

MCA572– Neural Networks and Deep Learning
V MCA
18-10-2024

Regular lab Question – 4

Lab Question: Radial Basis Function (RBF) Network for Handwritten Character Recognition

<https://www.kaggle.com/datasets/anokas/kuzushiji/data> (Link to download)

Objective:

Implement a Radial Basis Function (RBF) Network to classify ancient Japanese characters from the Kuzushiji dataset.

Instructions:

1. Data Preparation:

- Load the Kuzushiji dataset from the provided link.
- Preprocess the data by normalizing the pixel values between 0 and 1.
- Split the dataset into training (80%) and testing (20%) sets.

2. Radial Basis Function (RBF) Network:

- Implement an RBF network using a Gaussian basis function.
- Define the architecture:
 - Input layer: 28x28 (784 features for each image).
 - Hidden layer: RBF units with a Gaussian function.
 - Output layer: Softmax activation to classify the character labels (10 classes).

3. Training:

- Use K-means clustering to determine the centers of the RBF units.
- Implement gradient descent to optimize the network's weights.
- Train the network on the training set with a learning rate of 0.01 for 100 epochs.

4. Evaluation:

- Evaluate the model on the test set using accuracy and confusion matrix.
- Visualize the performance evaluation metrics

5. Analysis:

- Discuss the strengths and limitations of using an RBF network for this dataset.
- How does the number of RBF units affect model performance?

Program Evaluation Rubrics

Evaluation Criteria	
5 marks	C1-Implementation, Correctness and Complexity
2 marks	C2-Documentation and Visualization
3 marks	C3-Concept Clarity and Explanation

General Instructions

1. The file you have to save with your name, last 3 digits of register number and program number "Aaron_201_Lab1".
2. The implemented code you have to upload in Github and in the Google Classroom in the given scheduled time.
3. Failure to upload within the allotted time will result in the loss of all marks for the corresponding lab exercise.