

Team 3-1: Analyzing Billboard Songs

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Introduction

“The Billboard Hot 100 is the music industry standard record chart in the United States for songs, published weekly by Billboard magazine. Chart rankings are based on sales (physical and digital), radio play, and online streaming in the United States.”

The data was found on TidyTuesday and is from Data.World with the original data points found on Billboard.com and Spotify. The cases are songs from the certain week(s) in which they appeared on the Billboard 100 chart. It includes every weekly Hot 100 singles chart from Billboard.com and audio features (such as genre, danceability) from Spotify.

From this dataset, we’re interested in examining songs from 2000 to today. Since there are so many song attributes in the dataset, we decided to focus on attributes that are easily identifiable through hearing by the general population: genre, danceability, energy, speechiness, valence, and tempo. For more details about our variables, please refer to our ReadMe. Our main research question is: what factors influence a song’s ranking?

```
## Warning in system("timedatectl", intern = TRUE): running command 'timedatectl'
## had status 1
```

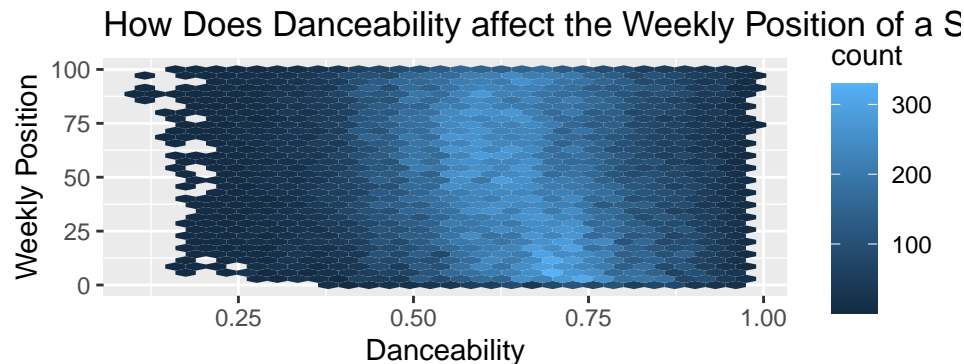
Looking into Song Rankings

To start answering our research question, we first took a general look at how attributes influence song rankings.

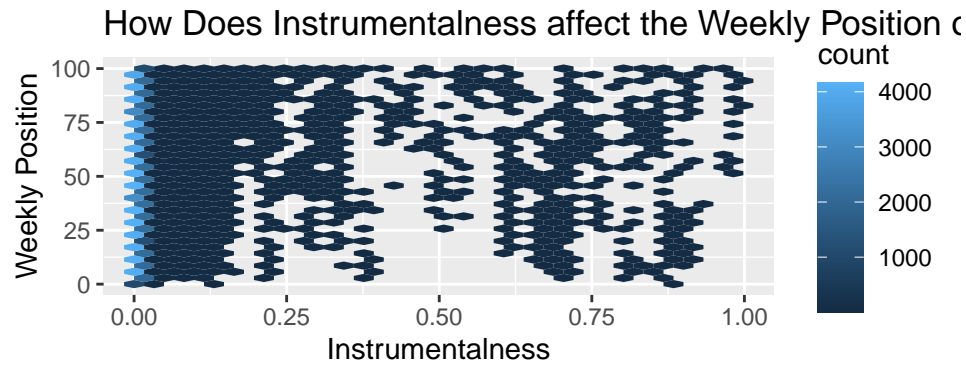
Correlation Between Song Rankings and Song Attributes

To accomplish this, we created a visualization to see to the correlation between songs’ weekly positions and song attributes. We first hypothesized that songs with higher speechiness and tempo will be ranked higher, given the rising popularity of rap, and that other attributes would correlate less with songs’ rankings.

