1. Implement the online perceptron model with algorithm described in Algorithm 1. 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.
2. Does the train accuracy reach to 100%? Why?

No

1. 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.

We decide using 15th weight values to be our final weight values. Because the values have lowest number gap.

1. Please implement the average perceptron described in Algorithm 2.
2. Plot the train and validation accuracies versus the iteration number for iters = 1… 15.
3. How average model has affected the validation accuracy comparing to the online perceptron?

Yes, the average model’s accuracy percentage is higher than the online perceptron.

1. Implement the polynomial kernel function kp in the Algorithm 3. This function takes two vectors x1 and x2 and an integer p for the polynomial degree, and returns a real value.
2. Define a Gram matrix K with size N X N where N is the number of training samples. Fill matrix K(I, j) = kp(xi, xj) for all of the pairs in the training set.
3. Implement the rest of the kernel perceptron in Algorithm 3. For each p in [1, 2, 3, 7, 15]:
   1. Run the algorithm to compute α.
   2. At the end of each iteration use the current α to predict validation set.
   3. Record the train and validation accuracy for each iteration and plot the train and validation accuracies versus the iteration number.
   4. Record the best validation accuracy achieved for each p over all iterations.
4. Plot the recorded best validation accuracies versus degrees. Please explain how p is affecting the train and validation performance.
5. Use your best \_ (the best you found over all d and iterations above) to predict the test data-set. Please name the predicted \_le as kplabel.csv.