179
## CategoryBEAUTY              -0.295877   0.483547  -0.612 0.540612
## CategoryBOOKS_AND_REFERENCE -0.301180   0.372427  -0.809 0.418691
## CategoryBUSINESS            -0.951116   0.346328  -2.746 0.006027 **
## CategoryCOMICS              -1.017709   0.458315  -2.221 0.026382 *
## CategoryCOMMUNICATION       -1.212047   0.347637  -3.487 0.000489 ***
## CategoryDATING              -1.429236   0.403055  -3.546 0.000391 ***
## CategoryEDUCATION           -0.150750   0.415391  -0.363 0.716672
## CategoryENTERTAINMENT       -1.274439   0.395827  -3.220 0.001283 **
## CategoryEVENTS              -0.068677   0.510372  -0.135 0.892958
```

```
## CategoryFAMILY               -0.854903   0.318495  -2.684 0.007271 **
## CategoryFINANCE              -0.953736   0.343959  -2.773 0.005557 **
## CategoryFOOD_AND_DRINK       -1.149055   0.401958  -2.859 0.004255 **
## CategoryGAME                 -0.954747   0.326692  -2.922 0.003473 **
## CategoryHEALTH_AND_FITNESS   -0.463037   0.355836  -1.301 0.193167
## CategoryHOUSE_AND_HOME       -1.026793   0.435961  -2.355 0.018511 *
## CategoryLIBRARIES_AND_DEMO   -0.876532   0.424403  -2.065 0.038892 *
## CategoryLIFESTYLE            -1.053662   0.342645  -3.075 0.002104 **
## CategoryMAPS_AND_NAVIGATION  -1.095832   0.382836  -2.862 0.004204 **
## CategoryMEDICAL              -0.385272   0.345604  -1.115 0.264945
## CategoryNEWS_AND_MAGAZINES   -1.203165   0.353192  -3.407 0.000658 ***
## CategoryPARENTING            -0.183855   0.485874  -0.378 0.705133
## CategoryPERSONALIZATION      -0.190532   0.351204  -0.543 0.587466
## CategoryPHOTOGRAPHY          -0.914695   0.348259  -2.626 0.008627 **
## CategoryPRODUCTIVITY         -0.625541   0.346518  -1.805 0.071040 .
## CategorySHOPPING             -0.630691   0.365246  -1.727 0.084212 .
## CategorySOCIAL               -0.793406   0.362522  -2.189 0.028628 *
## CategorySPORTS               -0.936514   0.349368  -2.681 0.007349 **
## CategoryTOOLS                -1.080079   0.324906  -3.324 0.000886 ***
## CategoryTRAVEL_AND_LOCAL     -1.021204   0.357272  -2.858 0.004259 **
## CategoryVIDEO_PLAYERS        -1.193101   0.371687  -3.210 0.001328 **
## CategoryWEATHER              -0.742432   0.444687  -1.670 0.095006 .
## Price                        -0.005925   0.002045  -2.897 0.003769 **
## Content.RatingEveryone      -11.153391 229.205284  -0.049 0.961189
## Content.RatingEveryone 10+  -11.484703 229.205330  -0.050 0.960037
## Content.RatingMature 17+    -11.515534 229.205331  -0.050 0.959930
## Content.RatingTeen          -11.470996 229.205294  -0.050 0.960085
## Content.RatingUnrated       -24.205913 397.484010  -0.061 0.951441
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 8670.8  on 6555  degrees of freedom
## Residual deviance: 7703.1  on 6514  degrees of freedom
## AIC: 7787.1
##
## Number of Fisher Scoring iterations: 11
```

Binomial backward elimination

```
##
## Call:
## glm(formula = above_avg ~ install_log + review_log + Category +
##     Price, family = "binomial", data = train)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.3070  -1.1228   0.6083   0.9182   2.4989
##
## Coefficients:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                  2.986227   0.342592   8.717  < 2e-16 ***
```