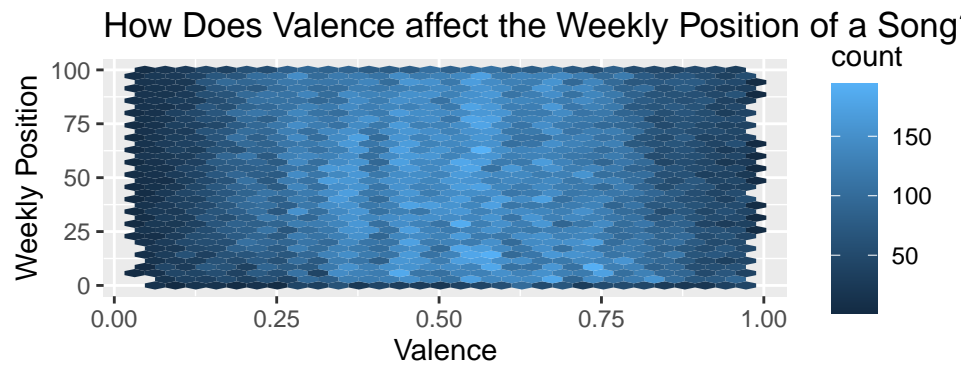
```
## Warning: Removed 8584 rows containing non-finite values (stat_binhex).
```



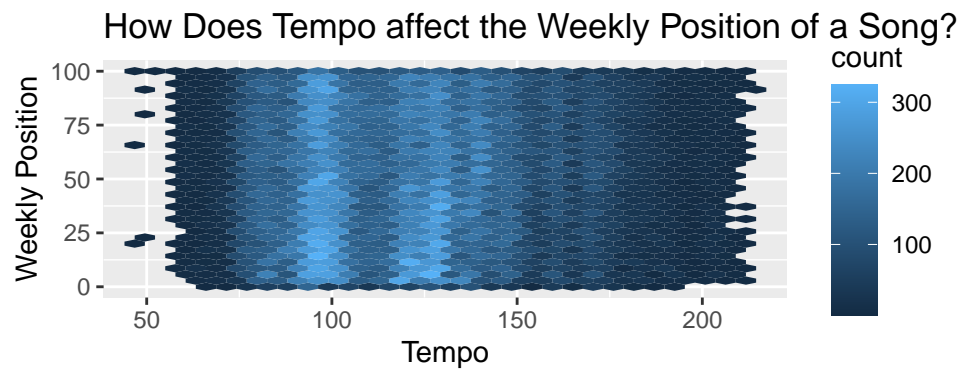
```
## Warning: Removed 8584 rows containing non-finite values (stat_binhex).
```



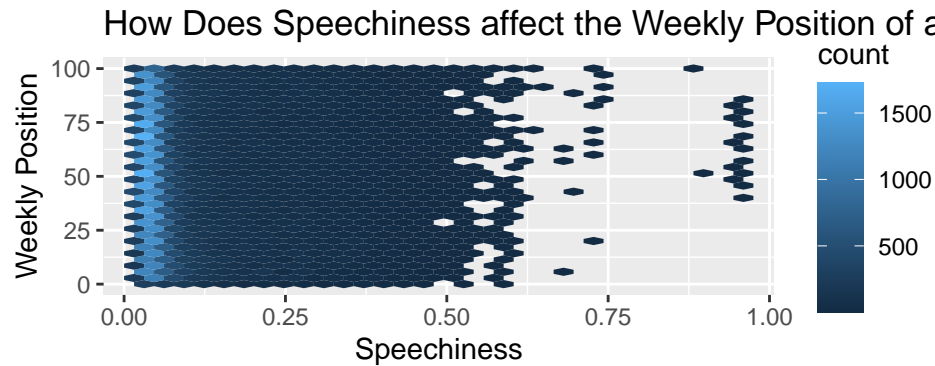
Warning: Removed 8584 rows containing non-finite values (stat_binhex).



Warning: Removed 8584 rows containing non-finite values (stat_binhex).



Warning: Removed 8584 rows containing non-finite values (stat_binhex).



