Visualizing BeerAdvocate Data

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ABSTRACT

The presented work aims to identify patterns and answers questions related to beer through the analysis of beer reviews using a variety of existing visualization systems. More specifically, the project consisted of acquiring the data from the BeerAdvocate website, creating a data and task abstraction of the problem, and analyzing the results. This paper describes the data analysis results and the various visualization techniques that were used to answer the questions. The key findings were: for good beers go to the Midwest/West Coast and avoid the South; higher alcohol content is associated with higher ratings for Ales but not Lagers; taste is the most important attribute in determining the overall rating; expert and user ratings are consistent, with a few exceptions; and Bad Porters tend to be "light"

The interactive visualization can be found at https://public.tableau.com/views/beer_2/Story1.

Keywords: beer reviews, data visualization

1 INTRODUCTION

Beer is one of the most famous drinks around the world. There are more than 90 different styles of beers. The world of beer reaches and has a heavy effect in the life of many: some people dedicate their life to the crafting and production of beer, businesses such as restaurants are built around beer, and festivals and countries are recognized world-wide by their beers and breweries.

The primary goal of this project was to gain insights from beer reviews, and ultimately answer the following interesting questions related to beer reviews and beer in general:

1. Where are the best states for beer?
2. Is there any relationship between a beer rating and alcohol content?
3. What determines beer ratings?
4. Do "professional" beer raters agree with what "regular" consumers think about beers?
5. Can we characterize good vs bad beers from their text reviews?

A project around beer is a great opportunity to expose the power of analytics to the beer industry. We believe that the deliverable of this project could have the quality and impact to be displayed on the Beer Advocate Website[1] . Currently that site produces lists of the highest and lowest rated beers, but lacks more sophisticated analysis. The analysis would synthesize thousands of reviews into easy-to-interpret visuals that can provide additional insights to beer drinkers.

Regarding the software used for this project, Python (Beautifulsoup library) was used for web scraping, R (tm package and ggplot2) for text analytics and data processing and visualization, and Tableau for data visualization with interactive capabilities and presentation.

2. BACKGROUND

The data for this project was extracted from BeerAdvocate (BA),which has one of the largest and most diverse beer communities in the world, with over 60 million monthly pageviews, 3 million monthly unique visitors and hundreds of new member per day[2] .

The datasets were scraped from Beer Advocate by extracting key beer information, statistics, numeric reviews and textual reviews. R was used extensively for data cleansing and data preparation (e.g. extracting location, creating beer style groups and formatting dates). Figure A1 and Table A1 in the appendix show an example of a beer review and sample data respectively. The final dataset contained 25 columns and over 450,000 records.

3. DISCUSSION AND RESULTS

3.1 Best States

In order to detect patterns between beer location (brewery) and beer rating, a web-deployable dashboard with interaction capabilities was designed. Figure 1 shows the interactive dashboard which includes
- A map of the states, with darker colors for states corresponding to higher average overall ratings for the beers produced in that state
- A bar plot where the top 10 breweries by number of reviews are displayed, with the color indicating the overall average rating.

The interactive component allows for zooming in and out the map, selecting a state and automatically displaying the top 10 breweries by number of reviews for the state selected.

The results were as expected, with the best breweries tending to be located on the west coast and in the midwest, while the worst where located in the south. Displaying two dimensions (count and rating), allows us to see that the most

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[1] http://www.beeradvocate.com/
[2] http://www.beeradvocate.com/about

