IGN Video Game Reviews

Machine Learning

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Predictive Models

Subsetting the Data

Prior to any ventures into modeling, a data set was created to remove any unnecessary features and any blank records. 36 records with a 'blank' genre were removed. Given that some of the kept features are categorical, a conversion to binary/dummy variables was needed using model matrix. I chose to not combine release day, month, and year into a combined date field as I don't believe it would have given any valuable insight as unique a combined value.

```
##   score_phrase          title       platform          score          genre
##              0              0              0              0             36
## editors_choice   release_year  release_month    release_day platform_group
##              0              0              0              0              0
##    genre_group
##             36
```

```
## 'data.frame':    18589 obs. of  7 variables:
##  $ score         : num  9 9 8.5 8.5 8.5 7 3 9 3 7 ...
##  $ editors_choice: Factor w/ 2 levels "N","Y": 2 2 1 1 1 1 1 2 1 1 ...
##  $ release_year  : Factor w/ 21 levels "1996","1997",..: 17 17 17 17 17 17 17 17 17 17 ...
##  $ release_month : Factor w/ 12 levels "1","2","3","4",..: 9 9 9 9 9 9 9 9 9 9 ...
##  $ release_day   : Factor w/ 31 levels "1","2","3","4",..: 12 12 12 11 11 11 11 11 11 11 ...
##  $ platform_group: Factor w/ 14 levels "Android","Apple",..: 9 9 2 14 9 2 14 12 9 12 ...
##  $ genre_group   : Factor w/ 21 levels "Action","Adventure",..: 12 12 14 19 19 20 6 16 6 20 ...
```

```
## [1] 18589    76
```

```
##  [1]  1  4  6  7 11 12 14 17 18 19 20 21 22 23 24 25 26 27 28 32 35 36 37
## [24] 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
## [47] 61 62 63 64 65
```

```
## [1] 18589    25
```

```
## integer(0)
```

```
## reg_data
##
##  26  Variables      18589  Observations
## ---------------------------------------------------------------------------
## editors_choiceY
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2     0.46     3515   0.1891   0.3067
##
## ---------------------------------------------------------------------------
## platform_groupApple
```

```
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.156     1025  0.05514   0.1042
##
## ----------------------------------------------------------------------------
## platform_groupGame Boy
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.153     1001  0.05385   0.1019
##
## ----------------------------------------------------------------------------
## platform_groupNintendo
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.497     3896   0.2096   0.3313
##
## ----------------------------------------------------------------------------
## platform_groupOther
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.147      959  0.05159  0.09786
##
## ----------------------------------------------------------------------------
## platform_groupPlayStation
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.594     5055   0.2719    0.396
##
## ----------------------------------------------------------------------------
## platform_groupWindows
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.447     3383    0.182   0.2978
##
## ----------------------------------------------------------------------------
## platform_groupXbox
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.368     2660   0.1431   0.2453
##
## ----------------------------------------------------------------------------
## genre_groupAdventure
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.191     1267  0.06816    0.127
##
## ----------------------------------------------------------------------------
## genre_groupRacing
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.189     1258  0.06767   0.1262
##
## ----------------------------------------------------------------------------
## genre_groupRPG
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.165     1089  0.05858   0.1103
##
## ----------------------------------------------------------------------------
## genre_groupShooter
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.238     1614  0.08683   0.1586
##
## ----------------------------------------------------------------------------
```

```
## genre_groupSports
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.287     1988   0.1069    0.191
##
## ------------------------------------------------------------------------
## genre_groupStrategy
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.163     1071  0.05761   0.1086
##
## ------------------------------------------------------------------------
## release_month2
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.199     1327  0.07139   0.1326
##
## ------------------------------------------------------------------------
## release_month3
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.231     1565  0.08419   0.1542
##
## ------------------------------------------------------------------------
## release_month4
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2     0.19     1263  0.06794   0.1267
##
## ------------------------------------------------------------------------
## release_month5
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.173     1141  0.06138   0.1152
##
## ------------------------------------------------------------------------
## release_month6
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2     0.22     1481  0.07967   0.1467
##
## ------------------------------------------------------------------------
## release_month7
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.179     1188  0.06391   0.1197
##
## ------------------------------------------------------------------------
## release_month8
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2      0.2     1334  0.07176   0.1332
##
## ------------------------------------------------------------------------
## release_month9
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.249     1701  0.09151   0.1663
##
## ------------------------------------------------------------------------
## release_month10
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.326     2306   0.1241   0.2173
##
```

```
## ------------------------------------------------------------------------
## release_month11
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.367     2655   0.1428   0.2449
##
## ------------------------------------------------------------------------
## release_month12
##        n  missing distinct     Info      Sum     Mean      Gmd
##    18589        0        2    0.223     1504  0.08091   0.1487
##
## ------------------------------------------------------------------------
## score
##        n  missing distinct     Info     Mean      Gmd      .05      .10
##    18589        0       93    0.998    6.951    1.889      3.5      4.5
##      .25      .50      .75      .90      .95
##      6.0      7.3      8.2      8.9      9.1
##
## lowest :  0.5  0.7  0.8  1.0  1.1, highest:  9.6  9.7  9.8  9.9 10.0
## ------------------------------------------------------------------------
```

