# DEEP CONVOLUTIONAL NEURAL NETWORK

# DCNN

KEZIA FOEJIONO

# CONTENT

# DATASET

The CIFAR-10 dataset is a widely used computer vision dataset for image classification. It consists of 60,000 32x32 color images in 10 classes, with 6000 images per class. The classes are airplane, automobile, bird, cat, deer, dog, frog, horse, ship, truck.

The dataset is divided into two parts: a training set of 50,000 images and a test set of 10,000 images. The training set is further divided into five batches of 10,000 images each. The test set contains exactly 1000 randomly-selected images from each class.

# WHY USE NETWORK ARCHITECTURE LENET-5

## Simplicity

LeNet-5 has only five layers, making it simple to implement.

## Efficiency

LeNet-5 has relatively few parameters so it can be trained quickly.

## Robustness to Overfitting

LeNet-5 has a relatively small number of parameters and uses simple regularization techniques such as dropout.

# KEY COMPONENTS OF LENET-5

### CONVOLUTIONAL LAYERS

- LeNet-5's key building block is its use of convolutional layers. In order for convolutional layers to function, the input image must be filtered. A small matrix of weights serves as the filter. The input image is subjected to the weights element by element, and the outcomes are summed to give a single output value. Every component of the input image is subjected to this process again.

### POOLING LAYERS

- By combining the values of nearby pixels, pooling layers seek to compress the size of the feature maps. They also assist in strengthening the network's resistance to noise and overfitting.

### FULLY CONNECTED LAYERS

- The features extracted from the convolutional layers are combined and predictions are made using fully connected layers. It performs its function by producing a single output vector using the convolutional layer output as its input. The projected probability for every class are contained in the output vector.

# LENET-5 ARCHITECTURE

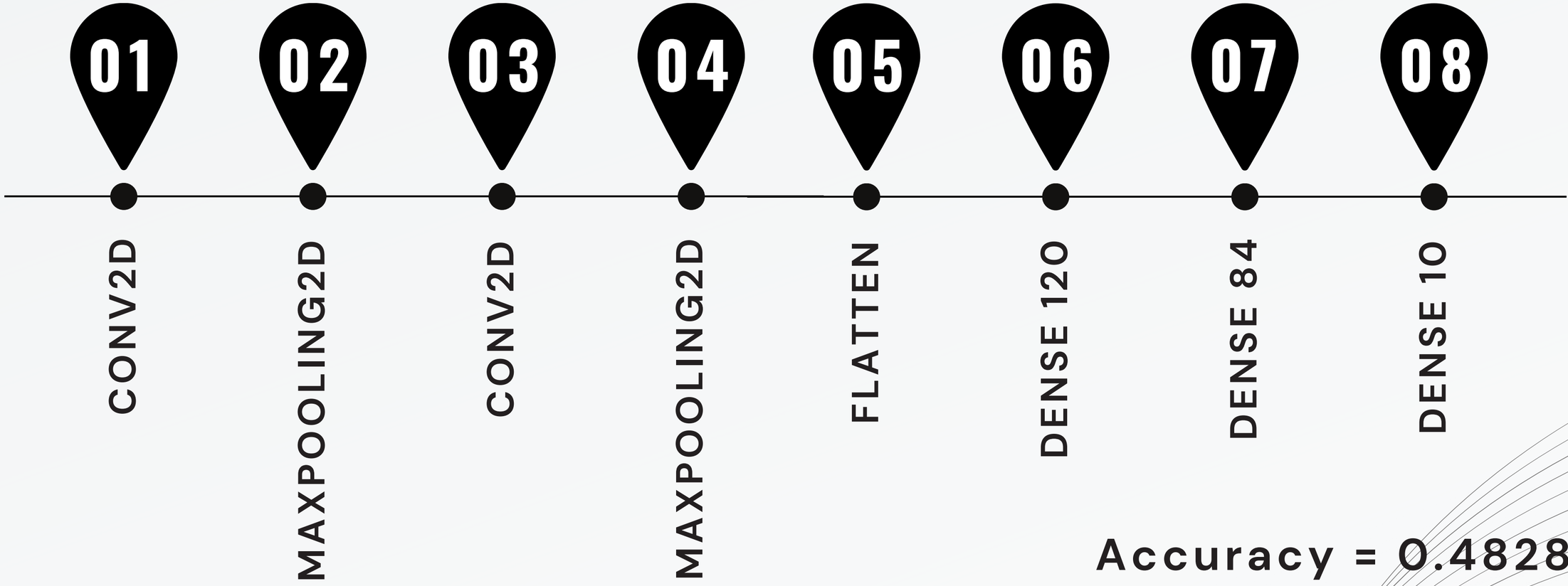
LeNet-5 has five layers:

* Two convolutional layers
* Two pooling layers
* One fully connected layer

The first convolutional layer extracts simple features such as edges and corners. The second convolutional layer extracts more complex features such as shapes and objects. The pooling layers reduce the size of the feature maps and make the network more efficient. The fully connected layer combines the features extracted from the convolutional layers and makes predictions.

