Paired Student t-test

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Abstract

The following is a experimental setup of Welch's Student Paired t-test for unequal variance samples. H_0 = same means, $H_a \neq$ same means. Below are the tables with corresponding p-values and results.

Experimental Setup

Mean Data Accuracy and Variance

	Dataset	
Classifier	Supernova Ia	Mars Landforms
NN + AL	85.75 (0.04)	87.43 (0.08)
SVM + AL	69.33 (0.17)	85.90 (0.03)
LR + AL	83.70 (0.03)	85.18 (0.02)
BDA	86.17 (0.35)	90.81 (1.49)

Method Description

I ran the following Active Learning methods directly on the target dataset with r = 10 as initial sample size. The results above are means for 100 query cost.

1. **Neural Network + Active Learning**: Utilizes a logistic activation function with hidden 1 layer containing 25 nodes. I used a lbfgs as the main solver for my Multi-Layer Perceptron Network. I set $\alpha = 2$.
2. **Support Vector Machine + Active Learning**: I used the rbf kernel as a default kernel in this experiment with default C and γ parameters.
3. **Logisitic Regression + Active Learning**: Plain and simple. Default parameters.

I conducted a Student's Paired t-test with unequal variance. Results shown in table below.

Mars Landforms				
Classifier	t-value	d.f.	Adjusted p-value	Result
BDA vs. NN+AL	22	9	3.548481e-08	H_0 Rejected
BDA vs. SVM+AL	10	9	2.524901e-05	H_0 Rejected
BDA vs. LR+AL	12	9	7.966252e-06	H_0 Rejected

Supernova Ia				
Classifier	t-value	d.f.	Adjusted p-value	Result
BDA vs. NN+AL	12	9	5.251112e-06	H_0 Rejected
BDA vs. SVM+AL	138	13	5.079992e-21	H_0 Rejected
BDA vs. LR+AL	22	9	2.893162e-08	H_0 Rejected

Conclusion

It is evident from the tables above that the pairwise t-test has concluded extreme statistical significance between our proposed Bayesian Domain Adaptation classifier and other active learning methods tested directly on the target dataset.