Insert discussion about the graph

Testing Predictors

To further examine the relationship, we looked to see how well each song attribute predicted songs' weekly positions. Given the results from above, we hypothesize that danceability would be one of the highest predictors, since its visualization is one of the only visualizations to show a difference between differently ranked songs. We created linear regression models for each attribute and also a linear model with all the attributes as the explanatory variables. We then found the r-squared value to see how well the explanatory variable(s) predicted songs' weekly positions.

```
## # A tibble: 2 x 5
##   term          estimate std.error statistic p.value
##   <chr>          <dbl>    <dbl>    <dbl>    <dbl>
## 1 (Intercept)    66.9      0.404    165.      0
## 2 danceability  -25.8      0.615   -42.0      0

## # A tibble: 2 x 5
##   term          estimate std.error statistic p.value
##   <chr>          <dbl>    <dbl>    <dbl>    <dbl>
## 1 (Intercept)    45.3      0.384    118.      0
## 2 energy          7.18     0.541    13.3 3.86e-40

## # A tibble: 2 x 5
##   term          estimate std.error statistic p.value
##   <chr>          <dbl>    <dbl>    <dbl>    <dbl>
## 1 (Intercept)    51.1      0.124    412.      0
## 2 speechiness   -7.89     0.876   -9.01 2.05e-19

## # A tibble: 2 x 5
##   term          estimate std.error statistic p.value
##   <chr>          <dbl>    <dbl>    <dbl>    <dbl>
## 1 (Intercept)    53.8      0.230    234.      0
## 2 valence       -6.64     0.403   -16.5 7.89e-61

## # A tibble: 2 x 5
##   term          estimate std.error statistic p.value
##   <chr>          <dbl>    <dbl>    <dbl>    <dbl>
## 1 (Intercept)    45.2      0.379    119.      0
## 2 tempo          0.0417  0.00304    13.7 1.26e-42

## # A tibble: 6 x 5
##   term          estimate std.error statistic p.value
##   <chr>          <dbl>    <dbl>    <dbl>    <dbl>
```

```
## 1 (Intercept)    60.7      0.733      82.7  0
## 2 danceability -22.9      0.719     -31.8 4.83e-221
## 3 energy        6.66      0.610      10.9 1.10e- 27
## 4 speechiness   1.40      0.904       1.55 1.22e- 1
## 5 valence       -3.53      0.480      -7.36 1.92e- 13
## 6 tempo         0.0118    0.00313      3.76 1.68e- 4
```

Calculation of R^2 Values of the different predictors.

```
## [1] 0.01639905
## [1] 0.001661981
## [1] 0.000767592
## [1] 0.002557178
## [1] 0.001769466
## [1] 0.01778684
```

insert discussion

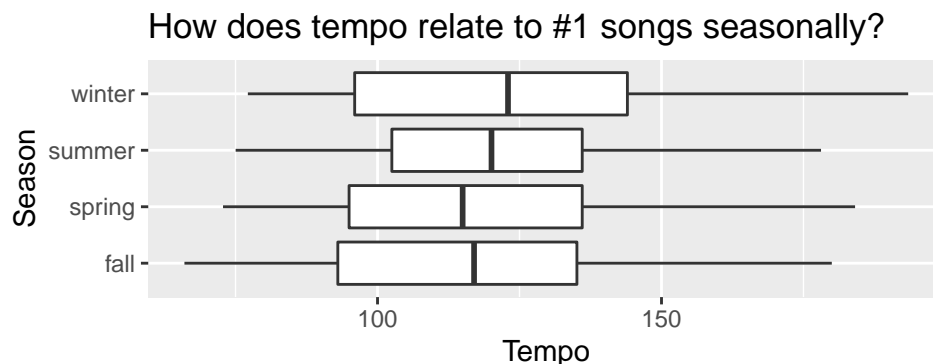
Looking into #1 Billboard Songs

Arguably, many artists' want to have a #1 Billboard song. So, to further investigate what factors play a role in songs' rankings, we looked at factors that influence #1 Billboard songs.