```
## install_log                 -0.599341   0.027256 -21.989  < 2e-16 ***
## review_log                   0.709068   0.028270  25.082  < 2e-16 ***
## CategoryAUTO_AND_VEHICLES   -0.570105   0.418511  -1.362 0.173128
## CategoryBEAUTY              -0.290754   0.482808  -0.602 0.547032
## CategoryBOOKS_AND_REFERENCE -0.318439   0.372285  -0.855 0.392349
## CategoryBUSINESS            -0.924490   0.345894  -2.673 0.007523 **
## CategoryCOMICS              -1.127037   0.455143  -2.476 0.013278 *
## CategoryCOMMUNICATION       -1.215207   0.347374  -3.498 0.000468 ***
## CategoryDATING              -1.732104   0.372242  -4.653 3.27e-06 ***
## CategoryEDUCATION           -0.135369   0.414087  -0.327 0.743736
## CategoryENTERTAINMENT       -1.431668   0.392942  -3.643 0.000269 ***
## CategoryEVENTS              -0.097364   0.510130  -0.191 0.848634
## CategoryFAMILY              -0.894225   0.318212  -2.810 0.004952 **
## CategoryFINANCE             -0.919272   0.343476  -2.676 0.007442 **
## CategoryFOOD_AND_DRINK      -1.137407   0.401601  -2.832 0.004623 **
## CategoryGAME                -1.077312   0.325058  -3.314 0.000919 ***
## CategoryHEALTH_AND_FITNESS  -0.461563   0.355324  -1.299 0.193947
## CategoryHOUSE_AND_HOME      -1.006601   0.434881  -2.315 0.020632 *
## CategoryLIBRARIES_AND_DEMO  -0.844651   0.423845  -1.993 0.046280 *
## CategoryLIFESTYLE           -1.055644   0.342359  -3.083 0.002046 **
## CategoryMAPS_AND_NAVIGATION -1.073603   0.382395  -2.808 0.004992 **
## CategoryMEDICAL             -0.398203   0.345061  -1.154 0.248497
## CategoryNEWS_AND_MAGAZINES  -1.277857   0.351935  -3.631 0.000282 ***
## CategoryPARENTING           -0.182916   0.484728  -0.377 0.705908
## CategoryPERSONALIZATION     -0.219705   0.350396  -0.627 0.530647
## CategoryPHOTOGRAPHY         -0.902311   0.347807  -2.594 0.009479 **
## CategoryPRODUCTIVITY        -0.596033   0.346124  -1.722 0.085066 .
## CategorySHOPPING            -0.653339   0.364795  -1.791 0.073297 .
## CategorySOCIAL              -0.967700   0.358309  -2.701 0.006918 **
## CategorySPORTS              -0.921318   0.349054  -2.639 0.008304 **
## CategoryTOOLS               -1.062658   0.324585  -3.274 0.001061 **
## CategoryTRAVEL_AND_LOCAL    -1.001418   0.357098  -2.804 0.005042 **
## CategoryVIDEO_PLAYERS       -1.204920   0.371211  -3.246 0.001171 **
## CategoryWEATHER             -0.731738   0.443888  -1.648 0.099255 .
## Price                       -0.006303   0.002045  -3.081 0.002061 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 8670.8  on 6555  degrees of freedom
## Residual deviance: 7722.5  on 6520  degrees of freedom
## AIC: 7794.5
##
## Number of Fisher Scoring iterations: 3
```

Google Results

Poisson Results

```
##                                 2.5 %        97.5 %
## (Intercept)                -0.068921041  0.6023115169
```

