

Homework 1

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CptS 577 Structured Prediction

February 19, 2019

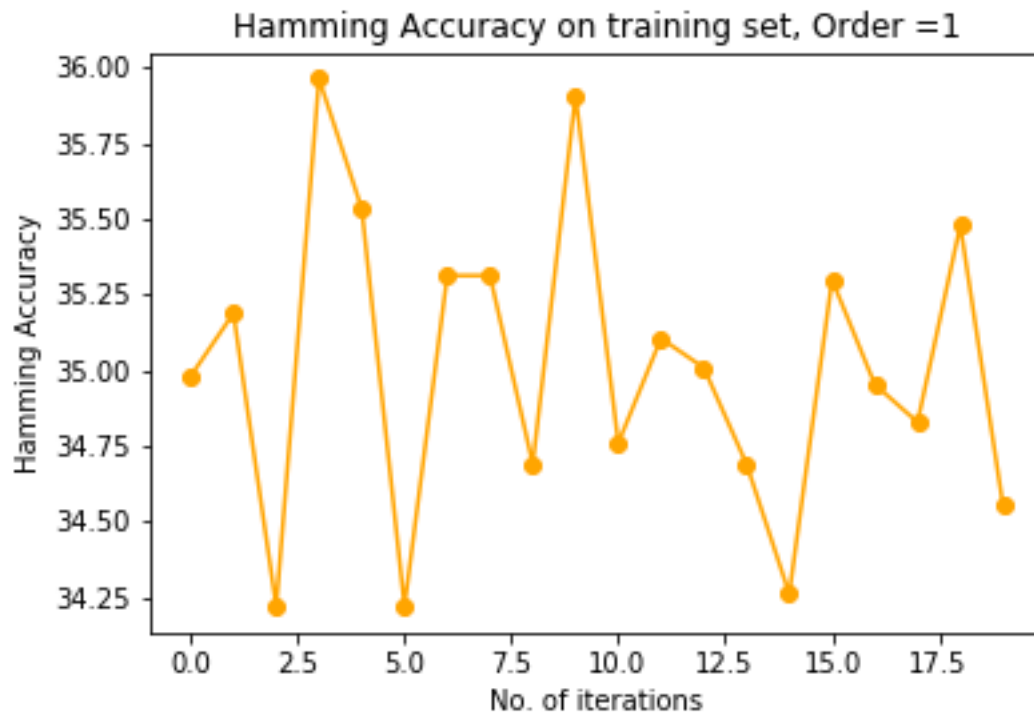
Exercise 1A. Implement the structured perceptron training algorithm and the randomized local search inference algorithm from scratch as shown in the above pseudo-code.

Answer: Please find the source code in the submitted zipped folder.

Exercise 1B. Plot the Hamming accuracy over the training and testing set as a function of the number of online learning iterations.

Answer:

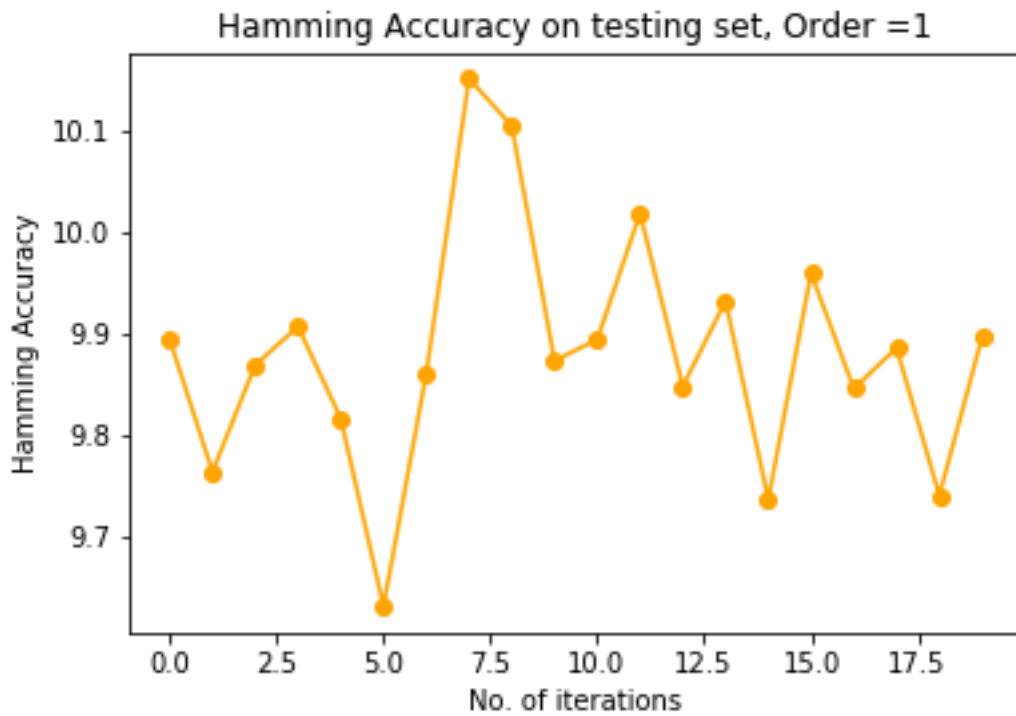
For text-to-speech dataset, and for feature order = 1, the plots for training and testing are as follows:





For handwriting recognition, and for feature order = 1, the plots for training and testing are as follows:



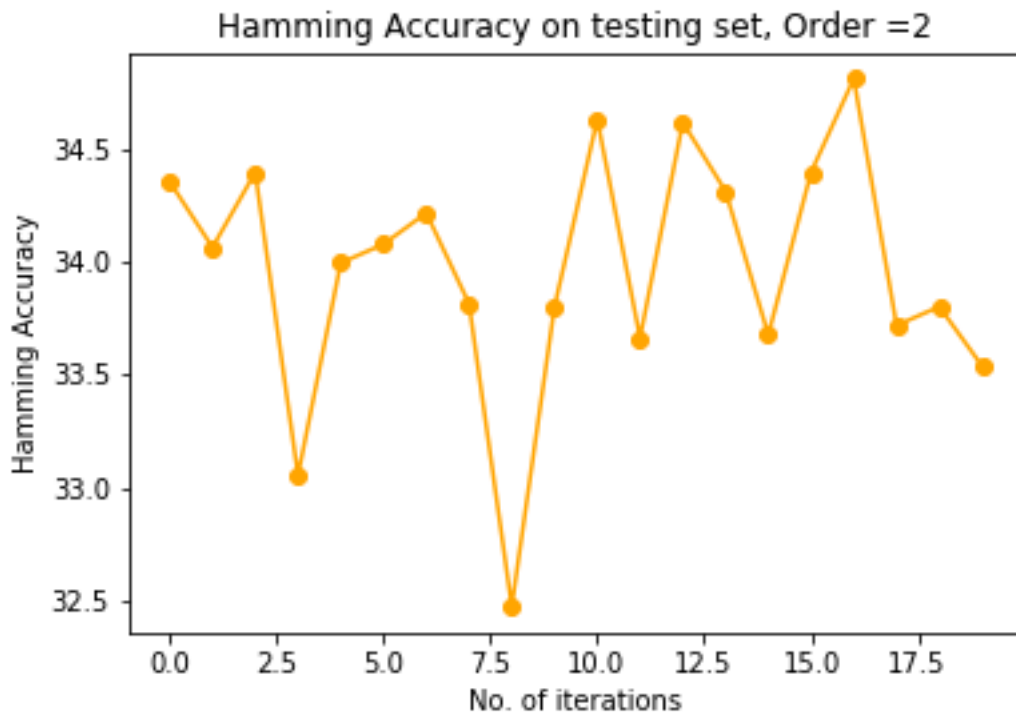


Exercise 1C. Repeat (b) with different feature representations Φ (First, Second and Third order).

