Machine Learning

HW 5: SVM SMO Algorithm

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Bailey, Shahapurkar, Vudatha, Poliseti

The program appears to work as expected as it trims out unfit points in the group of support vectors. There are some quirks that reduce the test accuracy that appear sometimes. If the training set can be classified perfectly relatively quickly (<4 iterations), the model is slightly overfit and will not result in 100% test accuracy. If it can train for >4 iterations, it has a fairly good chance at obtaining 100% test accuracy as demonstrated below. This is a result of the performance optimization of the SMO optimization where the algorithm can get stuck in a local misclassification minima, rather than a global one due to the fact that only one pair of alphas are optimized per iteration, rather than all of them.

**Results from a run:**

**Text Output:**

Standardization Result

ans =

-0.0000 -0.0000 -0.0000 -0.0000

1.0000 1.0000 1.0000 1.0000

Random alpha assignment

-19.0205

Enforce Zero Sum condition

-1.7764e-15

Iteration 1 Accuracy:

74 / 76

Iteration 2 Accuracy:

74 / 75

Iteration 3 Accuracy:

72 / 73

Iteration 4 Accuracy:

70 / 71

Iteration 5 Accuracy:

69 / 69

Final w:

-14.8375 19.5798 -24.1473 -22.9963

Final b: -1.8999

Number of support Vectors : 69

Test Accuracy:

100.00

**Figures:**

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**Another Run:**

Standardization Result

ans =

-0.0000 -0.0000 -0.0000 -0.0000

1.0000 1.0000 1.0000 1.0000

Random alpha assignment

-12.2359

Enforce Zero Sum condition

-4.1078e-15

Iteration 1 Accuracy:

83 / 85

Iteration 2 Accuracy:

76 / 83

Iteration 3 Accuracy:

77 / 81

Iteration 4 Accuracy:

75 / 79

Iteration 5 Accuracy:

73 / 77

Iteration 6 Accuracy:

71 / 75

Iteration 7 Accuracy:

69 / 73

Iteration 8 Accuracy:

67 / 71

Iteration 9 Accuracy:

66 / 69

Iteration 10 Accuracy:

64 / 67

Iteration 11 Accuracy:

62 / 65

Iteration 12 Accuracy:

61 / 63

Iteration 13 Accuracy:

58 / 61

Iteration 14 Accuracy:

57 / 59

Iteration 15 Accuracy:

54 / 57

Iteration 16 Accuracy:

52 / 55

Iteration 17 Accuracy:

51 / 53

Iteration 18 Accuracy:

50 / 51

Iteration 19 Accuracy:

48 / 49

Iteration 20 Accuracy:

46 / 47

Iteration 21 Accuracy:

44 / 45

Iteration 22 Accuracy:

43 / 43

Final w:

-4.7455 8.6197 -8.8776 -7.0176

Final b: 0.4286

Number of support Vectors : 43

Test Accuracy:

100.00

**Figures:**

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