DSEM 6150 ASSIGNMENT 8

# CONVOLUTIONAL NEURAL NETWORK

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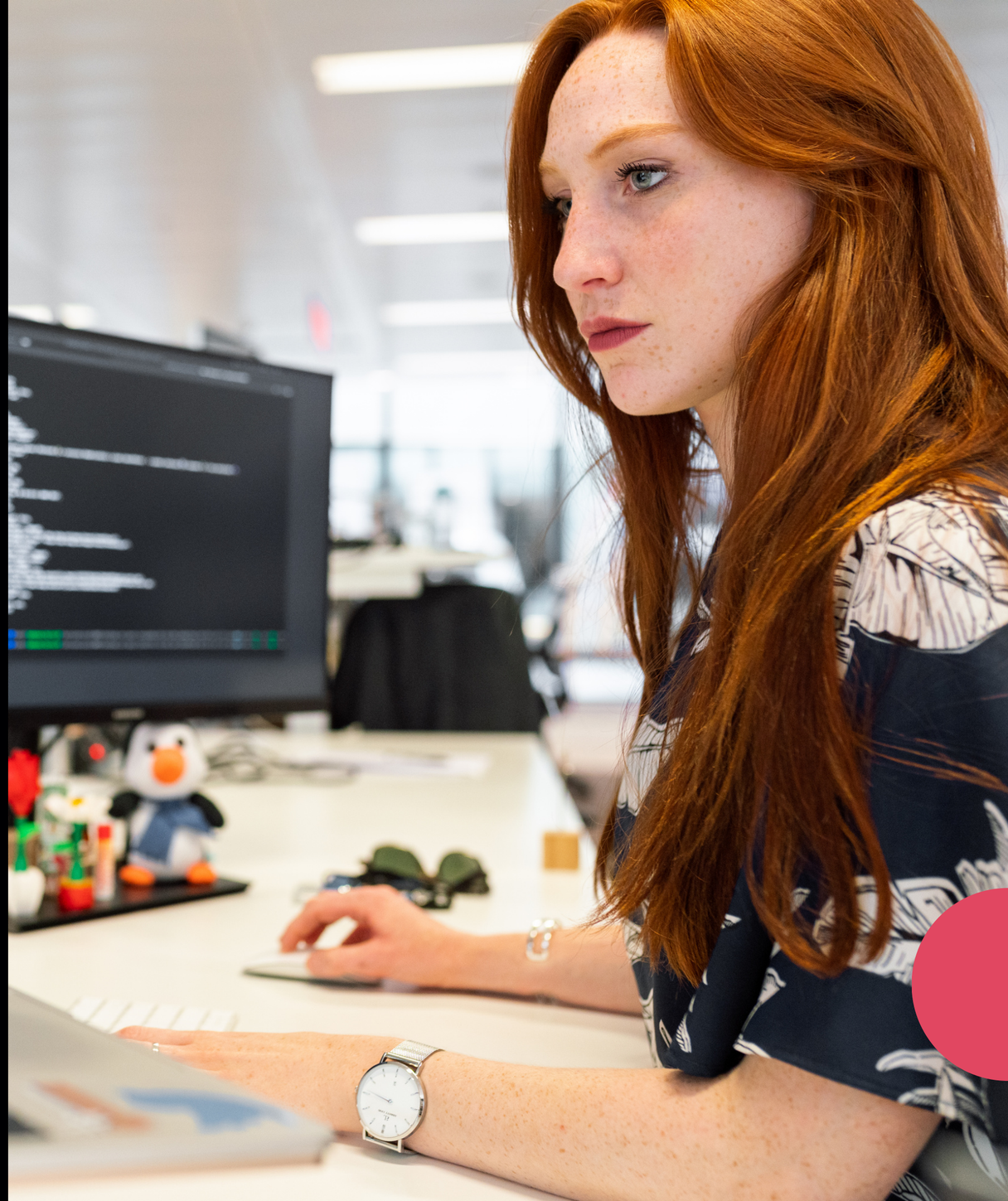
# INTRODUCTION

Convolutional Neural Networks (CNN) are mainly used for image recognition. The fact that the input is assumed to be an image enables an architecture to be created such that certain properties can be encoded into the architecture and reduces the number of parameters required.

The convolution operator is basically a filter that enables complex operations to be performed on an image. Examples are edge detection, gradient recognition, and smoothing. This allows pertinent data to be extracted from the image.



