1. Q. (a) Implement the online perceptron model with algorithm described in Algorithm Set the iters = 15. During the training, at the end of each iteration use the current w to make prediction on the validation samples. Record the accuracies for the train and validation at the end of each iteration. Plot the recorded train and validation accuracies versus the iteration number.

Ans:

|  |  |  |
| --- | --- | --- |
|  | Accaccuracy | |
| iteration | Train data | Validation data |
| 1 | 0.907733224 | 0.933701657 |
| 2 | 0.936170213 | 0.945365255 |
| 3 | 0.938216039 | 0.934929405 |
| 4 | 0.944762684 | 0.948434622 |
| 5 | 0.948240589 | 0.936771025 |
| 6 | 0.948445172 | 0.943523634 |
| 7 | 0.94905892 | 0.937998772 |
| 8 | 0.94905892 | 0.938612646 |
| 9 | 0.951104746 | 0.947820749 |
| 10 | 0.951718494 | 0.939226519 |
| 11 | 0.951923077 | 0.940454266 |
| 12 | 0.955605565 | 0.942909761 |
| 13 | 0.953559738 | 0.942295887 |
| 14 | 0.955605565 | 0.952731737 |
| 15 | 0.954787234 | 0.945979128 |

Q.(b) Does the train accuracy reach to 100%? Why?

Ans: The results we got show that the train accuracy can’t reach to 100%. We think the training data sets may not be linear separable. Thus, the accuracy can’t be perfect.

Q.(c) Use the validation accuracy to decide the test number for iters. Apply the resulting model to make predictions for the samples in the test set. Generate the prediction ﬁle oplabel.csv. Please note that your ﬁle should only contain +1 (for 3) and -1 (for 5) and the number of rows should be the same as pa2 test.csv.

Ans: We choose the number 14 iteration results to predict the test data.

2.(a) Please implement the average perceptron described in Algorithm 2.

(b) Plot the train and validation accuracies versus the iteration number for iters = 1, ..., 15.

Ans:

|  |  |  |
| --- | --- | --- |
|  | Accuracy | |
| iteration | Train data | Validation data |
| 1 | 0.907733224 | 0.944751381 |
| 2 | 0.936170213 | 0.94966237 |
| 3 | 0.938216039 | 0.950890117 |
| 4 | 0.944762684 | 0.950890117 |
| 5 | 0.948240589 | 0.950276243 |
| 6 | 0.948445172 | 0.950890117 |
| 7 | 0.94905892 | 0.95150399 |
| 8 | 0.94905892 | 0.952731737 |
| 9 | 0.951104746 | 0.952117864 |
| 10 | 0.951718494 | 0.952731737 |
| 11 | 0.951923077 | 0.952731737 |
| 12 | 0.955605565 | 0.952731737 |
| 13 | 0.953559738 | 0.953345611 |
| 14 | 0.955605565 | 0.952731737 |
| 15 | 0.954787234 | 0.953959484 |

(c) How average model has aﬀected the validation accuracy comparing to the online perceptron?

Ans: We observer that the average perceptron could achieve higher accuracy level and more stable than online perceptron in part1.