popular beers (more reviews) are not necessarily the highest rated beers. For example, Anheuser Busch is top 10 overall by count but has below average overall rating as shown in the map. The main takeaway is that for good beers, go to the Midwest and West, and avoid the South.
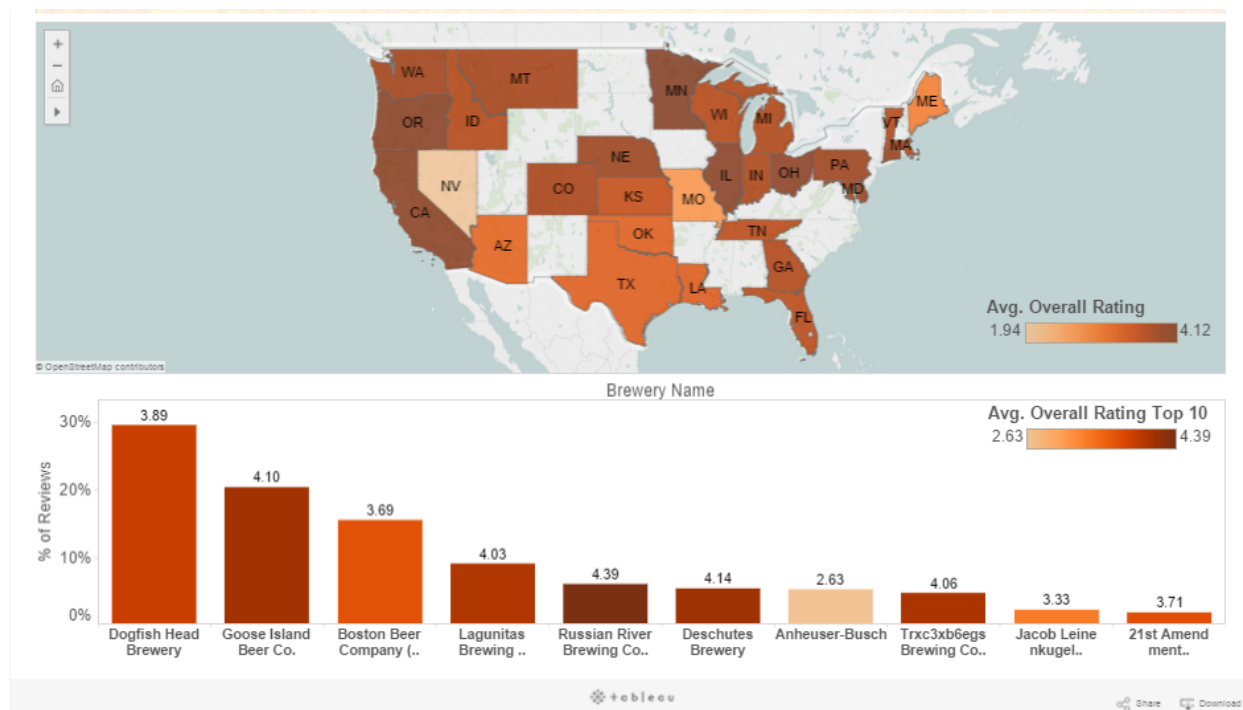

Figure 1. Map and Top 10 Breweries by number of reviews

3.2 Rating vs Alcohol

A major component of beer is alcohol, so a natural relationship to explore was the one between rating and alcohol content. Not surprisingly, there is a positive relationship between Alcohol by Volume (ABV) for a beer and its average Overall Rating, with a correlation of 0.38 (Figure A3). However, what is very interesting and unexpected is that this relationship only holds for Ales but not for Lagers as it can be seen below in Figure 2.
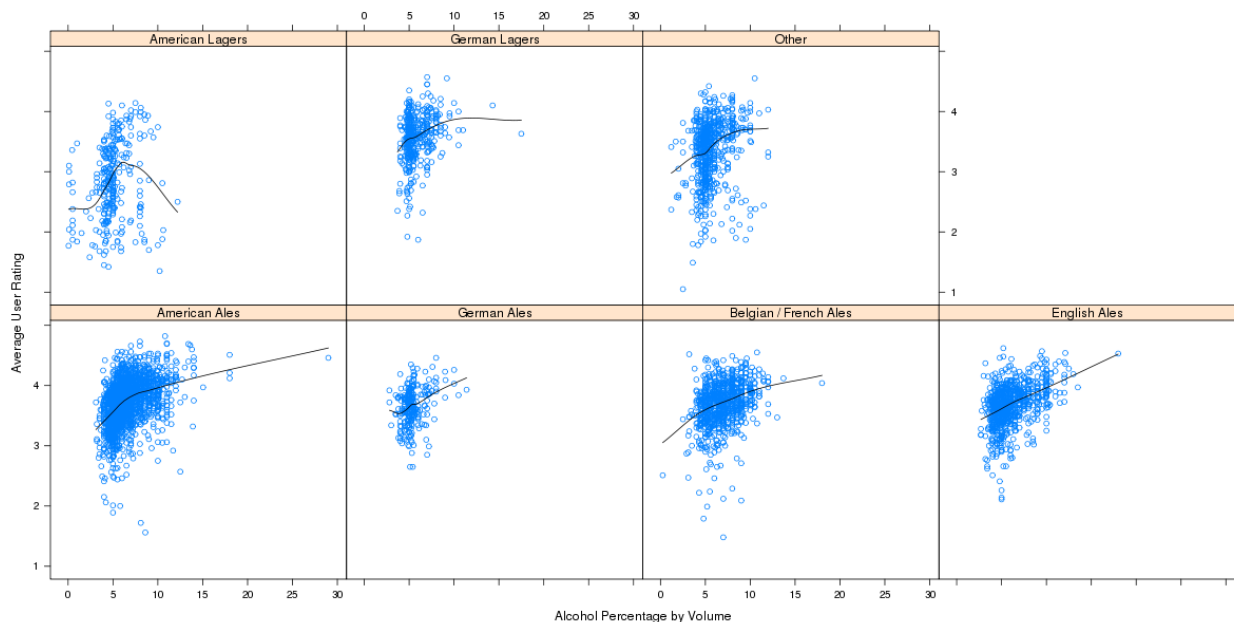