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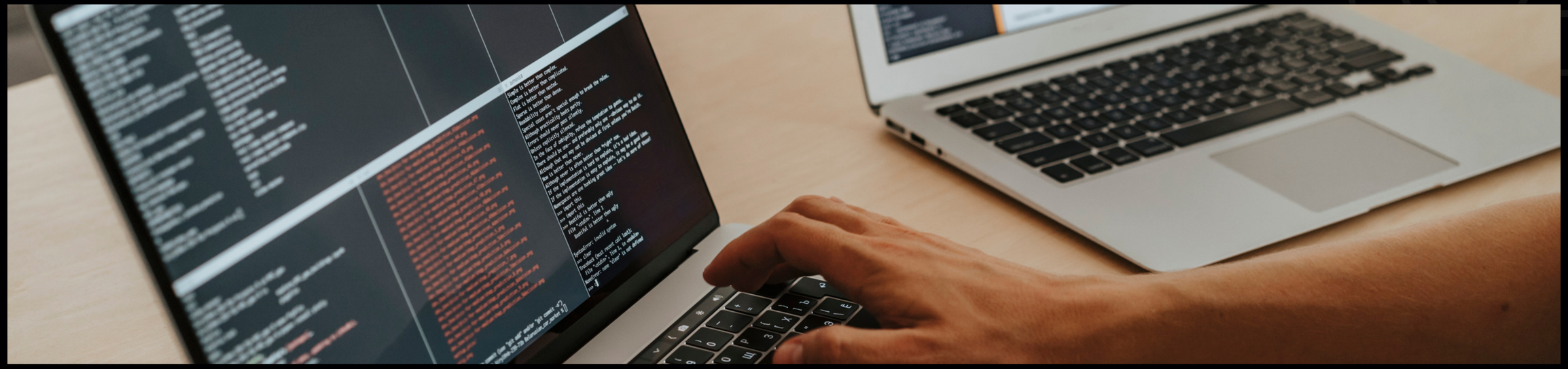

# PROBLEM STATEMENT

Develop a Convolutional Neural Network (CNN) model to classify CIFAR-10 images using TensorFlow and evaluate its performance using a 90/10 train-test split.

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# DATASET

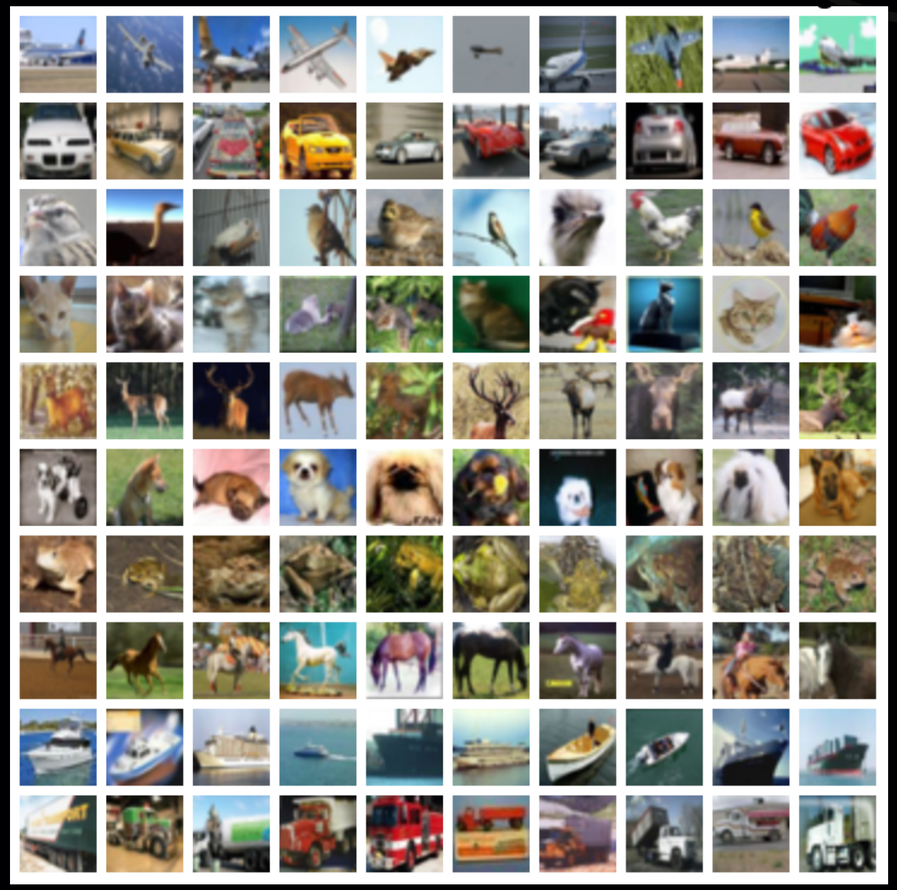
The CIFAR-10 dataset consists of 60000 32x32 colour images in 10 classes, with 6000 images per class. There are 50000 training images and 10000 test images.

The dataset 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.