# MODEL IMPLEMENTATION

loss = categorical_crossentropy
optimizer = adam
metrics = accuracy
epochs = 5
batch size = 64

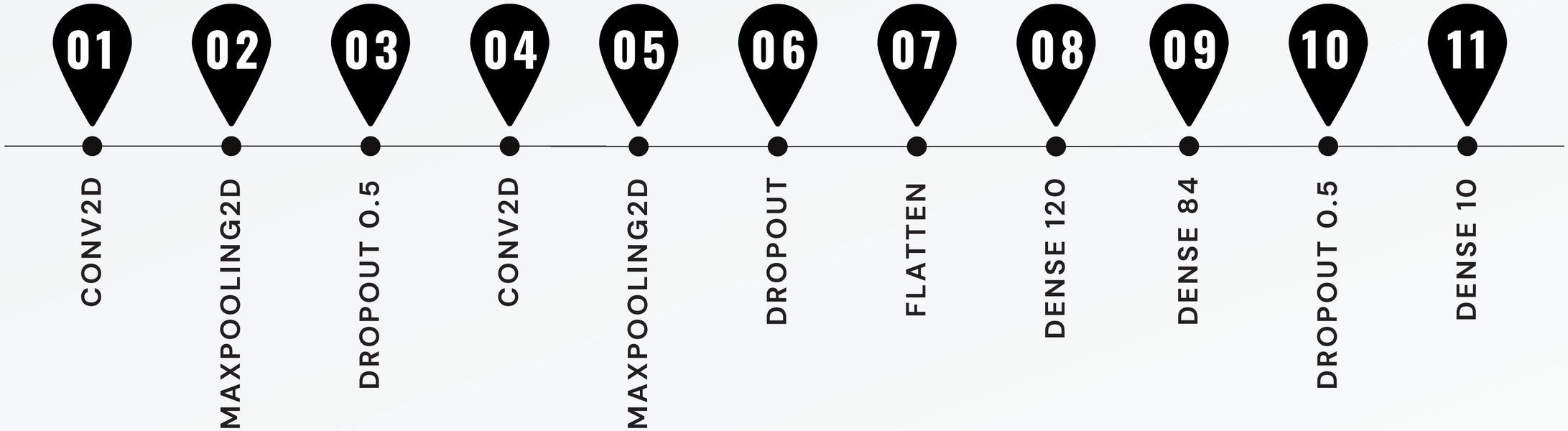



**Accuracy = 0.4828**

**Loss : 1.4563**

# MODEL IMPROVEMENT (I)

loss = categorical_crossentropy
optimizer = adam, learning rate = 0.001
metrics = accuracy
epochs = 5
batch size = 64