Figure 2. Scatte plot of Average User Rating vs Alcohol Content by Style Group

3.3 Ratings vs Beer Attributes

Since the data contains ratings for beer attributes (see Table 2A in appendix for a description), we explored which of these attributes are the main drivers of the overall rating. To answer the question, a regression of the overall rating against beer attributes was conducted and the results are shown below in Figure 3.
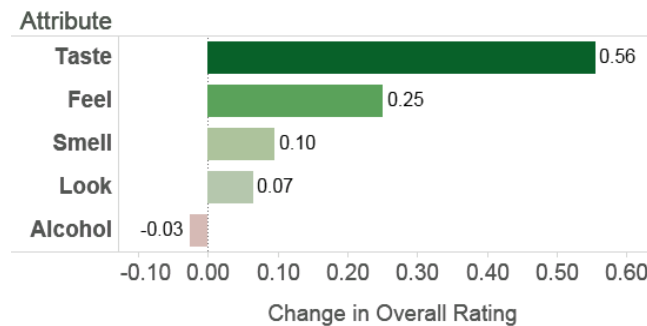

Figure 3. Regression coefficients of overall rating against beer attributes

All attributes are statistically significant. As expected, taste and feel are the most important factors in determining the overall rating, with taste being more than twice as important as feel. A surprising result is that, holding the other beer attributes constant, increasing alcohol has a negligible effect on the overall rating. Following up on the analysis in section 3.2 and 3.3, we investigated whether the ratings are linked to style groups. It was found that American Ales are both the most popular and best-rated style group of beer, although the average overall ratings of the styles were not found to be significantly different according to a t-test. In addition, American Lagers were found to be the only style group to have a below-average overall rating. The results are graphically shown in Figure A4 in the appendix.

3.4 Agreement and Disagreement of Reviewers

To explore whether "professional" beer raters and regular beer consumers have the same view on beers, we performed clustering analysis on the rating components (Look, Smell, Taste and Feel), the BeerAdvocate generated composite score (BA score) and the professional score given by the two owners of the site (Bro Score) at the beer style level. All the scores were standardized so they could be compared (Bro and BA score are on a scale of 0-100, while the others are on a scale of 1-5). We hoped that clustering would expose disagreements between expert and user ratings. For example, if one of the clusters was found to have been high on Look, Smell, Taste and Feel ratings, but low on BA and Bro Score, it would have suggested disagreement between users and experts. Performing k-Means clustering for k=3, we did not find this pattern (Figure 4); all the clusters have a fairly symmetric hexagonal shape. The clustering effectively divided the data into highly rated, mid-rated and low rated beers styles. The same pattern holds for k=4 and k=5 , indicating the consistency between the professional and consumer raters (see Figure 5A and 6A in the appendix for details).
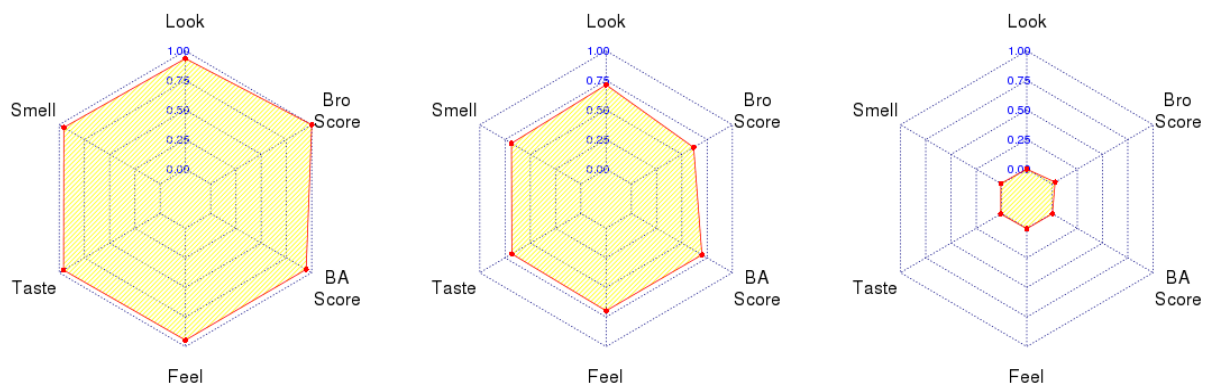

