**North East University Bangladesh, Sylhet**

**Project Proposal**

Classification of CIFAR-10 Dataset Using Convolutional Neural Networks (CNN)

Submitted To:

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# 1. Introduction

Image classification is one of the core problems in computer vision, with a wide range of real-world applications such as object recognition, autonomous driving, and surveillance. The CIFAR-10 dataset is a benchmark dataset in the machine learning community, consisting of 60,000 color images in 10 different classes. Each class contains 6,000 images. This project aims to classify images from the CIFAR-10 dataset using Convolutional Neural Networks (CNNs), a type of deep learning model proven to perform well for image-related tasks.

# 2. Problem Statement

The objective of this project is to build an effective image classification model using a CNN to classify images from the CIFAR-10 dataset into one of ten predefined classes. The challenge lies in training a model that is not only accurate but also computationally efficient given the complexity and diversity of the images.

# 3. Objective

The primary objective is to design, implement, and evaluate a CNN model for classifying images from the CIFAR-10 dataset. The specific goals are as follows:

- Develop a CNN architecture tailored to the CIFAR-10 dataset.  
- Train the model on the CIFAR-10 training set.  
- Optimize the model using techniques such as data augmentation, dropout, and batch normalization.  
- Evaluate the performance of the model on the test set using accuracy, precision, recall, and F1-score.  
- Compare the results with baseline models and state-of-the-art techniques.

# 4. Methodology

The project will follow these steps:

1. Data Preparation:  
- Load and preprocess the CIFAR-10 dataset (normalization, one-hot encoding of labels).  
- Implement data augmentation techniques to increase the dataset’s diversity.

2. Model Design:  
- Build a CNN model with multiple convolutional layers, pooling layers, and fully connected layers.  
- Experiment with different architectures (e.g., varying the number of layers, filters, etc.).  
- Use activation functions like ReLU and softmax.

3. Model Training:  
- Split the dataset into training and validation sets.  
- Train the model using an appropriate optimizer (e.g., Adam, SGD) and loss function (e.g., categorical cross-entropy).  
- Tune hyperparameters like learning rate, batch size, and epochs.

4. Model Evaluation:  
- Evaluate the trained model on the test set.  
- Use accuracy, confusion matrix, precision, recall, and F1-score to assess performance.

5. Optimization:  
- Implement techniques such as dropout, batch normalization, and early stopping to improve the model’s generalization.  
- Perform hyperparameter tuning using techniques like grid search or random search.

# 5. Tools and Technologies

- Programming Language:Python  
- Deep Learning Framework: TensorFlow   
- Dataset: CIFAR-10 (available in TensorFlow/Keras libraries)  
- Libraries: Matplotlib, Keras, TensorFlow,

# 6. Expected Outcomes

- A well-trained CNN model capable of accurately classifying images from the CIFAR-10 dataset.  
- A detailed analysis of the model's performance metrics   
- A comparison of the model’s performance with baseline methods and existing models in the literature.  
- A potential improvement in classification accuracy through model optimization and hyperparameter tuning.