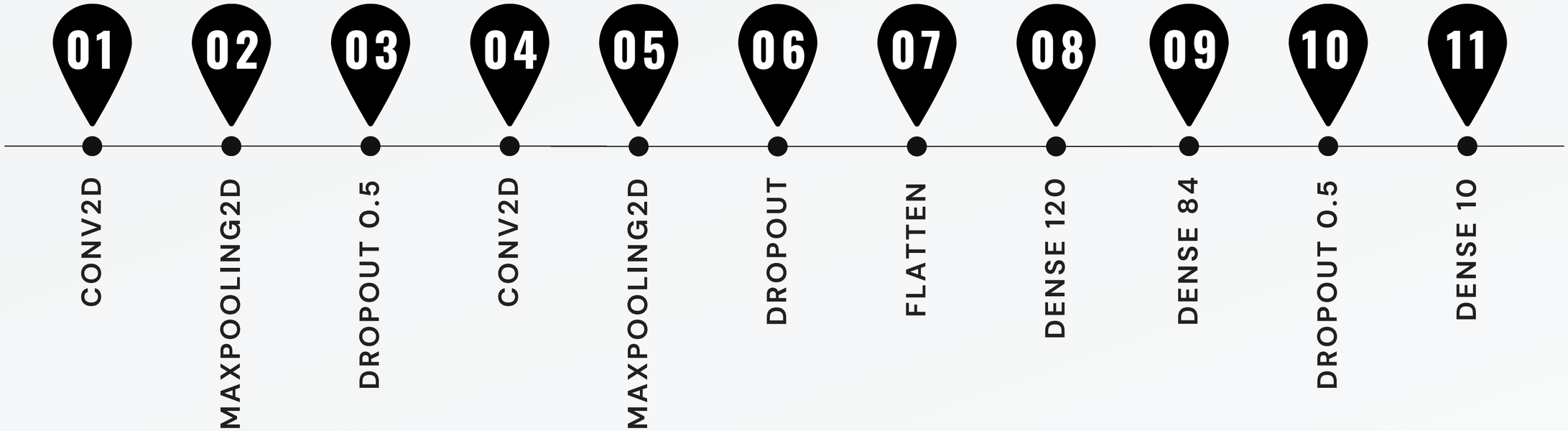



**Accuracy = 0.4906**

**Loss : 1.4746**

# MODEL IMPROVEMENT (II)

loss = categorical_crossentropy
optimizer = adam, learning rate = 0.001
metrics = accuracy
epochs = 50
batch size = 64



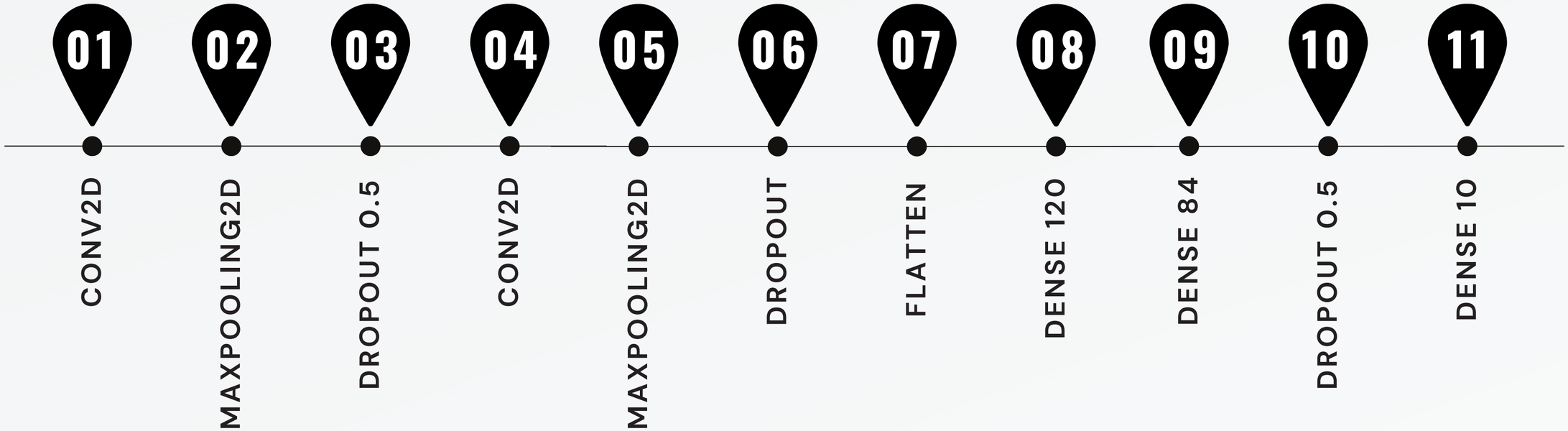

**Accuracy = 0.5857**

**Loss : 1.1754**

# MODEL IMPROVEMENT (III)

**USING DATA AUGMENTATION IMAGEDATAGENERATOR**

loss = categorical_crossentropy
optimizer = adam, learning rate = 0.001
metrics = accuracy
epochs = 50
batch size = 64




**Accuracy = 0.5857**

**Loss : 1.1754**

# CONCLUSION OF MODEL IMPROVEMENT

Based on the results of accuracy and loss evaluation, it is concluded that the best model is a model with dropout regularization, hypermarameter optimizer adam with a learning rate of 0.001 and epoch 50. The use of augmented data does not affect the accuracy and loss values significantly.

INSIGHT

# CHALLENGES

The CIFAR-10 images have greater diversity and detail, which makes it harder for LeNet-5 to learn to effectively categorise them.

LeNet-5 training will take longer on the CIFAR-10 dataset because it is bigger than the MNIST dataset.

Because LeNet-5 is a relatively shallow neural network, it might not have the ability to learn to represent the intricate details in the CIFAR-10 images.

# PRACTICAL APPLICATION OF DCNN

IMAGE CLASSIFICATION

PROJECT 1

OBJECT DETECTION

PROJECT 2

IMAGE SEGMENTATION

PROJECT 3

NATURAL LANGUAGE PROCESSING

PROJECT 4

# THANK YOU

Link code : https://bit.ly/Kezia_Foejiono-DCNN_code