Figure4. Beer Style clusters for k=3

To corroborate the results obtained from the segment analysis, a dashboard with a scatter plot of Average Overall rating vs. the Average Bro Score rating, and a bar plot with the beers sorted by number of reviews and colored by overall rating was created (Figure 5). The interactive dashboard allows for clicking on the beer style in the scatter plot, and displaying the top 10 most more popular beers by count within that style. The dashboard allows one to quickly filter beer styles, focus on the best-rated styles and see patterns between the beer styles and the different ratings by professional and consumers.

If professionals and regular consumers 100% agreed, the data points would have been perfectly aligned (correlation = 1). Overall, the data points fall along a straight line (the correlation is 0.85), but we can also observe that there are data points that fall outside the trend. We decided to investigate further the styles that are outside the trend line, which will be the beer styles where professionals and regular beer drinkers disagree (Figure 7A and Table 3A in appendix).
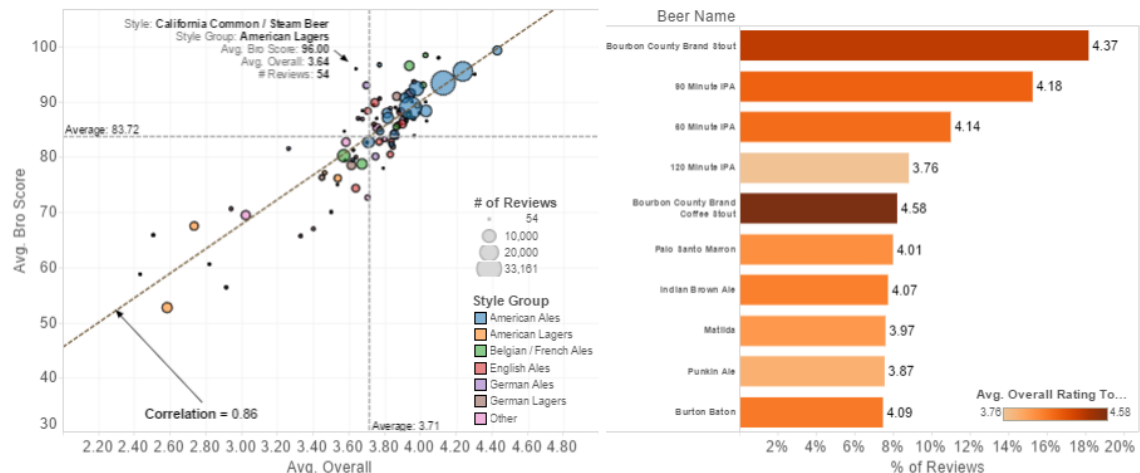

Figure 5. Scatter plot of Overall rating (reviewers) vs Bro Score (professionals)

