INTRODUCTION

I was never able to get into Game of Thrones. I thought the books were slow reading and that the TV show was kind of boring. But, I will admit that parts of the narrative do absolutely fascinate me – I'm interested in the white walkers and the history, culture, and geography of the world. Basically, anything that isn't the actual the story.

But, Game of Thrones is extremely character rich, and those characters are very busy vying for power. Murders and betrayals are rampant, and apparently, you shouldn't get too attached to a character because he or she may very well be killed off. Last year, a few students at Olin College created a Bayesian survival model (for the books) to estimate a character's chances of surviving until the end of the *A Song of Ice and Fire Series. (LINK HERE)*

People die of all sorts of causes, but the most emotionally (and narratively) significant ones are the betrayals. So, let's extend the analysis a bit. What are the characteristics of a character who is betrayed? What are the characteristics of a betrayer?

There may be some spoilers for people, but in terms of what conclusions to draw, don't worry too much. The plot isn't governed by these statistics. The actual story development is only contingent on what George R. R. Martin and the TV show writers deem a good story.

\*\*\*

We'll use 3 approaches in our analysis. First, we'll use logistic regression to predict the odds of a betrayal. Second, we'll use a Naive Bayes Classifier (a bit of machine learning) to classify characters into two categories: betrayers and betrayed. Finally, we'll use k-means clustering to validate our previous results.

\*\*\*

TERMINOLOGY

For this post, we'll be using statistics and machine learning. So, we should get some terminology out of the way first.

**Feature:** In machine learning parlance, machine learning is an attribute of a data point. So, for a Game of Thrones character, features may include the character's house, gender, class, nobility status, etc.

**Feature Vector:** A vector of features.

**Cluster**:

THE DATA

I obtained the data from two places. First, I used the dataset Ben Kahle and Erin Pierce, the Olin College students from above, collected which has information on every named character in the first five books of the series. Second, I used data collected by Sara McGuire, Joanna Lu, and Eugene Woo. The first dataset can be found here, and the second can be found here.

We have a fairly apparent problem. There are tons of characters who haven't committed betrayals, but there are probably characters in the book who are not in the Game of Thrones show (which our betrayals are from). So, I went through and found the major and minor characters from seasons 1 through 5 (but not mentioned characters) and removed any characters not also present in the TV show from the dataset.

I am assuming that the show and books are similar enough tfor seasons 1-5, but let me know if there are any major differences. Given the amount of data, I doubt one or two incorrect observations would greatly affect the model, but it's poor statistical practice to not acknowledge the possibility of poor data.

THE LOGISTIC REGRESSION MODEL

Logistic regression is a type of generalized linear model. We'll be using binary logistic regression which maps a set of explanatory variables to a binary response, usually 0 and 1. As opposed to normal linear regression where the value of the predictors should map to the expected value of the response, logistic regression maps the values of the predictors to the odds (or probability) of the response being either 0 or 1.

So practically, what does this mean? Say we have a set of explanatory variables (the character's house, gender, nobility etc). Then, the value of each of these should affect the odds (probability) of that character being betrayed (a response variable value of 1) or not (response variable value of 0).

Mathematically, this looks like:

INSERT LOGIT MATH

So, onto some analysis! We're interested in predicting two phenomena: which characters are betrayers and which characters get betrayed. The explanatory variables we have to work with are indications of house loyalty, status as a member of the nobility or smallfolk, and the character's gender.

In predicting who gets betrayed, gender and nobility status were (more or less) significant predictors – while nobility is not significant at $latex \alpha = 0.05$, it would be stupid to not acknowledge a relationship since some arbitrary threshold shouldn't determine significance. But that's a topic for a different day. In the logistic regression model, the coefficients for predictors are the log-odds or how a unit change in the variable changes the log-odds of the response. For nobility, smallfolk was the baseline, and for gender, female was the baseline.

So, exponentiating back shows us that nobles are 5.5 times as likely to be betrayed as smallfolk are (which makes sense since betrayals are oftentimes about power or loyalty). Very interestingly, though, males are about 40% as likely as women to be betrayed. We can directly calculate the probability that some random character with certain characteristics is betrayed then:

LATEX TABLE

smallfolk woman – 10.4%

noble woman – 38.6 %

smallfolk man – 4.4%

noble man – 20.1%

Good Lord, I'm glad I'm not a noblewoman! If you happened to be a recurring noblewoman in the show/books, you have almost a 40% chance of being betrayed by virtue of existing! On the other side of that coin, though, while smallfolk men are very rarely betrayed, they may not play as a role in the narrative development of power politics.

Now, affiliation with any particular house (or the Night's Watch or no affiliation at all) was not a significant predictor of getting betrayed. But, you might be saying, the Starks and Lannisters seem to be betrayed frequently! This is an example of confirmation bias. The Starks who are betrayed are central to the plot and are not representative of all the individuals loyal to the Stark house. Same with the Lannisters or any other house. So no, Lannister affiliates are not necessarily more likely to betray you.

I tried limiting the dataset to just members of the families, but even then, no family is particularly likely to be betrayed. Sure, there are misfortunes

Unfortunately, there is no real predictor for being a betrayer. It seems that everyone could equally do it.