KAPERNIKOV

Deep Learning On Hyperspectral Imaging

Machine Vision Internship

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INTRODUCTION

Spectral image processing has potential for numerous industrial applications and a large economic impact by improving quality inspection, increasing automation and the development of innovative applications.

Consequently, spectral imaging has become an active field of research in Flanders, illustrated by the many academic research labs (e.g., KULeuven Mebios, University of Antwerp Visionlab, UGent IPI, ...) and research centers (VITO, imec, Flanders Food, Flanders Make, Sirris, ...) involved in this topic via basis research or hardware design and exploitation. Industrial applications can already be found in food sorting, recycling and remote sensing.

PRACTICAL PURPOSE

Bring spectral processing algorithms from theory to practice, from the proof-of-concept and laboratory stage to practical industrial applications. The envisioned applications almost invariably rely on machine learning and AI methods, and many PoCs and academic results exist. These algorithms were typically trained on data collected in ideal settings by expensive generic hyperspectral imagers. It is often unclear how they would perform with less spectral bands or other optical constraints.
Furthermore, many algorithms only show small improvements at the cost of significantly increased complexity, or are aimed at one very specific data set or problem. Therefore, identifying and implementing robust, existing algorithms that perform well over a wide range of conditions and can be executed fast enough on spectral data in industrial applications will be an important step in this project. Furthermore there is the need to transfer these algorithms from research cameras to simpler industrial cameras or other application scenarios, which requires model transfer strategies (transfer learning) involving a minimal effort for acquiring training samples on the new industrial setup.

The internship

Mission

This internship will allow the intern to work on implementation of AI algorithms for classification, quantification and semantic segmentation.

Context

Spectral imaging allows seeing subtle optical signatures or light wavelengths invisible for human vision. This has industrial applications in waste and food sorting or quality control. Powerful spectral image processing algorithms exist, mostly based on artificial intelligence and deep learning. Unfortunately, these methods are often restricted to laboratory environments with controlled conditions and high-quality spectral imagers.
ThisI project brings these applications from laboratory environments to practical industrial use. To this end, smart task-optimized industrial spectral cameras will be developed with edge processing capabilities, which allows them to run AI-based decision making algorithms on-board. Camera design optimization will be based on design space modeling, camera simulation, and constrained optimization methods. These developments will be demonstrated at the proof-of-concept level by several end-use applications in a real industrial context: The determination of fruit quality parameters in a greenhouse environment, and quality inspection of food products in a free-fall sorting machine.

What we expect

The intern should be motivated to work on computer vision tasks.We expect a good understanding of computer science as a whole, but some competences are required for the task we propose:

- Good experience with Python and/or C++.
- Can work within a Linux environment.
- Eager to learn and can easily pick up new skills.
- Experience with deep learning algorithms/frameworks