

Physiochemical Properties in Wine Production

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May 22, 2018

Executive Summary

The following proposal is to regulate the yeast content during the fermentation stage of wine making in order to control the physiochemical characteristics of Portuguese Vinho Verde, red variant, that generate good quality wine. In particular, residual sugar levels and alcohol content will be the key variables utilized in determining which amounts result in quality wine.

Introduction

Oenology is the process of making wine. Within the wine industry, manufacturing is heavily reliant on physiochemical composition for wine quality. Residual sugar and alcohol are some of the main components for wine production. These components are regulated during the fermentation stage of wine making by yeast. During fermentation yeast feeds on the residual sugars to create alcohol. Many vineyards have taken to manually regulating the yeast themselves. Portuguese Vinho Verde tries to maintain high quality wine by focusing on this aspect.

A ranking of seven points or higher is regarded as good quality wine. The goal at the Portuguese vineyard is to achieve this particular ranking to promote consumptions and sales.

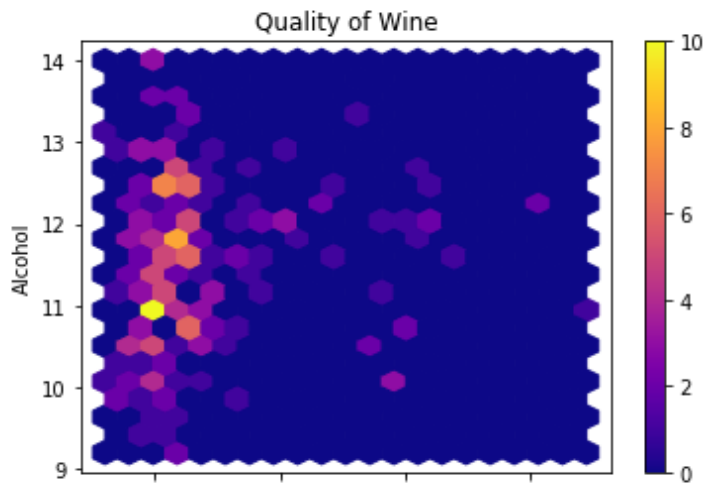
Problem Statement

Since there are various components to creating wine, pinpointing the most effective variables is essential. Residual sugar and alcohol are the most commonly known compounds in production. Figuring out how they interact with the remaining physiochemical properties will uncover which measures should be taken into consideration for producing good quality wine.

Using Jupyter Notebook, Python 3, we were able to analyze current data offered by the Portuguese vineyard on the physiochemical properties of their red variant wine.

The following plot demonstrates which residual sugar levels and alcohol content result good quality wine.

```
win2=win[win['quality'] > 6.99999]
win2.plot.hexbin(x='residual sugar', y='alcohol', gridsize=20, cmap='plasma')
plt.xlabel('Residual Sugar')
plt.ylabel('Alcohol')
plt.title('Quality of Wine')
plt.show()
```



Evidenced by the plot, quality points 7 or higher are typically generated when residual sugar levels are low and alcohol content is higher than 10.

Establishing a physiochemical structure which reflects the findings from the previous chart is dependent on how the other characteristics interact with these two properties. To test the interaction, we examined how the density of wine and pH compares to residual sugar and alcohol when quality is seven points or higher.