Linear Regression

```
##
## Call:
## lm(formula = score ~ ., data = reg_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.9827 -0.6511  0.2158  1.0260  3.4121
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 6.61710    0.07086  93.378  < 2e-16 ***
## editors_choiceY             2.29780    0.02693  85.334  < 2e-16 ***
## platform_groupApple         0.04548    0.07301   0.623 0.533318
## platform_groupGame.Boy     -0.63079    0.07332  -8.603  < 2e-16 ***
## platform_groupNintendo     -0.58438    0.06221  -9.393  < 2e-16 ***
## platform_groupOther        -0.33464    0.07393  -4.526 6.05e-06 ***
## platform_groupPlayStation -0.33149    0.06135  -5.403 6.63e-08 ***
## platform_groupWindows      -0.20208    0.06353  -3.181 0.001470 **
## platform_groupXbox         -0.20217    0.06425  -3.147 0.001654 **
## genre_groupAdventure        0.05884    0.04268   1.379 0.168006
## genre_groupRacing          -0.15182    0.04251  -3.572 0.000356 ***
## genre_groupRPG              0.42068    0.04576   9.194  < 2e-16 ***
## genre_groupShooter          0.07990    0.03853   2.074 0.038113 *
## genre_groupSports           0.04943    0.03503   1.411 0.158236
## genre_groupStrategy         0.21563    0.04755   4.535 5.80e-06 ***
## release_month2              0.16384    0.05764   2.843 0.004478 **
## release_month3              0.16889    0.05565   3.035 0.002412 **
## release_month4              0.15263    0.05829   2.619 0.008837 **
## release_month5              0.11642    0.05978   1.947 0.051499 .
## release_month6              0.22268    0.05622   3.961 7.51e-05 ***
## release_month7              0.12258    0.05923   2.069 0.038518 *
## release_month8              0.26927    0.05757   4.678 2.92e-06 ***
```

```
## release_month9             0.35055    0.05473   6.406 1.53e-10 ***
## release_month10            0.26770    0.05179   5.169 2.38e-07 ***
## release_month11            0.19154    0.05070   3.777 0.000159 ***
## release_month12            0.02856    0.05603   0.510 0.610195
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.42 on 18563 degrees of freedom
## Multiple R-squared:  0.3132, Adjusted R-squared:  0.3123
## F-statistic: 338.6 on 25 and 18563 DF,  p-value: < 2.2e-16
```