Answer:

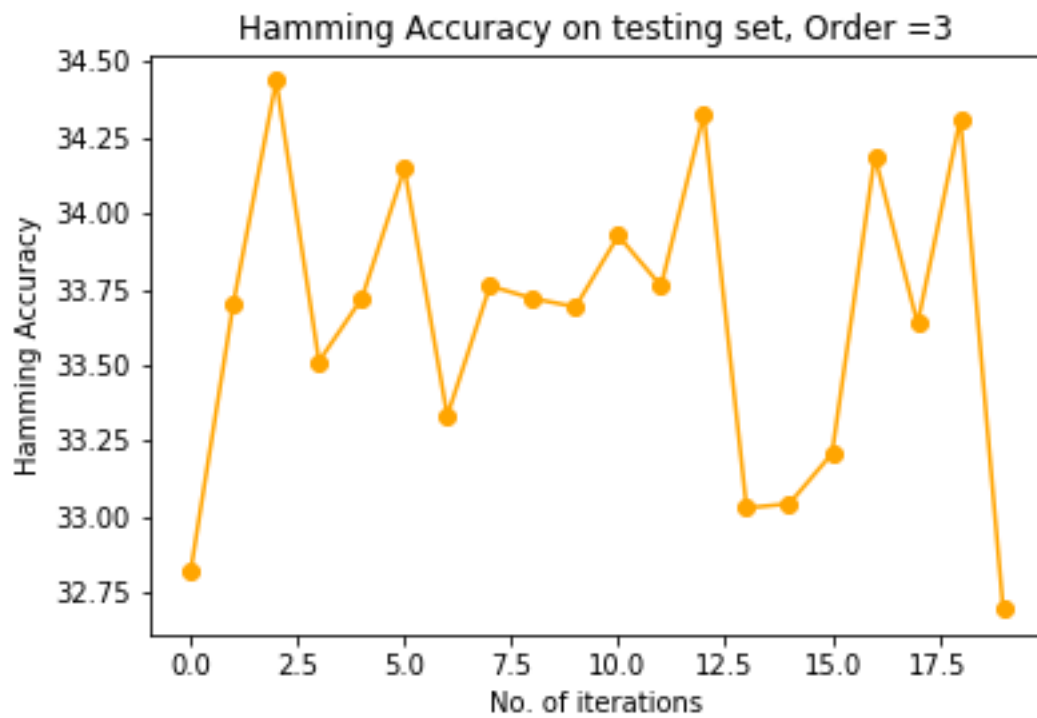
For text-to-speech dataset, and for feature order = 2, the plots for training and testing are as follows:



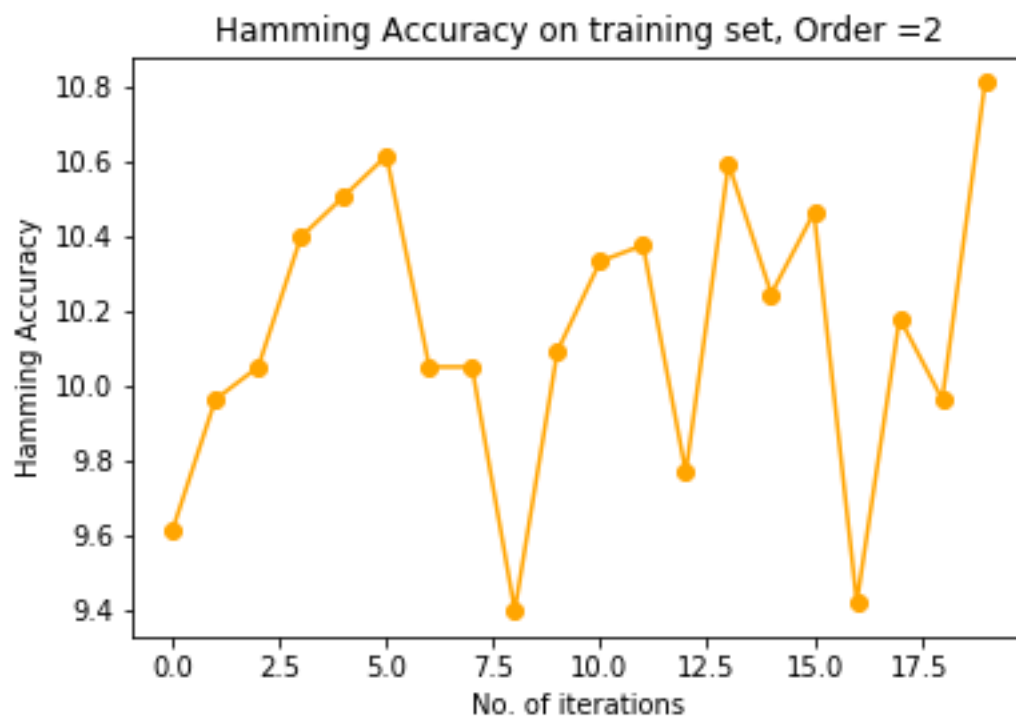


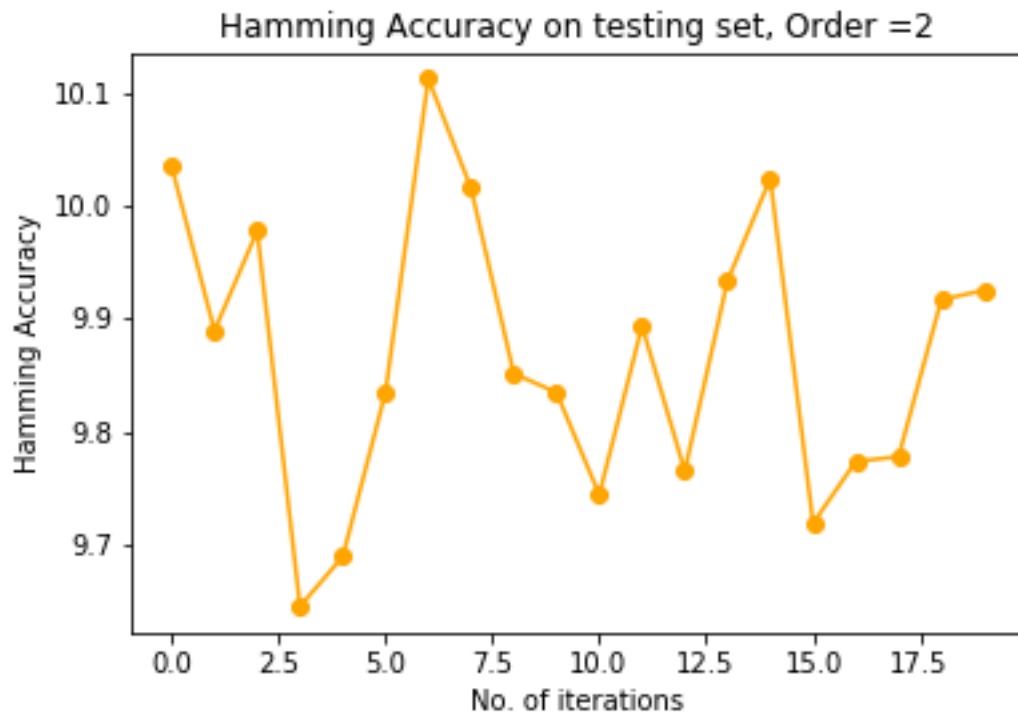
For text-to-speech dataset, and for feature order = 3, the plots for training and testing are as follows:





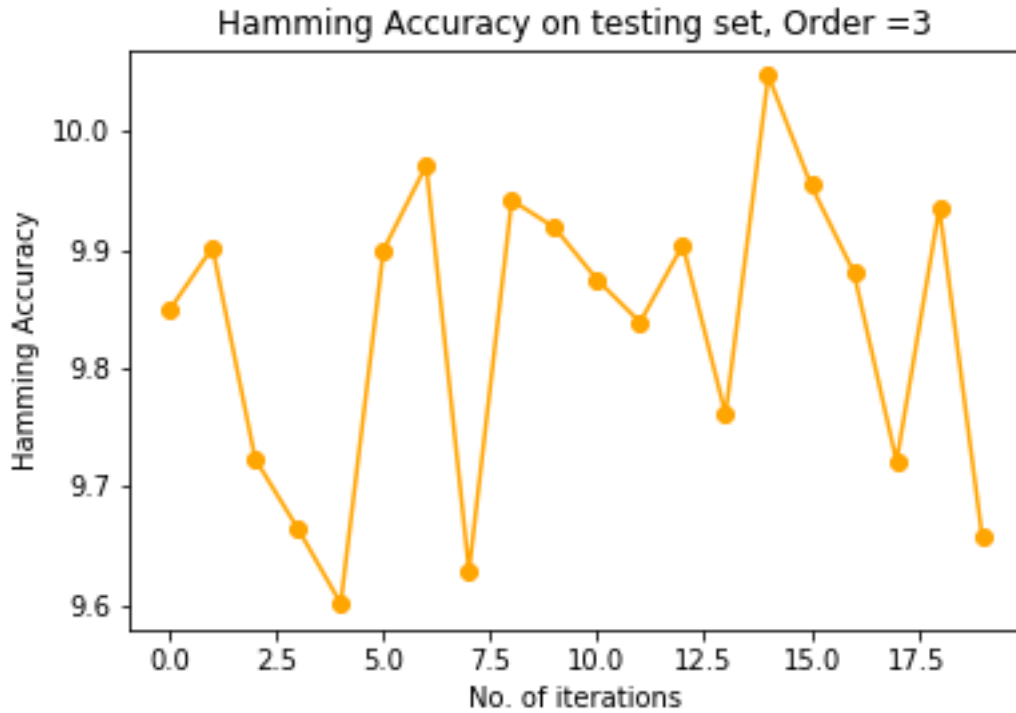
For handwriting recognition, and for feature order = 2, the plots for training and testing are as follows:





For handwriting recognition, and for feature order = 3, the plots for training and testing are as follows:

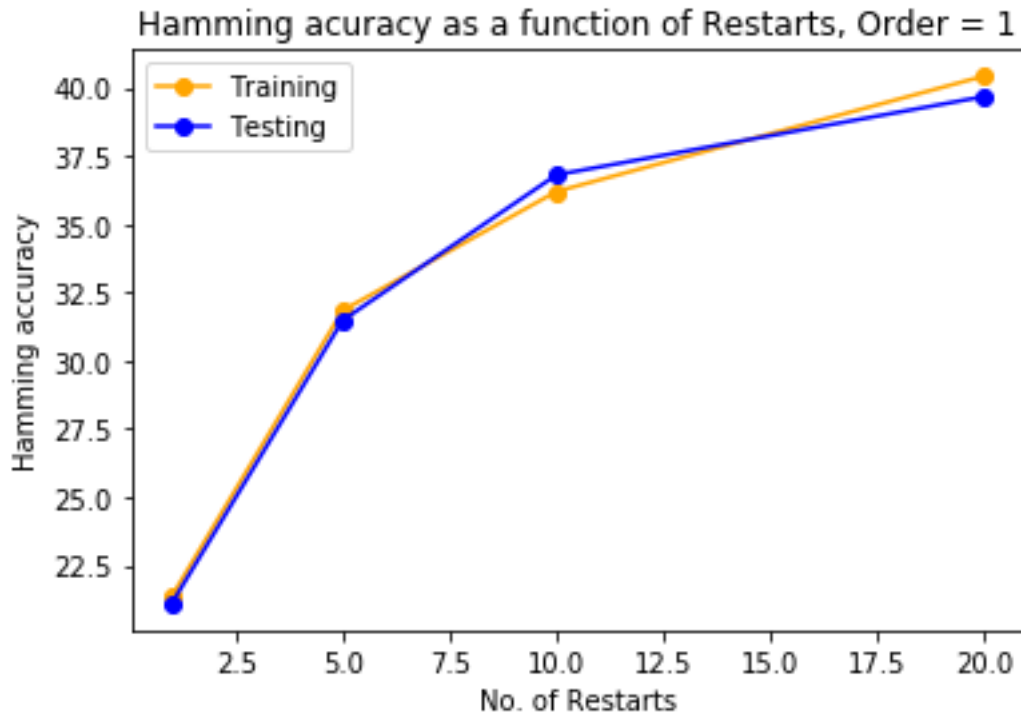




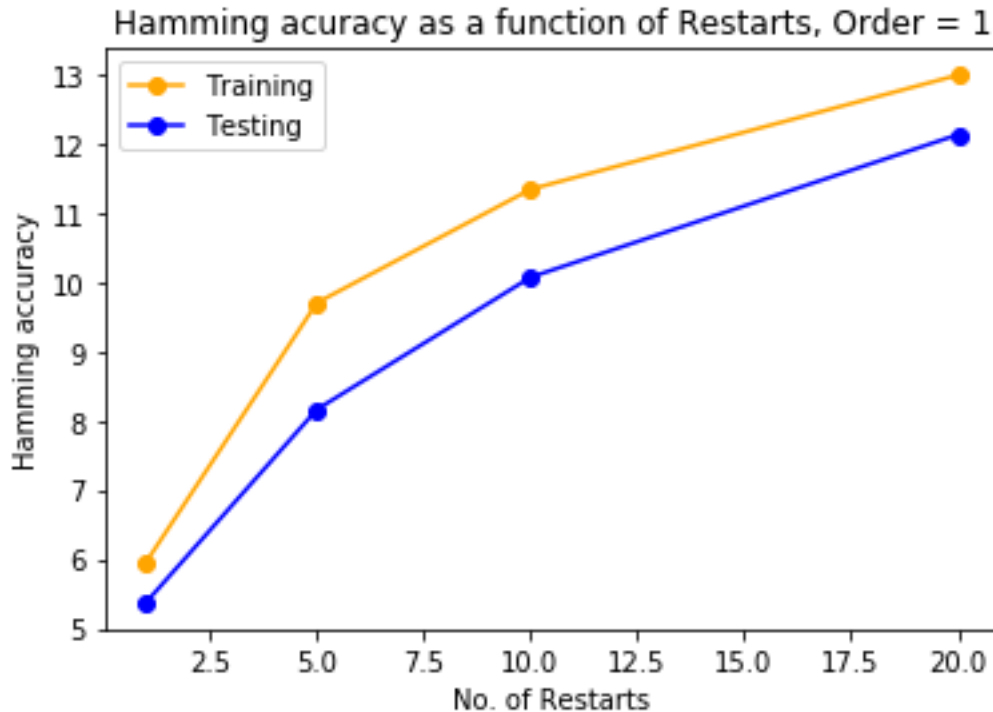
Exercise 1D. Fix the number of online learning iterations (MAX=20) and learning rate ($\eta = 0.01$) to reasonable values (based on (b)); and plot the Hamming accuracy for first-order representation as a function of the number of restarts $R = 1, 5, 10, 20$.

Answer:

For text-to-speech dataset, and for feature order = 1, the plots for Hamming accuracy as a function of Restarts for training and testing are as follows:



For handwriting recognition dataset, and for feature order = 1, the plots for Hamming accuracy as a function of Restarts for training and testing are as follows:



Exercise 1E. How will you diagnose the performance of learning algorithm? Please list your ideas and explain your intuition and rationale. Implement your ideas to perform diagnosis and test your hypotheses.

Answer: The algorithm gives a max accuracy of 37% on the text-to-speech dataset which gives us the clue that there is some serious implementation issue.

Also, from the plots of accuracy vs iterations, it can be noted that there is no monotonic increase as was expected. Its not clear whether that's an implementation issue or that is the nature of the Random Greedy Search algorithm.

Finally, from the plots of accuracy vs number of restarts, it is noted that the performance, while still being pretty bad, increases steadily indicating towards the fact that given enough restarts, the random greedy search has a better chance of finding the global optima.

Exercise 1F. Please feel free to try other ways of randomizing the local search and list your observations in comparison to RGS.

Answer: There was simply no time left to experiment with other search methods. But this is an exercise I intend to pursue after the submission deadline.