440 Final Project Report

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1 Introduction

When starting the project, we decided that we would use the files from the Berkeley AI site because it set a structure to help start the project. The part that was needed/modified was the classifier files. We used 3 different classifiers; Perceptron, Naive Bayes, and Mira.

2 Implementation

2.1 Perceptron

We used the layout and description from the Berkeley site to guide us. Compared to other classifiers, Perceptron procedure is easier to implement as it includes a weighted system and does not use probabilities to make its decisions. The weighted system compares y' to the true label y. If those values are equal then know we are correct, else we must guess y'. The implementation starts off with a global counter to associate with each individual label and then we run a nested loop where the outer loop is the number of iterations we would run. The inner loop iterates through the training data. Within the nested loop we are keep track of each score for each possible label which is a counter of pixels values. After these pixels values are counted for we then update the weights according to which score contains the higher value, the previous or the current one.

2.2 Naive Bayes

Naive Bayes uses probabilities to make decisions. The way this classifier works is that it contains three counters. The first counter is used for the prior distribution over the labels which is what Berkeley describes as P(Y). The way it is estimated is by looking at the training data where we get the number of training instances with the label y and divides it by the total number of training instances. This equations becomes P(Y) = c(y)/n. The second counter is used as a dictionary. It would use 0's and 1's to represent black (0) and white (1) features. This was used for the conditional probability. Third counter is used to count the number

of times we see a specific counter. The first loop goes through the training data and increment the third counter for each feature that we see while also increasing the first counter for each label and places the classification of 0's and 1's. After going through the whole data set we normalize the first counter. After that is done we being to smooth the conditional probabilities by adding adding a number to each feature to avoid features with values of 0's. Then lastly we normalize our conditional probabilities.

2.3 MIRA

We used the Berkeley page for the MIRA classifiers algorithm. It is similar to the perceptron classifier, and as such, scans over the data one instance at a time. It uses a global counter for the weights for each label but updates them if we guess wrong, unlike perceptron. They are updated using the value Tau, and we calculate it using the equation given by Berkeley. Essentially, it is the minimum of the Tau value and the maximum possible value, C. We use Tau to update the weight vectors, training the algorithm.

3 Results

Here are the results for each Classifiers:

NB Digits			
Percent	Time	Accuracy	std
10	5.3736	72.88	1.4481
20	5.7640	75.14	1.2219
30	5.9012	75.34	1.2934
40	5.5574	76.06	0.3209
50	6.1066	75.5	1.0050
60	5.9196	76.28	0.3421
70	5.9428	76.2	1.0559
80	6.3222	76.4	0.5657
90	6.1038	76.46	0.3050
100	6.6974	76.6	0.0000

NB Faces			
Percent	Time	Accuracy	std
10	3.8380	72.33	3.3508
20	4.3898	81.33	3.2318
30	4.2700	86.8	2.4221
40	4.6210	85.73	1.2996
50	4.7728	87.73	2.8519
60	4.8750	88.53	2.0763
70	5.0234	89.2	1.2824
80	5.3738	89.46	1.4453
90	5.5062	90.13	0.8692
100	5.7092	90.0	0.0000

Perceptron Digit			
Percent	Time	Accuracy	std
10	11.5112	73.350	1.0504
20	22.7003	78.6250	1.9704
30	33.6464	78.350	2.0936
40	44.4779	81.050	0.9327
50	55.0219	78.850	1.5264
60	63.3562	81.0	0.9832
70	71.3487	81.4750	0.9069
80	81.4028	81.40	0.7257
90	90.9719	81.0	0.4082
100	99.9783	81.0750	0.7136

Perceptron Face			
Percent	Time	Accuracy	std
10	2.1936	81.3333	4.0369
20	4.0166	87.0	1.6777
30	5.8025	85.8333	1.374
40	7.6135	84.8333	3.0
50	9.4106	87.3333	0.0
60	10.8560	87.3333	0.0
70	13.1078	87.3333	0.0
80	15.0333	87.3333	0.0
90	16.4522	87.3333	0.0
100	19.2845	87.3333	0.0

MIRA Digit			
Percent	Time	Accuracy	std
10	21.45	71.56	4.0790
20	36.80	76.46	2.3554
30	49.43	77.66	2.2854
40	61.32	76.8	2.2572
50	71.91	77.06	3.1942
60	83.81	74.96	3.1777
70	97.22	79.04	4.6592
80	110.2	77.52	2.7797
90	116.3	78.1	1.8193
100	131.2 80	.52	2.4448

MIRA Face			
Percent	Time	Accuracy	std
10	3.655	67.46	13.62
20	5.332	76.13	8.0884
30	6.654	80.66	4.6428
40	7.963	82.93	4.1258
50	9.489	82.53	1.1926
60	10.34	83.2	4.9306
70	11.74	83.86	4.9531
80	13.45	84.53	2.0763
90	14.64	85.6	2.3851
100	16.17	86.53	3.3797