3.5 Text Analytics

To characterize beer using the textual reviews written by users, a graph was created where the words appearing together in the same review are linked (the thicker the line the higher the co-occurrence frequency). We focused on a particular style of beer - Porters. As can be seen in Figure 6, the graph suggests that "Bad" Porters tend to be light.
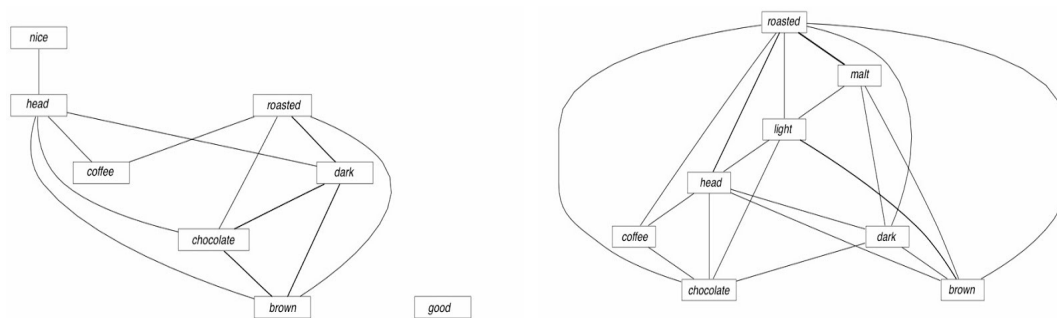

Figure 6. Graph for "Good" (Left) and "Bad" (Right) Porters

CONCLUSION

The project provided insights with respect to the stated goals. A wide array of visuals and interactive dashboards created an effective representation of the data that supported different analytical investigations into beer, resulting in both expected and unexpected conclusions. The visualization and analysis demonstrated how insights can be derived from beer review data, which ultimately can benefit the consumer by synthesizing thousands of reviews into easy-to-interpret visuals.
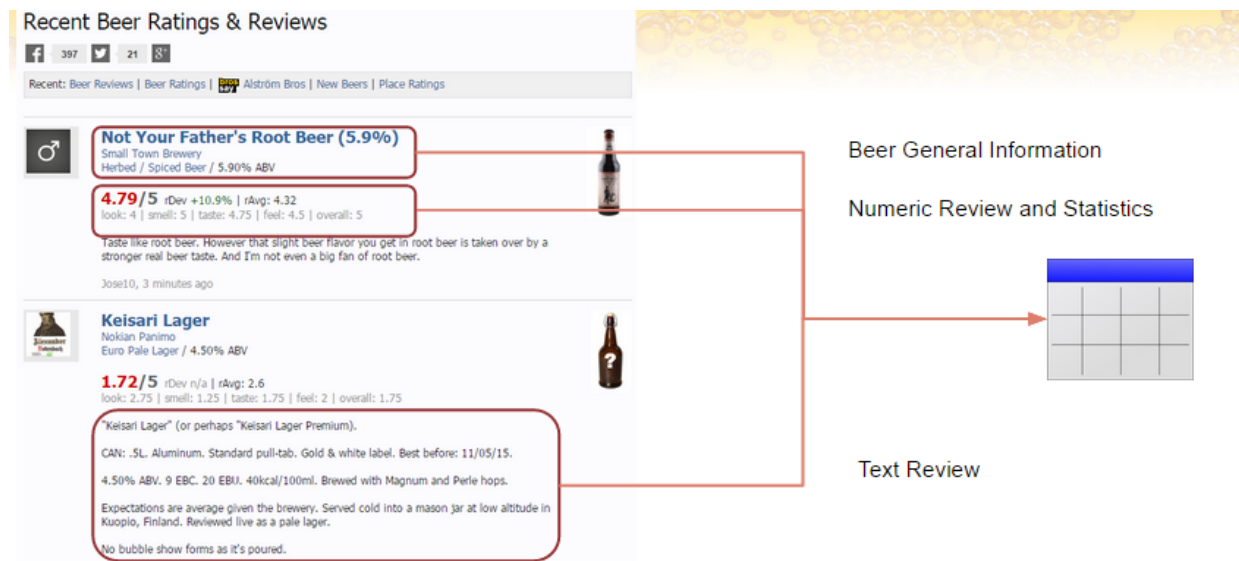
APPENDIX