```
## install_log                 -0.224191354 -0.1688518022
## review_log                   0.203979752  0.2607787189
## CategoryAUTO_AND_VEHICLES   -0.621167352  0.2615797286
## CategoryBEAUTY              -0.597010317  0.4390400035
## CategoryBOOKS_AND_REFERENCE -0.482155110  0.2518912133
## CategoryBUSINESS            -0.656115308  0.0579164922
## CategoryCOMICS              -0.863522395  0.1579521486
## CategoryCOMMUNICATION       -0.739065453 -0.0279197913
## CategoryDATING              -1.044936791 -0.2068566248
## CategoryEDUCATION           -0.472026861  0.3021800302
## CategoryENTERTAINMENT       -0.854929571 -0.0144704579
## CategoryEVENTS              -0.511098635  0.4847947538
## CategoryFAMILY              -0.597807688  0.0312140409
## CategoryFINANCE             -0.625363592  0.0703710336
## CategoryFOOD_AND_DRINK      -0.786442893  0.0749077021
## CategoryGAME                -0.661412245 -0.0206001009
## CategoryHEALTH_AND_FITNESS  -0.497388679  0.1965654687
## CategoryHOUSE_AND_HOME      -0.799540157  0.1722459872
## CategoryLIBRARIES_AND_DEMO  -0.728956815  0.2222449024
## CategoryLIFESTYLE           -0.697785257  0.0097529603
## CategoryMAPS_AND_NAVIGATION -0.737981428  0.0775911943
## CategoryMEDICAL             -0.465866241  0.2253510963
## CategoryNEWS_AND_MAGAZINES  -0.772024825 -0.0330668878
## CategoryPARENTING           -0.559762953  0.4349313984
## CategoryPERSONALIZATION     -0.425449365  0.2512922006
## CategoryPHOTOGRAPHY         -0.622720873  0.0767853957
## CategoryPRODUCTIVITY        -0.530946572  0.1540452146
## CategorySHOPPING            -0.558131347  0.1660935643
## CategorySOCIAL              -0.665347499  0.0521950157
## CategorySPORTS              -0.622126189  0.0744654680
## CategoryTOOLS               -0.670742899 -0.0208217423
## CategoryTRAVEL_AND_LOCAL    -0.688841538  0.0610710041
## CategoryVIDEO_PLAYERS       -0.796258777 -0.0065738766
## CategoryWEATHER             -0.677172242  0.2132772850
## Price                       -0.006934916  0.0001055615
```

```
##       pred
## actual    0    1
##      0 1031 1424
##      1  743 3358
```

Quasi Results

```
##                                 2.5 %       97.5 %
## (Intercept)                 0.977023452  1.2329217789
## install_log                -0.131200410 -0.1115021876
## review_log                  0.133886195  0.1539837632
## CategoryAUTO_AND_VEHICLES  -0.277542639  0.0471465710
## CategoryBEAUTY             -0.246499888  0.1334840112
## CategoryBOOKS_AND_REFERENCE -0.208057074  0.0718331497
## CategoryBUSINESS           -0.319793418 -0.0549726108
## CategoryCOMICS             -0.407650322 -0.0452100638
## CategoryCOMMUNICATION      -0.375638984 -0.1104539845
## CategoryDATING             -0.504773027 -0.2162576657
```

```
## CategoryEDUCATION           -0.192270035  0.1082990833
## CategoryENTERTAINMENT       -0.437153913 -0.1301515637
## CategoryEVENTS              -0.204000761  0.1798025196
## CategoryFAMILY              -0.299948358 -0.0601300286
## CategoryFINANCE             -0.312136826 -0.0503779613
## CategoryFOOD_AND_DRINK      -0.384097363 -0.0710904164
## CategoryGAME                -0.338186448 -0.0935325230
## CategoryHEALTH_AND_FITNESS  -0.226392338  0.0398085787
## CategoryHOUSE_AND_HOME      -0.374856778 -0.0300766297
## CategoryLIBRARIES_AND_DEMO  -0.336265243  0.0013900237
## CategoryLIFESTYLE           -0.344978371 -0.0829887402
## CategoryMAPS_AND_NAVIGATION -0.362873679 -0.0651165296
## CategoryMEDICAL             -0.209831742  0.0522014692
## CategoryNEWS_AND_MAGAZINES  -0.393091249 -0.1216773968
## CategoryPARENTING           -0.226207161  0.1473341434
## CategoryPERSONALIZATION     -0.179163856  0.0815392554
## CategoryPHOTOGRAPHY         -0.310145073 -0.0457585560
## CategoryPRODUCTIVITY        -0.249540863  0.0115648704
## CategorySHOPPING            -0.265644656  0.0103808714
## CategorySOCIAL              -0.329597756 -0.0579620445
## CategorySPORTS              -0.311200980 -0.0464795639
## CategoryTOOLS               -0.337211224 -0.0916449346
## CategoryTRAVEL_AND_LOCAL    -0.338835964 -0.0632278801
## CategoryVIDEO_PLAYERS       -0.389188522 -0.1028078137
## CategoryWEATHER             -0.316706403  0.0214601275
## Price                       -0.001957228 -0.0006140706
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -0.4602  0.5005  0.6215  0.6255  0.7525  1.1898
```

