

## **Project : Image classification using CNN with Keras on [CIFAR-10](#)**

### **Problem Statement:**

CIFAR-10 is an established computer-vision dataset used for object recognition. It is a subset of the 80 million tiny images dataset and consists of 60,000 32x32 color images containing one of 10 object classes, with 6000 images per class. The images are full-color RGB, but they are fairly small, only 32 x 32. We developed a classification model with the CIFAR10 dataset using Keras.

### **Approach:**

1. Examine the dataset – There are 50000 training and 10000 test images in the dataset. The images have a structure of (32,32,3) which correspond to (width, height, RGB).
2. Preparing the dataset:
  - a. Normalize the inputs from 0-255 to between 0 and 1 by dividing by 255
  - b. Transfer the labels using one-hot encoding
3. load\_data() function within keras for cifar\_10 dataset, splits the dataset into 50,000 training examples (83.3%) and 10,000 testing examples (16.7%).
4. Create CNN model:

We will use 4/7 convolutional layers, each with filters - kernel size of (3,3) and ReLU/ELU(Exponential Linear Units) activation function, dropout layer(0.2), MaxPooling2d.
5. Train the CNN:

Hyperparameters – Epochs = 25; batch\_size = 64; elu\_alpha = 0.1; optimizer = 'adam'; loss='categorical\_crossentropy'
6. Evaluating the CNN(with and without data)

Plot the training history(loss and accuracy)

### **Experiments and results:**

Below data is for the test set (epochs = 25).

Scenario	CNN layers	Activation func	Data Aug	Accuracy
1	4	ReLU	No	81.22%
2	7	ReLU	No	83.42%
3	4	ELU	No	84.37%
4	7	ELU	No	85.52%
5	7	ELU	Yes	84.89%

### **Conclusions:**

State-of the art solutions for CIFAR-10 hint at better accuracy when,

- a. larger number of convolutional layers are used,
- b. epochs greater than 50 or so,
- c. ELU activation function performs better when more than 5 convolutional layers are used.

In the experiments performed as part of this project, ELU activation function with 7 convolutional layers performed the best with an accuracy of 85.52%. I tried to improve this accuracy by using data augmentation, but that didn't increase the accuracy of the model (84.89%).

## References:

1. Dataset - <https://www.cs.toronto.edu/~kriz/cifar.html>
2. <https://adeshpande3.github.io/A-Beginner%27s-Guide-To-Understanding-Convolutional-Neural-Networks/>
3. <https://adeshpande3.github.io/adeshpande3.github.io/A-Beginner's-Guide-To-Understanding-Convolutional-Neural-Networks-Part-2/>
4. <https://adeshpande3.github.io/adeshpande3.github.io/The-9-Deep-Learning-Papers-You-Need-To-Know-About.html>
5. [https://keras.io/examples/cifar10\\_cnn/](https://keras.io/examples/cifar10_cnn/)