Figure A1. Beer review and extracted fields from Beer Advocate

| BeerID	brewery_name	beer_name	ba_score	bro_score	n_ratings	n_reviews	r_avg	p_dev	n_wants	n_gots	style	alcohol	date_add	person_add	ReviewID	Look	Smel	Tast	Feel	Over	Date	Style_Group	country	state
10005	Upstream Brewing	White Satin B	0	0	7	4	3.9	0	0	0	Witbier	5.5	5/25/2003	baltrgis7	1277764	3.5	4.5	4	4	4	5/25/2003	Belgian / French Ales	US	NE
10005	Upstream Brewing	White Satin B	0	0	7	4	3.9	0	0	0	Witbier	5.5	5/25/2003	baltrgis7	1277761	3.5	3.5	3.5	3.5	3.5	2/12/2011	Belgian / French Ales	US	NE
10005	Upstream Brewing	White Satin B	0	0	7	4	3.9	0	0	0	Witbier	5.5	5/25/2003	baltrgis7	1277762	3.5	4	4.5	3.5	4.5	8/12/2010	Belgian / French Ales	US	NE
10005	Upstream Brewing	White Satin B	0	0	7	4	3.9	0	0	0	Witbier	5.5	5/25/2003	baltrgis7	1277763	3.5	4	4.5	4	4.5	8/30/2004	Belgian / French Ales	US	NE
100053	BrickHouse Brew	""Poppin' Pil:	0	0	1	1	4.16	0	0	0	German Pil	5	9/30/2013	plaid75	1249173	3.75	4	4.25	4.25	4.25	9/30/2013	German Lagers	Other	NA
100054	BrickHouse Brew	The Great Pu	0	0	1	1	3.93	0	0	0	Pumpkin A	5.5	9/30/2013	plaid75	1249182	3.75	3.75	4	4	4	9/30/2013	American Ales	Other	NA
100103	Valkyrie Brewing	Whispering E	0	0	3	2	3.53	0	0	0	Rauchbier	5	9/30/2013	joerolo	1124576	3.5	3.5	3.5	3.25	3.5	10/1/2013	German Lagers	US	WI
100103	Valkyrie Brewing	Whispering E	0	0	3	2	3.53	0	0	0	Rauchbier	5	9/30/2013	joerolo	1124575	4	3.75	4	3.5	3.75	10/15/2013	German Lagers	US	WI
10023	Ferme Brasserie S	La Suroxo3xa	0	0	1	1	3.2	0	0	0	Belgian Pa	5	5/26/2003	Beerlover	1202220	3	3	3.5	3	3	10/10/2008	Belgian / French Ales	US	CA
100314	21st Amendment E	He Said (Trip:	85	90	424	90	3.79	11.35	13	37	Tripel	8.2	10/3/2013	Beerlover	1175793	2.75	4.25	4	3.5	3.75	6/23/2014	Belgian / French Ales	US	CA
100314	21st Amendment E	He Said (Trip:	85	90	424	90	3.79	11.35	13	37	Tripel	8.2	10/3/2013	Beerlover	1175826	3.5	3.5	3.5	3.5	3.5	11/11/2013	Belgian / French Ales	US	CA

Table A1. Sample Data
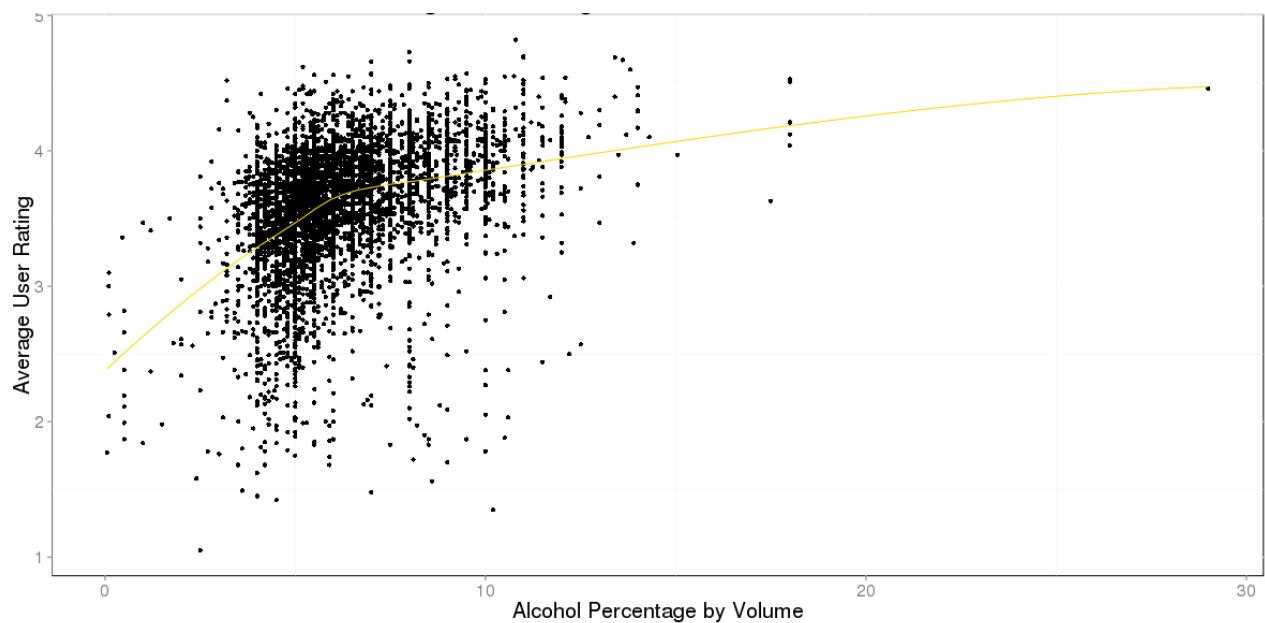
Figure A3. Overall User Rating vs Alcohol Content for all beers

