Assignment 2: a few directions and t test

September 29, 2016

1 General discussion

Though the t test is an important concept for the comparison of two algorithms, we are not giving extra effort on it in our experiment. The recommended technique for t-test is given below (I have slightly changed it comparing to the one told in the class). But if you have already done it otherwise, you may submit whatever you have done.

The most important things before the final submission are

- Both the team members MUST have knowledge about both of the algorithms. If you have done k-NN, then you must have the knowledge about NB and vice-versa.
- Group 1 to Group 11 (having first member's student_id <=1105032) please come to the sessional at 11:00 AM and rest of the groups come at 12:15 PM.
- Remember that, viva and report both contain marks. So, be prepared for the viva and write report even when you cannot complete the assignment. If you have failed to complete the assignment, your report should be written on theoretical concept.

2 t test

For our t test, we think that we have already run the k-NN (with the best k value and the best measure) n_1 number of times and Naive Bayes (with the best α) n_2 number of times. Actually, in our assignment n_1=n_2=R. However, after running n_1 times, k-NN gives $\overline{x_1}$ (It should be in percentage) mean and s_1 standard deviation. On the other hand, NB gives $\overline{x_2}$ (It should be in percentage) mean and s_2 standard deviation. Let's consider μ_1 as the mean of k-NN and μ_2 as the mean of NB.

Before moving to next, we discuss about some related issues. In this t-test we are going to compare between two populations: k-NN with mean μ_1 (overall mean accuracy of k-NN algorithm) and NB with mean μ_2 (overall mean accuracy of NB). These means are actual means and we do not know these. But we are interested to know about their characteristic. So we have done our experiment and taken one sample (for one sample we have run R number of iterations and thus have got R number of accuracies) from each of the two algorithms. The mean in the sample of k-NN is $\overline{x_1}$ and the mean in the sample of NB is $\overline{x_2}$. Now, we are interested about whether their overall actual means have d difference among them. So, the first step is to state the null hypothesis and an alternative hypothesis. We are doing it here for one-tailed test. In this experiment, the claim we are going to do is that the difference between the overall/actual mean of algorithms is more than d (let d=5, you can consider any other value). So, the null hypothesis is

Null Hypothesis, H_o: μ_1-$\mu_2 \geq$ d

And the alternative hypothesis is

Alternative Hypothesis, H_a: μ_1-$\mu_2 <$ d

As we have the means and standard deviations with us, then our next task is to determine t-value.

$$t = \frac{\overline{x_1} - \overline{x_2} - d}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \tag{1}$$

Next we have to determine the degree of freedom (d.o.f) which is required for t-test.

$$d.o.f = \frac{(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2})^2}{\frac{s_1^4}{n_1^2(n_1-1)} + \frac{s_2^4}{n_2^2(n_2-1)}} \tag{2}$$

Now check the critical value of t for the given α and above calculated d.o.f. As we are going for one-tailed test, we have to check $t_{\alpha/2,\text{d.o.f}}$ from the t-table (http://www.sjsu.edu/faculty/gerstman/StatPrimer/t-table.pdf). Be careful, we are using $\alpha/2$ for the significance level α because we are doing one-tailed test. Again, if you cannot found the critical value of t for the corresponding $\alpha/2$, then linearly interpolate it from the immediate smaller and immediate larger ones. For example, if $\alpha = 0.005$ and so $\alpha/2$=0.0025, then you will not find the exact t-value in the table but you will find entries for $\alpha/2$=0.005 and $\alpha/2$=0.001. In this case, manually calculate or interpolate the required critical value.

Finally, if the absolute value of the t is greater than the critical value of $t_{\alpha/2,\text{d.o.f}}$ than we reject the null hypothesis and accept the alternative one. If the absolute value of the t is less than the critical value of $t_{\alpha/2,\text{d.o.f}}$, then we "fail to reject" the null hypothesis and cannot accept the alternative hypothesis. Note that, "fail to reject" does not mean you accept it rather it means you have found evidence against rejecting it.

3 About Version

A version is included with the assignment pdf name. This is because if any information is changed, then the version number will be incremented.