

Problem Statement and Goals

Artificial Neural Network

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January 19, 2024

Table 1: Revision History

Date	Developer(s)	Change
January 19, 2024	Tanya Djavahepour	Initial Draft
January 26, 2024	Tanya Djavahepour	Fixx Problem Statement

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 software is compatible with various types of operating systems such as Windows, Linux, or macOS and should work on various types of personal computers and laptops.

2 Goals

The project aims to achieve the following goals:

- To enhance the accuracy and performance of the Artificial Neural Network model for classifying images in the CIFAR-10 dataset.
- To explore and refine the neural network architecture, balancing computational efficiency with classification accuracy.
- To develop a user-friendly terminal-based interface that allows users to interact with the model and test its performance.
- To produce comprehensive and accessible documentation detailing the development process, model architecture, and implementation techniques.

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.