| Beer Attribute[3]	Description
Look	Beer's color, clarity, head retention and lacing.
Smell	Any malt, hops, yeast and other aromatics.
Taste	Any malt, hops, fermentation byproducts, balance, finish or aftertaste and other flavor characteristics
Feel	Beer's body, carbonation, warmth, creaminess, astringency and other palate sensations.
Overall	Overall impression of the beer

Table A2. Beer attributes
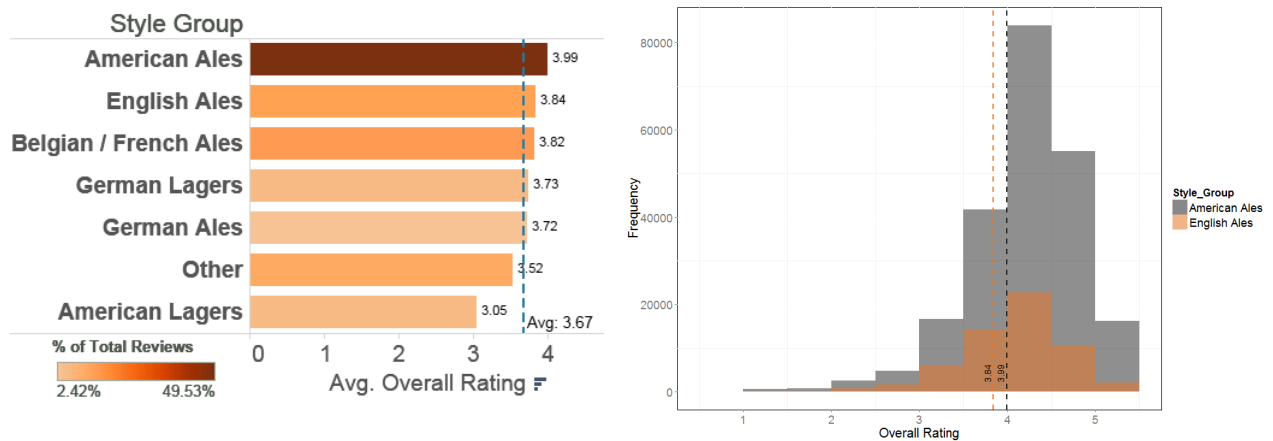
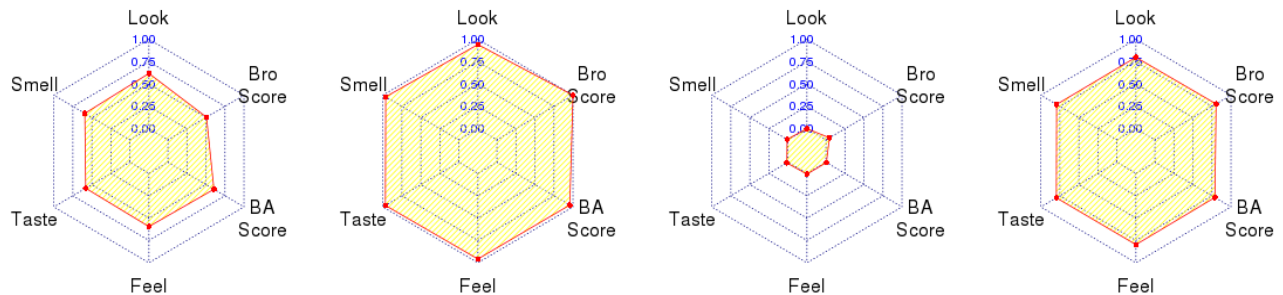**Figure 4.** Rating by Style group (Left) and Histogram of American and English Ales (Right)

