Convex Optimization

(July – December 2022)

Assignment 1

(Graded)

Evaluation Date: 19th September 2022

Group A

1. Implementation Nearest Neighbor Algorithm. The details are as follows
    a. k-NN with k=1 to 20
    b. r-NN with suitable values of r

    a. Distance metric
        i. Euclidean distance
        ii. Manhattan distance

    b. The algorithm is to be implemented on the following datasets
        i. Generate gaussian variates $\mathcal{N}\sim(0,2)$ and $\mathcal{N}\sim(10,2)$ (may be use library for generation of gaussian variates)
        ii. Generate gaussian variates $\mathcal{N}\sim(0,2)$ and $\mathcal{N}\sim(10,5)$ (may be use library for generation of gaussian variates)
        iii. Iris dataset

Note: Except where explicitly indicated, use of libraries is prohibited.

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Group B

2. Implementation of Discriminant Analysis. The details are as follows

    a. The algorithm is to be implemented on the following datasets
        i. Generate gaussian variates $\mathcal{N} \sim \left(\mu = \begin{bmatrix} 3 \\ 2 \end{bmatrix}, \Sigma = \begin{bmatrix} 25 & 0 \\ 0 & 9 \end{bmatrix}\right)$ and $\mathcal{N} \sim \left(\mu = \begin{bmatrix} 10 \\ 5 \end{bmatrix}, \Sigma = \begin{bmatrix} 25 & 0 \\ 0 & 9 \end{bmatrix}\right)$ (may be use library for generation of gaussian variates)
        ii. Generate gaussian variates $\mathcal{N} \sim \left(\mu = \begin{bmatrix} 3 \\ 2 \end{bmatrix}, \Sigma = \begin{bmatrix} 25 & 0 \\ 0 & 9 \end{bmatrix}\right)$ and $\mathcal{N} \sim \left(\mu = \begin{bmatrix} 10 \\ 5 \end{bmatrix}, \Sigma = \begin{bmatrix} 10 & 5 \\ 5 & 10 \end{bmatrix}\right)$ (may be use library for generation of gaussian variates)
        iii. Iris dataset

Note:

- *Except where explicitly indicated, use of libraries is prohibited.*
- *Use Stochastic Gradient Descent*

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Group C

3. Implementation of Fisher Discriminant Analysis and kernel Fisher Discriminant Analysis. The details are as follows

    a. The algorithm is to be implemented on the following datasets
        i. Generate gaussian variates $\mathcal{N} \sim \left(\mu = \begin{bmatrix}3\\2\end{bmatrix}, \Sigma = \begin{bmatrix}25 & 0\\0 & 9\end{bmatrix}\right)$ and $\mathcal{N} \sim \left(\mu = \begin{bmatrix}10\\5\end{bmatrix}, \Sigma = \begin{bmatrix}25 & 0\\0 & 9\end{bmatrix}\right)$ (may be use library for generation of gaussian variates)
        ii. Generate gaussian variates $\mathcal{N} \sim \left(\mu = \begin{bmatrix}3\\2\end{bmatrix}, \Sigma = \begin{bmatrix}25 & 0\\0 & 9\end{bmatrix}\right)$ and $\mathcal{N} \sim \left(\mu = \begin{bmatrix}10\\5\end{bmatrix}, \Sigma = \begin{bmatrix}10 & 5\\5 & 10\end{bmatrix}\right)$ (may be use library for generation of gaussian variates)
        iii. Iris dataset

Note:

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Group D

4. Implementation of Logistic Regression. The details are as follows

    b. The algorithm is to be implemented on the following datasets

        iv. Generate gaussian variates $\mathcal{N} \sim \left(\mu = \begin{bmatrix}3\\2\end{bmatrix}, \Sigma = \begin{bmatrix}25 & 0\\0 & 9\end{bmatrix}\right)$ and $\mathcal{N} \sim \left(\mu = \begin{bmatrix}10\\5\end{bmatrix}, \Sigma = \begin{bmatrix}25 & 0\\0 & 9\end{bmatrix}\right)$ (may be use library for generation of gaussian variates)

        v. Generate gaussian variates $\mathcal{N} \sim \left(\mu = \begin{bmatrix}3\\2\end{bmatrix}, \Sigma = \begin{bmatrix}25 & 0\\0 & 9\end{bmatrix}\right)$ and $\mathcal{N} \sim \left(\mu = \begin{bmatrix}10\\5\end{bmatrix}, \Sigma = \begin{bmatrix}10 & 5\\5 & 10\end{bmatrix}\right)$ (may be use library for generation of gaussian variates)

        vi. Iris dataset

Note:

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Group E

5. Implementation of Perceptron Algorithm. The details are as follows

   c. The algorithm is to be implemented on the following datasets

      vii. Generate gaussian variates $\mathcal{N} \sim \left(\mu = \begin{bmatrix}3\\2\end{bmatrix}, \Sigma = \begin{bmatrix}25 & 0\\0 & 9\end{bmatrix}\right)$ and $\mathcal{N} \sim \left(\mu = \begin{bmatrix}10\\5\end{bmatrix}, \Sigma = \begin{bmatrix}25 & 0\\0 & 9\end{bmatrix}\right)$ (may be use library for generation of gaussian variates)

      viii. Generate gaussian variates $\mathcal{N} \sim \left(\mu = \begin{bmatrix}3\\2\end{bmatrix}, \Sigma = \begin{bmatrix}25 & 0\\0 & 9\end{bmatrix}\right)$ and $\mathcal{N} \sim \left(\mu = \begin{bmatrix}10\\5\end{bmatrix}, \Sigma = \begin{bmatrix}10 & 5\\5 & 10\end{bmatrix}\right)$ (may be use library for generation of gaussian variates)

      ix. Iris dataset

Note:

- *Except where explicitly indicated, use of libraries is prohibited.*
- *Use Stochastic Gradient Descent*