TensorFlow is an open-source software library for dataflow and differentiable programming across a range of tasks in machine learning and deep learning. It was developed by the Google Brain team and is widely used for building and training deep neural networks.

TensorFlow provides a flexible and efficient platform for implementing and deploying machine learning models across a range of devices and platforms, including desktop computers, mobile devices, and cloud servers. It allows users to define and execute complex mathematical computations on large datasets efficiently, making it ideal for developing deep learning models.

TensorFlow provides a high-level API called Keras, which simplifies the process of building and training deep neural networks, making it accessible to both beginners and experts in the field of deep learning. TensorFlow also provides a range of tools and libraries for data visualization, model debugging, and performance optimization, making it a popular choice for developing state-of-the-art machine learning models.

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# TECHNICAL APPROACH

1. Data Preprocessing: Load the CIFAR-10 dataset. Preprocess the data by scaling the pixel values to the range [0, 1] and one-hot encoding the labels.

2. Model Architecture: Define the architecture of the CNN model, including the number of layers, the number of filters in each layer, the filter sizes, and the activation functions. Compile the model by specifying the optimizer, loss function, and evaluation metric.

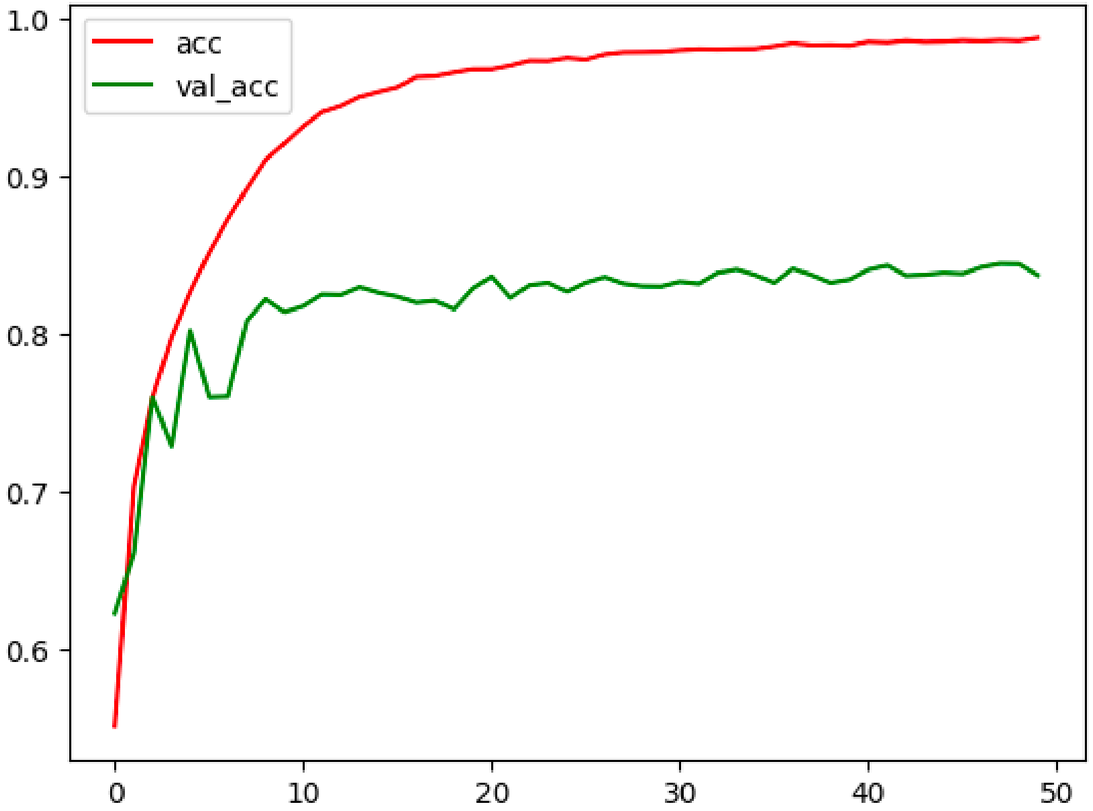
3. Training: Initialize the model's variables. Train the CNN model on the training data. Evaluate the performance of the model on the validation data after each epoch.

4. Testing: Evaluate the final performance of the model on the test data.

5. Hyperparameter Tuning: Experiment with different architectures, such as varying the number of layers, filters, and filter sizes. Adjust hyperparameters, such as learning rate, batch size, and the number of epochs, to improve model performance.

5. Visualization: Visualize the CIFAR-10 images to get a better understanding of the dataset. Plot the training and validation loss and accuracy curves to visualize the model's performance during training.

# Results




Test Accuracy: 0.8220000267028809

Original label is cat and predicted label is cat