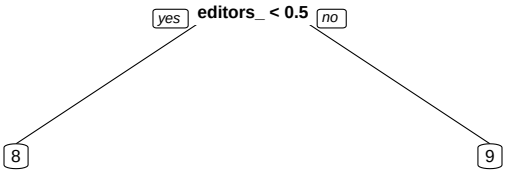
```
##
## Call:
## lm(formula = score ~ ., data = reg_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -5.9962 -0.6504  0.2144  1.0254  3.3865
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 6.70192    0.04108 163.145  < 2e-16 ***
## editors_choiceY             2.29975    0.02690  85.502  < 2e-16 ***
## platform_groupGame.Boy     -0.66284    0.05727 -11.574  < 2e-16 ***
## platform_groupNintendo     -0.61250    0.04208 -14.555  < 2e-16 ***
## platform_groupOther        -0.36223    0.05792  -6.254 4.09e-10 ***
## platform_groupPlayStation -0.35633    0.04073  -8.748  < 2e-16 ***
## platform_groupWindows      -0.22645    0.04344  -5.213 1.88e-07 ***
## platform_groupXbox         -0.22708    0.04494  -5.053 4.39e-07 ***
## genre_groupRacing          -0.16459    0.04191  -3.927 8.63e-05 ***
## genre_groupRPG              0.40826    0.04517   9.038  < 2e-16 ***
## genre_groupShooter          0.06955    0.03783   1.838  0.06603 .
## genre_groupStrategy         0.20393    0.04690   4.348 1.38e-05 ***
## release_month2              0.11781    0.04539   2.595  0.00945 **
## release_month3              0.12292    0.04283   2.870  0.00411 **
## release_month4              0.10751    0.04620   2.327  0.01998 *
## release_month6              0.17529    0.04358   4.022 5.79e-05 ***
## release_month7              0.07613    0.04734   1.608  0.10781
## release_month8              0.22506    0.04528   4.971 6.74e-07 ***
## release_month9              0.30486    0.04161   7.327 2.45e-13 ***
## release_month10             0.22076    0.03769   5.857 4.80e-09 ***
## release_month11             0.14380    0.03615   3.977 7.00e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.42 on 18568 degrees of freedom
## Multiple R-squared:  0.3129, Adjusted R-squared:  0.3121
## F-statistic: 422.8 on 20 and 18568 DF,  p-value: < 2.2e-16
```

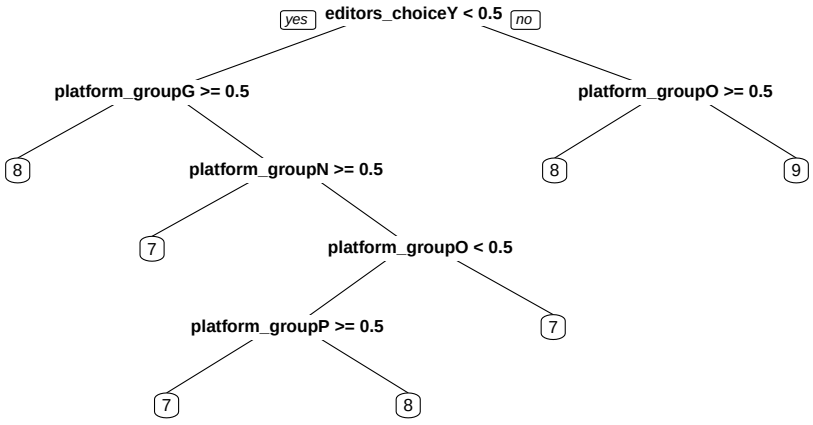
```
##
## Call:
## lm(formula = score ~ ., data = reg_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

