

Problem definition

We will be using CIFAR-10 dataset. The dataset comprises 60000 color images with a resolution of 32×32 , separated into 10 classes (airplane, automobile, bird, cat, deer, dog, frog, horse, ship, truck), with 6000 images per class. It is already split into 6 batches with 10000 images each.

Therefore, this is a classification problem with 10 classes.

Problem specification

To solve the classification problem, we will use 2 supervised learning algorithms, more specifically an artificial neural network (ANN), and a convolutional neural network (CNN).

Input:

- ANN: vectorized version of the image: $32 \times 32 \times 3 = 3072$ feature vector
- CNN: the actual $32 \times 32 \times 3$ image tensor

Output: 10 values representing class probabilities

Specification of the learning task

Task: 10 class classification

Performance: accuracy, precision, recall, f-score, specificity, AUC, AUPRC

Experience:

- Direct
- Teacher: Labeled data
- The training experience is representative for the performance goal

Target function to be learned

ANN:

$f : \{3072 \text{ dimensional feature vector}\} \rightarrow \{10 \text{ dimensional vector}\}$

The input represents the image in a vectorized form, and the output represent the raw logits for each of the 10 classes that can be further transformed into probabilities using SoftMax.

$3072 = 32 \times 32 \times 3$ (input image shape)

CNN:

$f : \{32 \times 32 \times 3 \text{ image tensor}\} \rightarrow \{10 \text{ dimensional vector}\}$

The input represents the image tensor, and the output is the same as in the case of ANN.