Seasons

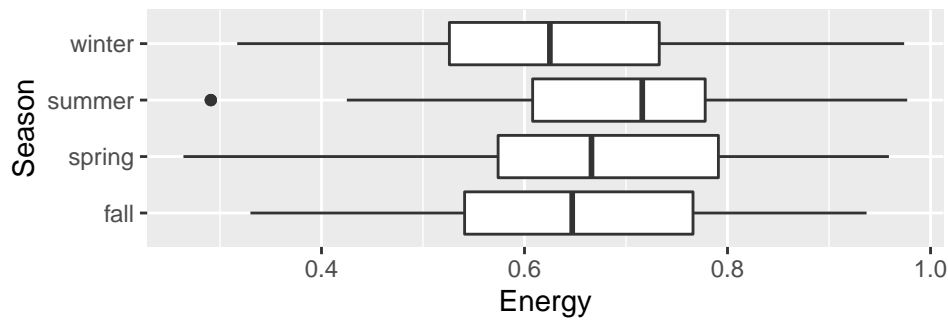
Seasons can influence what song attributes are preferred. For example, winter has many holidays, so that we hypothesize that that happier songs with medium tempos will be #1 Billboard songs. We separated the dataset by seasons and looked at the distribution of attributes' values. We defined fall as from September to November, winter as from December to February, spring as March to May, and summer as June to August.

```
## Warning: Removed 95 rows containing non-finite values (stat_boxplot).
```



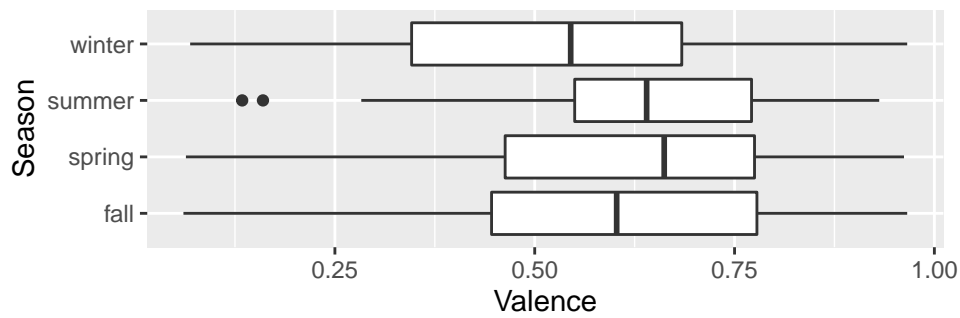
```
## Warning: Removed 95 rows containing non-finite values (stat_boxplot).
```

How does energy relate to #1 songs seasonally?



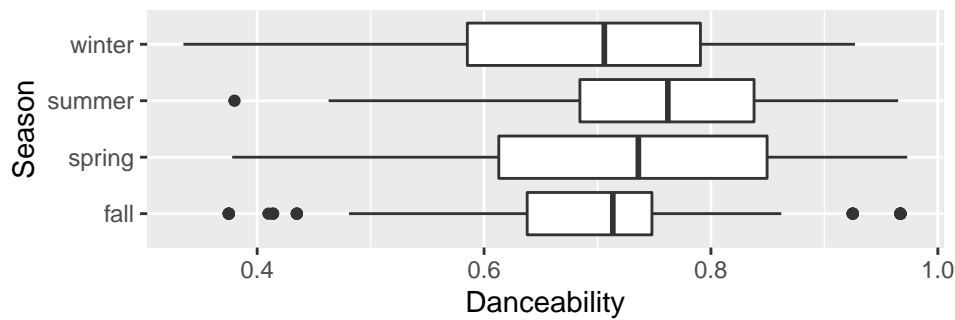
Warning: Removed 95 rows containing non-finite values (stat_boxplot).

How does valence relate to #1 songs seasonally?