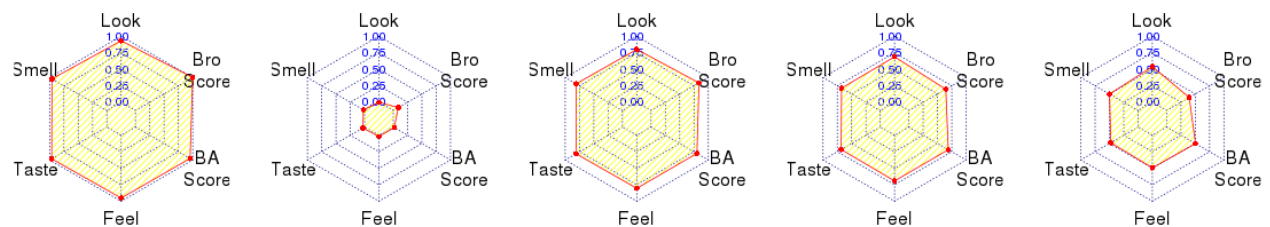**Figure 5A**. Beer Style clusters for k=4

Figure 6A. Beer Style clusters for k=5

[3] http://www.beeradvocate.com/community/threads/how-to-review-a-beer.241156/

Additionally, we look at the ones that are the closest ones to find out the beer styles where they agree the most. To do this, we calculated the difference between the scores given by the raters and the professional (overall rating and bro score). We scaled and normalized (min-max) this ratings and scores, and calculated the absolute difference. The highest the absolute difference, the further apart the views from regular and professional reviewers are. From our analysis the beers where they disagree the most are:
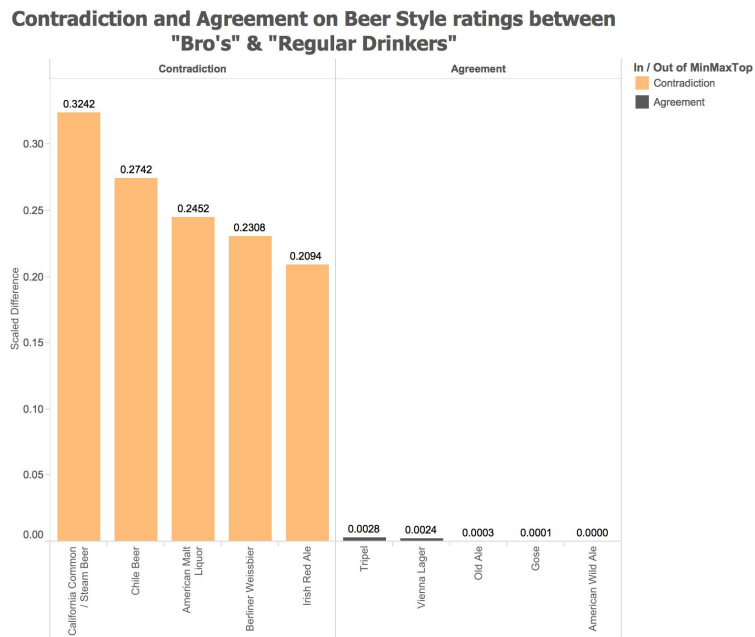

Figure 7A. Left: Top 5 disagreed beer styles. Right: Top 5 agreed beer styles

Rank	Disagree		Agree	
	Beer Style	**Absolute Difference**	**Beer Style**	**Absolute Difference**
1	California Common - Steam Beer	0.3242	American Wild Ale	0.0000
2	Chile Beer	0.2742	Gose	0.0001
3	American Malt Liquor	0.2452	Old Ale	0.0003
4	Berliner Weissbier	0.2308	Vienna Lager	0.0024
5	Irish Red Ale	0.2094	Tripel	0.0028

Table 3A. Left: Top 5 disagreed beer styles. Right: Top 5 agreed beer styles