

# Problem Statement and Goals

## Artificial Neural Network

Tanya Djavaheerpour

January 19, 2024

Table 1: Revision History

Date	Developer(s)	Change
January 19, 2024	Tanya Djavaheerpour	Initial Draft

## 1 Problem Statement

In the rapidly evolving field of artificial intelligence and machine learning, image classification stands as a cornerstone application, enabling machines to interpret and analyze visual data with increasing accuracy. This project addresses the specific challenge of image classification using Artificial Neural Networks (ANN) on the CIFAR-10 dataset, a well-known benchmark in the machine learning community.

### 1.1 Problem

CIFAR-10 is divided into five training batches and one test batch, each with 10000 images. The test batch contains exactly 1000 randomly-selected images from each class. The training batches contain the remaining images in random order, but some training batches may contain more images from one class than another. Between them, the training batches contain exactly 5000 images from each class.

In a preceding project, available on [GitHub](#), an ANN-based model was developed to classify images from a reduced subset of the CIFAR-10 dataset, encompassing only 4 out of the 10 available classes. This reduction was primarily to manage computational complexity. However, the model achieved a modest accuracy of less than 50%, indicating substantial room for improvement.

The current project aims to extend this prior work by incorporating all 10 classes of the CIFAR-10 dataset, thus significantly increasing the scope and challenge of the classification task. The primary objective is to improve the accuracy

of the image classification model by modifying the ANN architecture. This involves experimenting with various configurations, such as adjusting the number of neurons and layers, to find an optimal structure that enhances performance.

Additionally, a novel feature is planned for this project: the ability to accept an image input (via directory input) from the user, process it through the trained model, and output the classified category.

## **1.2 Inputs and Outputs**

Inputs: The complete CIFAR-10 dataset, encompassing 10 categories of images, each representing different objects like animals and vehicles. User-provided images for classification.

Outputs: Classification accuracy of the ANN model, measured against a benchmark. For user-provided images, the output will be the category name into which the image is classified.

## **1.3 Environment**

The development and execution of this project will take place in a Python-based environment.

# **2 Goals**

The primary aim of this project is an enhancement of the ANN model's performance in classifying images from the CIFAR-10 dataset. The focus is on refining the neural network architecture to achieve a balance between computational efficiency and increased classification accuracy. A key aspect of this project is the implementation of a terminal-based interface, which will allow users to input image paths and receive classification results directly through the command line. This approach not only simplifies the user interaction but also aligns well with the project's emphasis on the core functionality of image classification. Additionally, creating detailed and accessible documentation of the entire development process is an essential goal.

## **3 Stretch Goals**

A key stretch goal for this project is to implement a user interface that is easy for everyone to use, both online and offline. This interface would enable users to upload images in any format. Additionally, by utilizing a dataset like CIFAR-100 for training the model, we could classify a wider range of image classes. However, it's important to note that using a larger dataset like this would significantly increase computational complexity.