```
## -6.0058 -0.6557  0.2087  1.0293  3.4429
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 6.72969    0.03872 173.784  < 2e-16 ***
## editors_choiceY             2.30134    0.02689  85.593  < 2e-16 ***
## platform_groupGame.Boy     -0.67136    0.05717 -11.744  < 2e-16 ***
## platform_groupNintendo     -0.61872    0.04200 -14.732  < 2e-16 ***
## platform_groupOther        -0.36714    0.05788  -6.343 2.31e-10 ***
## platform_groupPlayStation -0.36001    0.04068  -8.850  < 2e-16 ***
## platform_groupWindows      -0.22569    0.04333  -5.209 1.92e-07 ***
## platform_groupXbox         -0.22600    0.04486  -5.038 4.75e-07 ***
## genre_groupRacing          -0.17263    0.04172  -4.138 3.52e-05 ***
## genre_groupRPG              0.40065    0.04496   8.912  < 2e-16 ***
## genre_groupStrategy         0.19513    0.04661   4.186 2.85e-05 ***
## release_month2              0.10024    0.04397   2.280 0.022630 *
## release_month3              0.10592    0.04132   2.563 0.010379 *
## release_month4              0.09026    0.04480   2.015 0.043954 *
## release_month6              0.15790    0.04210   3.751 0.000177 ***
## release_month8              0.20687    0.04384   4.719 2.39e-06 ***
## release_month9              0.28605    0.04005   7.142 9.52e-13 ***
## release_month10             0.20184    0.03598   5.611 2.05e-08 ***
## release_month11             0.12746    0.03437   3.709 0.000209 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.42 on 18570 degrees of freedom
## Multiple R-squared:  0.3127, Adjusted R-squared:  0.312
## F-statistic: 469.3 on 18 and 18570 DF,  p-value: < 2.2e-16
```

The first iteration of the linear regression showed multicollinearity between score and score phrase with a multiple R-squared of 0.9726. After removing score_phrase, R-squared drops to 0.3187. In an attempt to improve R-squared, near zero variance predictors (NZP) were identified and removed because they are non-informative and tend to occur when breaking categorical variables into dummy variables, as was done above. After removing NZP and checking for high collinearity, a few iterations of the linear model were run in order to narrow down which features are not significant. A few of the fields removed are platform_groupApple, genre_groupAdventure, and genre_groupSports. After removing non-significant fields, the adjusted R-squared is now 0.3127.

CART/Random Forest


yes
editors_ < 0.5
no
8
9


yes
editors_choiceY < 0.5
no
platform_groupG >= 0.5
platform_groupO >= 0.5
8
platform_groupN >= 0.5
8
9
7
platform_groupO < 0.5
platform_groupP >= 0.5
7
7
8

##

```
## Call:
##  randomForest(formula = score ~ ., data = Train, ntree = 500)
##                Type of random forest: regression
##                      Number of trees: 500
## No. of variables tried at each split: 6
##
##           Mean of squared residuals: 2.026652
##                     % Var explained: 30.95
```

```
## [1] 0.3269865
```

```
##          [,1]
## 0.5 0.3039893
## 0.7 0.3039893
## 0.8 0.3039893
## 1   0.3039893
## 1.1 0.3039893
## 1.2 0.3039893
## 1.3 0.3039893
## 1.4 0.3039893
## 1.5 0.3039893
## 1.7 0.3039893
## 1.8 0.3039893
## 1.9 0.3039893
## 2   0.3039893
## 2.1 0.3039893
## 2.2 0.3039893
## 2.3 0.3039893
## 2.4 0.3039893
## 2.5 0.3039893
## 2.6 0.3039893
## 2.7 0.3039893
## 2.8 0.3039893
## 2.9 0.3039893
## 3   0.3039893
## 3.1 0.3039893
## 3.2 0.3039893
## 3.3 0.3039893
## 3.4 0.3039893
## 3.5 0.3039893
## 3.6 0.3039893
## 3.7 0.3039893
## 3.8 0.3039893
## 3.9 0.3039893
## 4   0.3039893
## 4.1 0.3039893
## 4.2 0.3039893
## 4.3 0.3039893
## 4.4 0.3039893
## 4.5 0.3039893
## 4.6 0.3039893
## 4.7 0.3039893
## 4.8 0.3039893
## 4.9 0.3039893
## 5   0.3039893
```

```
## 5.1 0.3039893
## 5.2 0.3039893
## 5.3 0.3039893
## 5.4 0.3039893
## 5.5 0.3039893
## 5.6 0.3039893
## 5.7 0.3039893
## 5.8 0.3039893
## 5.9 0.3039893
## 6   0.3039893
## 6.1 0.3039893
## 6.2 0.3039893
## 6.3 0.3039893
## 6.4 0.3039893
## 6.5 0.3039893
## 6.6 0.3039893
## 6.7 0.3039893
## 6.8 0.3039893
## 6.9 0.3039893
## 7   0.3039893
## 7.1 0.3039893
## 7.2 0.3039893
## 7.3 0.3039893
## 7.4 0.3039893
## 7.5 0.3039893
## 7.6 0.3039893
## 7.7 0.3039893
## 7.8 0.3039893
## 7.9 0.3039893
## 8   0.3039893
## 8.1 0.3039893
## 8.2 0.3039893
## 8.3 0.3039893
## 8.4 0.3039893
## 8.5 0.3039893
## 8.6 0.3039893
## 8.7 0.3039893
## 8.8 0.3039893
## 8.9 0.3039893
## 9   0.3039893
## 9.1 0.3039893
## 9.2 0.3039893
## 9.3 0.3039893
## 9.4 0.3039893
## 9.5 0.3039893
## 9.6 0.3039893
## 9.7 0.3039893
## 9.8 0.3039893
## 9.9 0.3039893
## 10  0.3039893
```