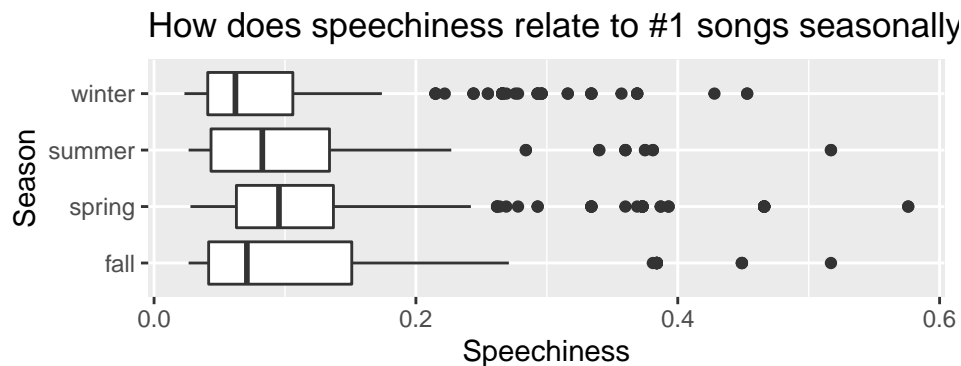


Warning: Removed 95 rows containing non-finite values (stat_boxplot).

How does danceability relate to #1 songs seasonally?



Warning: Removed 95 rows containing non-finite values (stat_boxplot).



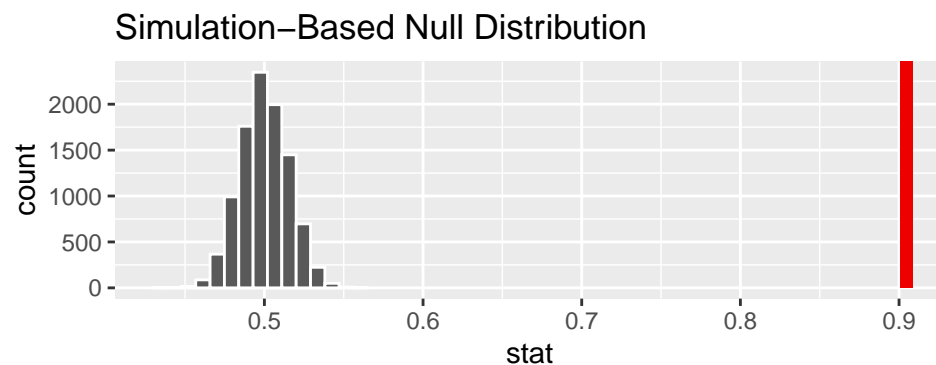
Testing Pop Genre

To examine the correlation between genre and Billboard rankings, we created a null and alternative hypotheses to test with simulation-based methods. Since the labels “pop genre” and “popular genre” tend to be interchangeable, we predict that the majority of songs that are #1 on the Billboard are of the pop genre.

Null Hypothesis: 50% of the #1 Billboard songs are of the pop genre. Alternative Hypothesis: Over 50% of the #1 Billboard songs are of the pop genre.

$$H_0 : p_{pop} = 0.5 \text{ v.s. } H_a : p_{pop} > 0.5$$

To test our hypotheses, we first created a dataset of just the #1 Billboard songs. We then checked to see if the word “pop” appears in the Spotify genre column. With our dataset set up, we constructed a null distribution. We set the seed to make this reproducible.



```
## Warning: Please be cautious in reporting a p-value of 0. This result is an
## approximation based on the number of `reps` chosen in the `generate()` step. See
## `?get_p_value()` for more information.
```

```
## [1] 0
```

Using the typical significance level of 0.05, we reject the null hypothesis. Given that the p-value is 0, there is strong evidence that the majority of #1 Billboard songs are of the pop genre.

To verify our conclusion from above, we also decided to perform a confidence interval Test. We decided to do a 95% confidence interval test since that seems to be the typical confidence interval.

```
## # A tibble: 1 x 2
##   lower upper
##   <dbl> <dbl>
## 1 0.887 0.922
```

We are 95% confident that the proportion of #1 Billboard songs that are of the pop genre is between 0.89 and 0.92. Since this interval does not have 0.5 between it, we reject our null hypothesis, further providing evidence that the majority of #1 Billboard songs are of the pop genre.

Conclusion

Need to add: This will require a summary of what you have learned about your research question along with statistical arguments supporting your conclusions. You should critique your own methods and provide suggestions for improving your analysis and future work. Issues pertaining to the reliability and validity of your data and the appropriateness of the statistical analyses should also be discussed. Also include a brief paragraph on what you would do differently if you were able to start over with the project.