Face Detection System for a Digital Camera

Project Context

ProCam S.p.A. is preparing to launch a new compact and affordable digital camera designed for young photography enthusiasts.

The main objective of the product is to enhance the shooting experience, particularly for selfies involving one or multiple people.

To support this goal, the camera must be able to automatically detect faces in an image and adjust its internal settings accordingly.

The Challenge

You have been hired as a Data Scientist to develop a Face Detection system that will assist engineers in automatically optimizing camera settings during selfies.
Your task is to build a pipeline that:
- Identifies faces in an input image
- Returns the coordinates of bounding boxes where faces are detected
- Returns an empty list if no faces are present

This is a Computer Vision problem, specifically focused on Face Detection.

Project Requirements

Objective: Build a face detection system using Scikit-learn.
The pipeline must:
- Take an image as input
- Return a list of bounding box coordinates for detected faces
- Return an empty list if no faces are detected

Constraints

Dataset

- No dataset is provided.
- You must search for a suitable dataset online.
- If necessary, you may build your own dataset.

Pre-trained Models

- The use of pre-trained models is strictly forbidden.
- The face detection model must be trained from scratch using Scikit-learn.

Computational Resources

- You will work in a limited computational environment.
- The model must be optimized to use minimal resources.

Documentation

The solution must be thoroughly documented.

You must clearly explain:
- Algorithm choices
- Preprocessing steps
- Optimization techniques
- Design decisions

Additionally, all external resources used (academic papers, blog posts, GitHub repositories, etc.) must be properly cited.

Literature Review

Since no detailed implementation guidelines are provided, conducting an in-depth literature review is essential.

You are expected to:
- Analyze existing face detection approaches
- Identify techniques compatible with project constraints
- Adapt and justify your selected methodology

Support

This project is complex and requires advanced knowledge in:
- Computer Vision
- Machine Learning

If you encounter difficulties during development, you may rely on the support of your coaches in the Machine Learning Virtual Class on Discord.

Conclusion

Building a face detection system without a pre-built dataset and under limited computational resources is a challenging task that requires strong problem-solving skills and adaptability.

A well-optimized and well-documented pipeline will not only contribute to the successful launch of ProCam's new product but will also represent a significant step forward in your professional growth as a Data Scientist.