Lab 4
CS114 Spring 2018
Probability Theory II: Naive Bayes and Maximum Likelihood Estimation

Exercises

Naive Bayes

Use the data set below to answer the questions. Show all of the calculation steps.

Movie Review	**Sentiment**
“long”	Positive
“great”	Positive
“great long great”	Positive
“great long great poor long great”	Positive
“great poor great”	Positive
“great”	Positive
“poor”	Negative
“poor long poor”	Negative
“long long long”	Negative
“great poor poor poor”	Negative

1. Using a multinomial event model, write down the class probabilities P(Positive) and P(Negative), and the conditional probabilities of each feature (“great”, “long”, and “poor”) given each class (don’t worry about smoothing).

2. If a review contains the text “great great poor poor”, what is the probability that the review is positive according to a multinomial Naive Bayes classifier?

Maximum Likelihood Estimation

Suppose we use the Bernoulli model to model whether an email is spam or not. Let our data set contain 9 spam emails and 1 non-spam email.

3. Write down the likelihood function $L(\theta)$ in terms of the Bernoulli parameter θ.

4. Show that the maximum likelihood estimate of θ is 9/10. (Take the derivative of the likelihood function; set it to zero; and solve for θ)