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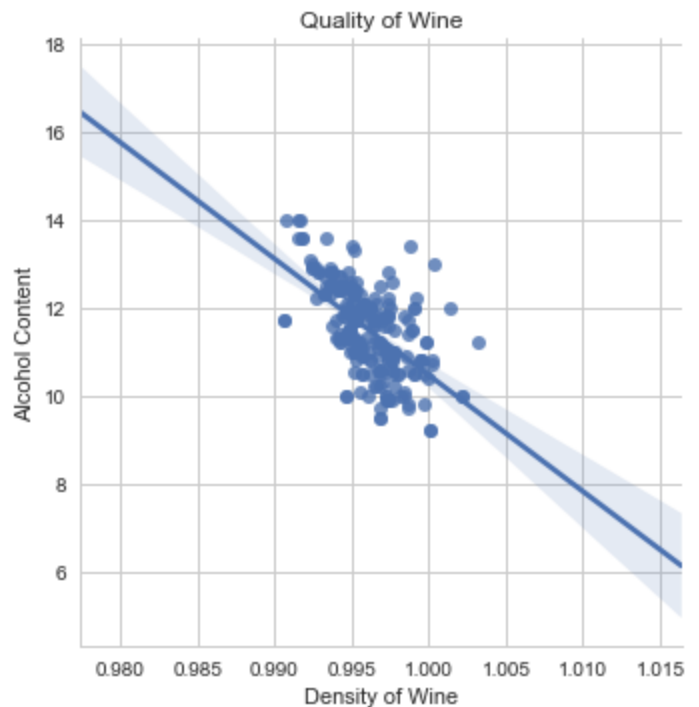
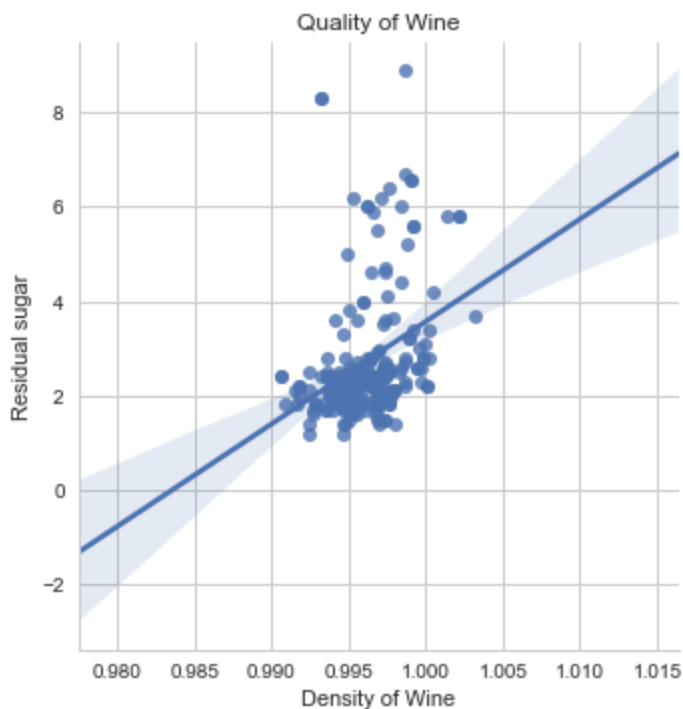
win2=win[win['quality'] > 6.99999]
sns.set(style= 'whitegrid')
win3=sns.lmplot(x='density', y='alcohol', data=win2, fit_reg=True)
win3.set_xlabels('Density of Wine')
win3.set_ylabels('Alcohol Content')
plt.title('Quality of Wine')
plt.show()

