CS 534: SPRING 2018

Midterm Exam

This exam has 7 questions for a total of 130 points.

Name :

|  |  |  |
| --- | --- | --- |
| Question | Points | Score |
| 1 | 30 |  |
| 2 | 20 |  |
| 3 | 10 |  |
| 4 | 20 |  |
| 5 | 15 |  |
| 6 | 15 |  |
| 7 | 20 |  |
| Total: | 130 |  |

Be sure to show all work. Attach extra sheets as necessary. Collaboration is allowed for only 30 points. Please indicate your collaborator and where you collaborate.

1. (30 points) Design a gradient descendent algorithm to fit a logistic regression with the following training set (show the derivatives for each component, no vector notation is allowed):

|  |  |  |  |
| --- | --- | --- | --- |
| x1 | x2 | x3 | y |
| 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 |

1. (20 points) Change the formulation of the logistic regression and its gradient descendent algorithm to handle the importance (IP) of the examples (no vector notation is allowed, show the algorithm).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x1 | x2 | x3 | y | IP |
| 0 | 1 | 0 | 1 | 2 |
| 1 | 0 | 0 | 1 | 2 |
| 0 | 0 | 1 | 1 | 2 |
| 1 | 1 | 1 | 0 | 3 |
| 1 | 1 | 0 | 0 | 3 |

1. (10 points) Show the results for both points 1 and point 2 for 3 different initial points in input to the gradient descendent algorithm.
2. (20 points) By using a binary classifier (logistic regression or SVM) please implement in python the 2 different procedure (one vs. one, one vs. other) to handle the problem of more than two different classes (use the iris dataset).
3. (15 points) Implement the Naïve Bayes classifier, use the training set in point 1 and test it with the following dataset

|  |  |  |  |
| --- | --- | --- | --- |
| x1 | x2 | x3 | y |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |

1. (15 points) Implement the K-nearest neighbor classifier with the same training and test of the point 5.
2. (20 points) Create examples to explain the property an the importance of the following kernels:
   1. <https://en.wikipedia.org/wiki/Graph_kernel>
   2. <https://en.wikipedia.org/wiki/String_kernel>
   3. <https://en.wikipedia.org/wiki/Polynomial_kernel> , in this case make a comparison with another procedure that in not based on kernels.