Assignment: Animal Image Classification using CNN

Problem Statement

In this assignment, you will build a Convolutional Neural Network (CNN) to classify animal images using the **Animals10** dataset. The dataset contains 10 classes of animals (e.g. dog, cat, horse, etc.). Students will perform an end-to-end workflow: Exploratory Data Analysis (EDA), preprocessing, baseline CNN model, optimized CNN, and evaluation. The goal is to understand how CNNs work for image classification and how to tune them.

Dataset Link

Animals10 Dataset (Kaggle)

Guidelines for Students

Data Understanding

- Download and inspect the dataset.
- Identify the classes and count the number of images per class.
- Observe image sizes, file types; note any irregularities.

EDA (Exploratory Data Analysis)

- Display sample images from each class.
- Plot class distribution (how many images per animal category).
- Visualize image size distribution (width & height).
- Display data augmentation examples: take one image and show original plus rotated, flipped, zoomed versions side by side.

Preprocessing

- Normalize image pixel values (e.g., scale to [0, 1]).
- Resize images to a consistent target size (e.g. 64×64 or 128×128).
- Split dataset into training and validation sets (e.g., 80/20).
- Use appropriate data augmentation (rotation, zoom, flip).

Model Building

Baseline CNN

- Simple architecture: e.g. Conv2D → MaxPooling → Conv2D → MaxPooling → Flatten → Dense → Output.
- Use categorical crossentropy loss, Adam optimizer.
- Evaluate training & validation accuracy.

Optimized CNN

- Make a deeper network: more Conv2D layers and/or more filters.
- Add Dropout or BatchNormalization.
- Use callbacks such as EarlyStopping and ReduceLROnPlateau to avoid overfitting.
- Experiment with different hyperparameters: number of layers, number of neurons/filters, learning rate, batch size.

Evaluation

- Metrics: Accuracy, Confusion Matrix, Classification Report (Precision, Recall, F1-score).
- Plot training vs validation loss & accuracy curves.

- Show several example predictions: image + true label + predicted label.
- Analyze where the model fails (which classes are misclassified and why).

Expected Outcomes

- Students will learn to explore image datasets, perform visualizations, and understand class imbalances.
- Students will gain skills in image preprocessing + data augmentation.
- Students will be able to build CNNs and tune hyperparameters to improve performance.
- Students will learn to interpret model results, including misclassifications and model generalization.