```
##       pred
## actual    0    1
##      0  950 1505
##      1  680 3421
```

Binomial Results

```
##                                 2.5 %       97.5 %
## (Intercept)                 2.3147584  3.657694968
## install_log                -0.6527619 -0.545921026
## review_log                  0.6536599  0.764476810
## CategoryAUTO_AND_VEHICLES  -1.3903714  0.250161876
## CategoryBEAUTY             -1.2370408  0.655533093
## CategoryBOOKS_AND_REFERENCE -1.0481036  0.411224990
## CategoryBUSINESS           -1.6024296 -0.246550956
## CategoryCOMICS             -2.0191014 -0.234971715
## CategoryCOMMUNICATION      -1.8960472 -0.534367403
## CategoryDATING             -2.4616848 -1.002522784
## CategoryEDUCATION          -0.9469645  0.676226240
## CategoryENTERTAINMENT      -2.2018206 -0.661516257
## CategoryEVENTS             -1.0972009  0.902472688
## CategoryFAMILY             -1.5179088 -0.270540527
## CategoryFINANCE            -1.5924716 -0.246071937
```

```
## CategoryFOOD_AND_DRINK      -1.9245304 -0.350283799
## CategoryGAME                -1.7144145 -0.440208758
## CategoryHEALTH_AND_FITNESS  -1.1579850  0.234859830
## CategoryHOUSE_AND_HOME      -1.8589521 -0.154249638
## CategoryLIBRARIES_AND_DEMO  -1.6753729 -0.013929415
## CategoryLIFESTYLE           -1.7266546 -0.384632550
## CategoryMAPS_AND_NAVIGATION -1.8230836 -0.324122494
## CategoryMEDICAL             -1.0745092  0.278104144
## CategoryNEWS_AND_MAGAZINES  -1.9676362 -0.588077913
## CategoryPARENTING           -1.1329659  0.767134745
## CategoryPERSONALIZATION     -0.9064690  0.467058696
## CategoryPHOTOGRAPHY         -1.5840009 -0.220621966
## CategoryPRODUCTIVITY        -1.2744243  0.082358331
## CategorySHOPPING            -1.3683237  0.061645111
## CategorySOCIAL              -1.6699724 -0.265428462
## CategorySPORTS              -1.6054517 -0.237183307
## CategoryTOOLS               -1.6988327 -0.426483284
## CategoryTRAVEL_AND_LOCAL    -1.7013177 -0.301517338
## CategoryVIDEO_PLAYERS       -1.9324795 -0.477360421
## CategoryWEATHER             -1.6017416  0.138265988
## Price                       -0.0103116 -0.002293666
```

```
##       pred
## actual    0    1
##      0  988 1467
##      1  700 3401
```

For the results we took all of the reduced models and ran them on the test dataset. The Quasi results gave unexpected negavite results and the Posisson had 1 reults with a flag of 2. The Binomial reduced results had no strange errors. When looking at the accuracy of these models, they all came in at being 67% accurate and predicted that ~53% of apps would be above the average number of downloads.

Conclusion

While the Apple store data was difficult to deal with since it did not come with the number of downloads, we were still able to use a zero inflated model to get some predictions. The predictions took into a account that there were not that many apps with ratings in the millions so it had a reasonable max number of ratings, around 500,000.

The Google Play store data was easier to work with since that did come with a total number of installs. We were abnle to get a lot more visualizations with it and run numerous models. We saw that the Binomial reduced model was the biggest help when trying to predict how many times an app woulf be downloaded, by not giving any unexpected results.

Appendix

Code for this project can be found her: https://github.com/dquarshie89/DATA-621-FINAL_PROJECT/blob/master/AppPrediction.Rmd