```
##           [,1]
## 0.5 0.002800549
## 0.7 0.008878185
```

```
## 0.8 0.050681353
## 1   0.168364769
## 1.1 0.008878185
## 1.2 0.074436848
## 1.3 0.050681353
## 1.4 0.050681353
## 1.5 0.170604906
## 1.7 0.050681353
## 1.8 0.008878185
## 1.9 0.141738963
## 2   0.188234501
## 2.1 0.098294830
## 2.2 0.095596742
## 2.3 0.068539370
## 2.4 0.141738963
## 2.5 0.206847665
## 2.6 0.040542881
## 2.7 0.183752866
## 2.8 0.114532262
## 2.9 0.031017862
## 3   0.209434249
## 3.1 0.115976027
## 3.2 0.128864287
## 3.3 0.111168899
## 3.4 0.106220543
## 3.5 0.270060070
## 3.6 0.134784624
## 3.7 0.156766723
## 3.8 0.186255350
## 3.9 0.147748589
## 4   0.228438652
## 4.1 0.154514978
## 4.2 0.153497017
## 4.3 0.163411769
## 4.4 0.135636163
## 4.5 0.314802332
## 4.6 0.170604906
## 4.7 0.180114702
## 4.8 0.183259583
## 4.9 0.182905655
## 5   0.254307880
## 5.1 0.272243153
## 5.2 0.144062721
## 5.3 0.198881102
## 5.4 0.204123980
## 5.5 0.297174699
## 5.6 0.166627655
## 5.7 0.147886183
## 5.8 0.225282896
## 5.9 0.196638929
## 6   0.288484908
## 6.1 0.209504802
## 6.2 0.207938385
## 6.3 0.196227515
```

```
## 6.4 0.138348341
## 6.5 0.304851280
## 6.6 0.137854307
## 6.7 0.125600725
## 6.8 0.187693565
## 6.9 0.216742135
## 7   0.304526719
## 7.1 0.157718903
## 7.2 0.143526487
## 7.3 0.114916755
## 7.4 0.136100400
## 7.5 0.250626873
## 7.6 0.176002450
## 7.7 0.166906413
## 7.8 0.232580019
## 7.9 0.164058437
## 8   0.068128708
## 8.1 0.033286442
## 8.2 0.025397658
## 8.3 0.010624332
## 8.4 0.073718808
## 8.5 0.311736210
## 8.6 0.316118824
## 8.7 0.309791793
## 8.8 0.314440048
## 8.9 0.306944876
## 9   0.294821162
## 9.1 0.298964548
## 9.2 0.296214965
## 9.3 0.284737042
## 9.4 0.284388680
## 9.5 0.300943109
## 9.6 0.283367433
## 9.7 0.285865991
## 9.8 0.286941378
## 9.9 0.283367433
## 10  0.298015403
```

When looking at the first tree, the only node shown is for editor's choice. If editor's choice is greater than 0.5, it is no or 1. One important note is that a high score can imply an editor's choice designation. However, a high score, say 8 or greater, does not automatically receive an editor's choice designation. Using the complexity parameter (cp), we can force more nodes to appear with cp = .0025. Looking at the tree, we see that editor's choice has remained as the first node. The first tree produces an R-squared of 30.4% which is similar to the linear regression model. When forcing the tree to have multiple nodes, the same R-squared calculation doesn't work as nicely nor is it the most efficient.

The random forest model, built on the training dataset, appears to be the best model based on a comparison of R-squared at 32.69% versus 30.4% (CART), and 31.27% (linear regression).