Thesis topic:
Data augmentation for computer vision applications robust to common industrial perturbations, application to a person re-identification algorithm.

This thesis is part of a joint project between GIPSA-lab and the company ATOS financed by the Auvergne Rhône Alpes region. The project focuses on a subject that is currently very popular in research, namely the production of reliable data in sufficient quantity for the training of automatic learning systems, in particular deep neural networks, and its application to a particularly difficult computer vision task such as the re-identification of people.

Person reidentification consists in recognizing an individual on a set of video surveillance cameras whose fields of view do not overlap [1, 2]. The recognition is based primarily on characteristics related to clothing because the resolution of the cameras is not sufficient for facial recognition. The difficulties associated with this task are numerous because from one camera to another, there may have been changes in viewpoint, variations in illumination, partial occultation of the person to be tracked... However, great progress has been made in recent years in this field since the introduction of deep learning networks [3, 4]. But then an additional difficulty appeared, namely the lack of training data. Indeed, most of the commonly used databases contain only two instances of each person to be recognized. As a result, the learned network is likely to suffer from overlearning.

In this context, we propose to address these two issues. First, we will address the problem of the robustness of a deep network for the re-identification of persons when it has been learned mainly with data acquired in a controlled environment (laboratory conditions) and when it is implemented in an industrial environment in which many disturbances may appear (blur, change of illumination, compression artifacts, ...). This is a direct continuation of the Cifre thesis of Alfred Laugros, currently in progress and jointly supervised by GIPSA-lab and ATOS, which is studying the robustness of deep networks to this type of perturbations [5, 6] and which has proposed a new metric to define an effective benchmark for testing the robustness of a deep network. In this first part of the project, we will test the robustness of the deep network developed by ATOS [8] using the methods proposed in this thesis.

In a second step, we will address the problem of lack of data. In practice, the dataset is often the limiting element, compromising the realization of a project using machine learning. Unfortunately, collecting large databases of people can be complex (image rights) and laborious (data labeling). We propose to explore the use of generative models to address this issue [7]. These systems are able to generate new samples from existing data sets. For example, one can use a set of 10,000 images of people, to generate new images of people that do not exist, but could ideally be mistaken for real samples. These systems can be used to complete, modify a database, or generate datasets with predefined properties. The collaboration between GIPSA-lab and Atos will aim at demonstrating the interest of using
sample generators in the case of person re-identification. The objective is to study and quantify the performance gains obtained by the use of automatically generated samples.

[8] Matthieu Ospici, Antoine Cecchi, Person re-identification across different datasets with multi-task learning, arXiv, 2018

Profile: engineering or master student with knowledge in machine learning, deep learning and significant experience using Python and libraries associated with deep learning (Keras or Pytorch).

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