

Homework 1 Report: Perceptrons and All-Pairs Method

In this experiment, 325 perceptrons were trained on approximately 10,000 examples using the Perceptron Learning Algorithm. All the examples with target values of A or B, for example, were used to train the A vs. B perceptron. In one experiment, 9 perceptrons achieved 100% accuracy, 275 achieved accuracies better than 90%, and 38 with at least 80% accuracy.

Afterward, the all-pairs method was used to classify another approximate 10,000 unseen examples. All 325 perceptrons voted on each example, and the most popular classification from each election was added to the prediction column for the target row in the confusion matrix.

Other groups incorporated regular shuffling of data to gain up to a 10% higher average accuracy in classification. That technique was not used in this experiment.

Average accuracy: 69.9590%

CONFUSION MATRIX																										
	P R E D I C T E D L E T T E R																									
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	347	1	0	1	0	0	0	1	0	3	3	0	0	2	13	0	3	1	7	0	7	0	1	0	4	0
B	0	361	0	0	0	1	3	4	2	0	1	0	0	0	3	0	3	5	0	0	0	0	0	0	0	0
C	0	1	304	1	6	4	6	0	0	0	24	5	2	0	10	0	0	0	0	0	5	0	0	0	0	0
D	0	75	0	228	2	1	0	1	0	1	0	0	0	10	77	0	0	2	0	2	2	0	0	0	0	1
E	0	47	59	0	218	4	21	0	2	0	4	7	0	0	0	0	4	4	9	3	0	0	0	0	0	2
F	1	37	11	4	0	297	7	0	5	3	0	0	0	5	0	5	0	1	4	5	1	0	0	0	1	0
G	0	7	148	2	1	4	139	2	0	0	12	2	1	1	18	0	11	7	15	0	1	2	13	0	0	0
H	1	25	5	21	1	9	8	182	1	2	18	0	0	8	45	2	4	11	0	0	18	3	0	3	0	0
I	2	19	4	4	0	16	0	0	289	10	0	0	0	0	1	0	0	0	27	0	0	0	0	5	0	0
J	2	11	6	5	0	9	0	2	16	297	0	0	0	1	10	0	1	0	8	0	3	0	0	0	0	2
K	1	18	16	8	2	0	1	8	0	0	280	6	0	2	3	0	0	13	0	0	4	0	0	7	0	0
L	2	13	11	4	4	0	3	2	0	0	4	322	0	0	3	0	4	0	4	1	0	0	0	3	0	0
M	20	6	0	0	0	0	3	11	0	0	3	0	220	63	2	0	0	4	0	0	20	0	44	0	0	0
N	0	4	0	9	0	0	0	13	0	0	2	0	0	342	11	0	0	2	0	0	1	4	3	0	0	0
O	4	4	11	8	0	0	0	4	0	1	0	0	2	3	310	0	1	3	0	0	7	0	18	0	0	0
P	1	13	0	8	0	55	8	1	2	0	1	1	0	8	14	267	4	0	2	0	0	3	2	0	11	0
Q	13	16	2	1	6	0	13	2	0	8	4	7	0	0	76	0	216	0	17	0	0	0	2	0	6	2
R	8	93	1	4	1	0	10	13	0	0	31	2	0	5	22	0	0	188	0	0	0	0	0	0	1	0
S	0	91	4	1	13	14	0	0	2	2	0	18	0	0	4	0	1	0	209	0	0	0	0	2	0	13
T	1	5	0	1	15	67	6	1	1	0	11	0	0	0	1	2	0	2	13	249	7	4	0	0	8	4
U	1	0	4	2	0	0	0	2	0	0	6	0	3	7	3	0	0	1	0	0	362	0	15	0	0	0
V	0	9	0	0	0	1	2	2	0	0	0	0	0	2	1	0	0	2	0	5	1	323	14	0	20	0
W	2	5	0	0	0	0	0	2	0	0	0	0	2	19	2	0	0	0	0	0	2	3	339	0	0	0
X	0	30	0	14	12	0	1	0	29	0	7	6	0	0	8	0	6	0	14	3	5	0	0	258	0	0
Y	0	1	0	4	0	37	0	3	0	0	0	0	1	0	0	0	10	0	7	79	7	25	0	1	218	0
Z	0	9	0	1	26	3	0	0	0	32	0	2	0	0	0	0	1	1	62	3	0	0	0	1	0	226

For reference, these are the calculated values for each test set.

Letter: A Tests: 394 Correct votes: 347 Correct/Total: 0.880711
Letter: B Tests: 383 Correct votes: 361 Correct/Total: 0.942559
Letter: C Tests: 368 Correct votes: 304 Correct/Total: 0.826087
Letter: D Tests: 402 Correct votes: 228 Correct/Total: 0.567164
Letter: E Tests: 384 Correct votes: 218 Correct/Total: 0.567708
Letter: F Tests: 387 Correct votes: 297 Correct/Total: 0.767442
Letter: G Tests: 386 Correct votes: 139 Correct/Total: 0.360104
Letter: H Tests: 367 Correct votes: 182 Correct/Total: 0.495913
Letter: I Tests: 377 Correct votes: 289 Correct/Total: 0.766578
Letter: J Tests: 373 Correct votes: 297 Correct/Total: 0.796247
Letter: K Tests: 369 Correct votes: 280 Correct/Total: 0.758808
Letter: L Tests: 380 Correct votes: 322 Correct/Total: 0.847368
Letter: M Tests: 396 Correct votes: 220 Correct/Total: 0.555556
Letter: N Tests: 391 Correct votes: 342 Correct/Total: 0.874680
Letter: O Tests: 376 Correct votes: 310 Correct/Total: 0.824468
Letter: P Tests: 401 Correct votes: 267 Correct/Total: 0.665835
Letter: Q Tests: 391 Correct votes: 216 Correct/Total: 0.552430
Letter: R Tests: 379 Correct votes: 188 Correct/Total: 0.496042
Letter: S Tests: 374 Correct votes: 209 Correct/Total: 0.558824
Letter: T Tests: 398 Correct votes: 249 Correct/Total: 0.625628
Letter: U Tests: 406 Correct votes: 362 Correct/Total: 0.891626
Letter: V Tests: 382 Correct votes: 323 Correct/Total: 0.845550
Letter: W Tests: 376 Correct votes: 339 Correct/Total: 0.901596
Letter: X Tests: 393 Correct votes: 258 Correct/Total: 0.656489
Letter: Y Tests: 393 Correct votes: 218 Correct/Total: 0.554707
Letter: Z Tests: 367 Correct votes: 226 Correct/Total: 0.615804