Computer Science and Engineering Artificial Neural Networks & Deep Learning

A.A. 2021-2022

Immagine che contiene testo, segnale

Descrizione generata automaticamente

Homework 1

Image Classification

Group: I\_tre\_neuroni

Authors: Riccardo Campi, Matteo Bianchi, Leonardo Galeazzi

Version: v1.0

Professors: M. Matteucci, G. Boracchi, F. Lattari, E. Lomurno

Date: 28/11/2021

Summary

[1. Introduction 3](#_Toc88783390)

[2. Dataset 3](#_Toc88783391)

[2.1 Class-imbalance problem 3](#_Toc88783392)

[2.1.1 Under-sampling 4](#_Toc88783393)

[2.2 Image data augmentation 4](#_Toc88783394)

[2.2.1 Horizontal and vertical shift augmentation 4](#_Toc88783395)

[2.2.2 Horizontal and vertical flip augmentation 4](#_Toc88783396)

[2.2.3 Random rotation augmentation 4](#_Toc88783397)

[2.2.4 Random zoom augmentation 4](#_Toc88783398)

[2.3 Some useful observation 5](#_Toc88783399)

# Introduction

This is the first Homework of the Artificial Neural Networks and Deep Learning course.

In this homework the groups are required to **classify images of leaves**, which are divided into categories according to the species of the plant to which they belong. Being a classification problem, given an image, the goal is to predict the correct class label.

 

Figure 1: an example of leaf images

# Dataset

The dataset provided by the competition’s promoters is a **folder containing 17 728 files**, grouped into several categories. In particular, there are **14 different types of leaves** with whom is possible to classify the images (Tomato, Orange, Soybean, Grape, Corn, Apple, Peach, Pepper, Potato, Strawberry, Cherry, Squash, Blueberry, Raspberry).

## Class-imbalance problem

Table 1: the class-imbalance problem

As is shown in *Table 1: the class-imbalance problem*, some classes contain **much more images than the others**. In particular, the sum of Tomato, Orange and Soybean represents more than the half of the entire distribution.

This problem is known as **class-imbalance**. Due to this, the fitted model tends to be **biased** towards the majority class data, which leads to **lower accuracy** during the testing phase.

### Under-sampling

One of the most used techniques to **bring the required balance** in the data is called **under-sampling**. In particular, for this homework was used under-sampling to partially solve the problem by removing some files in larger classes .

## Image data augmentation

Image data **augmentation** is a technique that can be used to artificially **expand the size of a training dataset** by creating modified versions of images in the dataset.

Training models on more data can result in more skilful models, and the augmentation techniques can create **variations of the images** that can improve the ability of the fit models to **generalize** what they have learned to new images.

For this homework were used the 4 image data augmentation types:

Immagine che contiene testo

Descrizione generata automaticamente

Figure : the ImageDataGenerator object with augmentation techniques

### Horizontal and vertical shift augmentation

A shift to an image means moving all pixels of the image in one direction, such as horizontally or vertically, while keeping the image dimensions the same.

### Horizontal and vertical flip augmentation

An image flip means reversing the rows or columns of pixels in the case of a vertical or horizontal flip respectively.

### Random rotation augmentation

A rotation augmentation randomly rotates the image clockwise by a given number of degrees from 0 to 360. The rotation will rotate pixels out of the image frame and leave areas of the frame with no pixel data, that were filled using black.

### Random zoom augmentation

A zoom augmentation randomly zooms the image in and either adds new pixel values around the image or interpolates pixel values respectively.

## Some useful observation