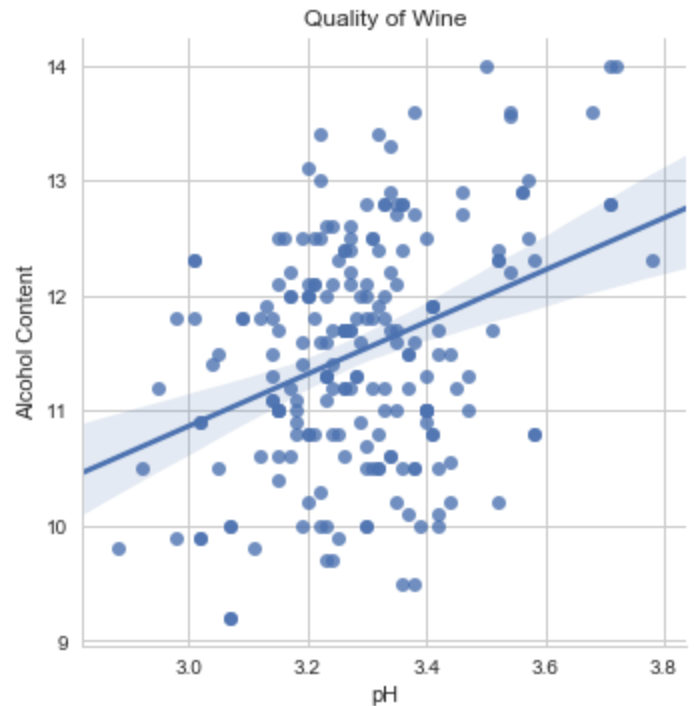
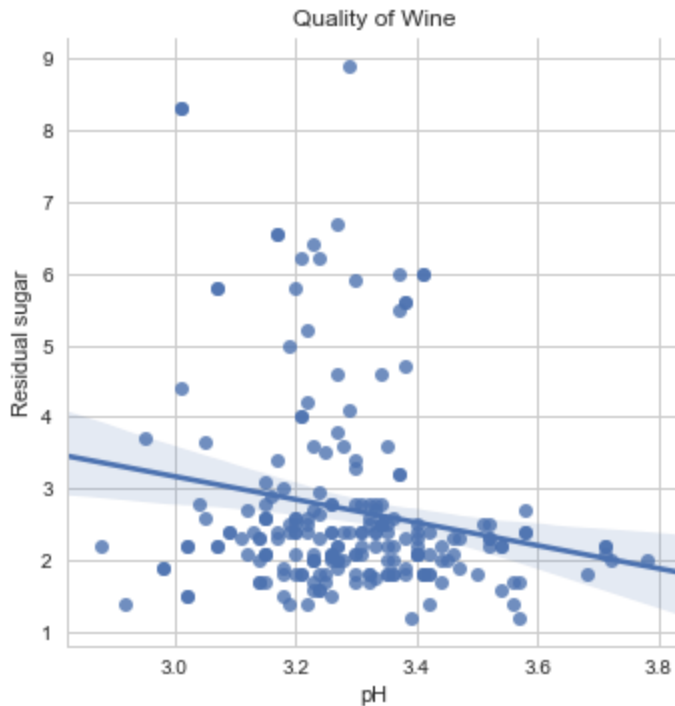
win6=sns.lmplot(x='density', y='residual sugar', data=win2, fit_reg=True)
win6.set_xlabels('Density of Wine')
win6.set_ylabels('Residual sugar')
plt.title('Quality of Wine')
plt.show()

win11=sns.lmplot(x='pH', y='alcohol', data=win2, fit_reg=True)
win11.set_xlabels('pH')
win11.set_ylabels('Alcohol Content')
plt.title('Quality of Wine')
plt.show()

win12=sns.lmplot(x='pH', y='residual sugar', data=win2, fit_reg=True)
win12.set_xlabels('pH')
win12.set_ylabels('Residual sugar')
plt.title('Quality of Wine')
plt.show()

```





Upon examination of the plot, residual sugar and alcohol have two distinct relationships to density and pH. As residual sugar increase, density increase, and as alcohol decreases, density increase. For pH, as residual sugar decreases, pH increase. Finally, as alcohol increase, pH increases.

Proposal

Given good quality is obtained by gaining seven or more points, physiochemical components that generate a rating of seven points or higher should be the only ones taken into consideration.

We recommend modifying the physiochemistry of Vinho Verde to only utilize residual sugar and alcohol levels that generate good quality wine. Given the relationships these two properties shared with density and pH, using them as main structural bases for wine production should generate positive results. Increasing Alcohol content and lowering residual sugar levels is the combination for good quality wine. The comparisons to density and pH demonstrated that the interaction residual sugar and alcohol hold with other structural properties does not exhibit complications for wine production. Thus, using residual sugar and alcohol numbers which correlate with quality at seven points or higher is a sound method for wine production.

Methods

For the purposes of this study, the control group will consist of a regulated physiochemical structure with quality being the dependent variable. The experiment will encompass the following:

- As far as grapes are concerned, we will only be using one grape variety provided by the Portuguese vineyard
- The main focus will be on the fermentation stage
- During fermentation, yeast levels will be regulated, the process will take ten days
- By regulating yeast, residual sugar level will be two and alcohol content will be between eleven to thirteen as the baseline composition
- Three batches of wine will be created for comparison
- The groups will be as follows: residual sugar =2, alcohol=11; residual sugar=2, alcohol=12; residual sugar=2, alcohol=13

Resulting Action

After carrying out the criteria listed in methods, residual sugar should be two and alcohol levels should be between eleven to thirteen. Given the residual sugar is only two and the alcohol content is between eleven to thirteen, all three should generate a quality of seven points or higher.

If yeast regulation during the fermentation stage does not produce the desired residual sugar and alcohol levels. Fermentation stage should be repeated for another ten days. This process should only be repeated for up to two months before declaring the experiment a failure.