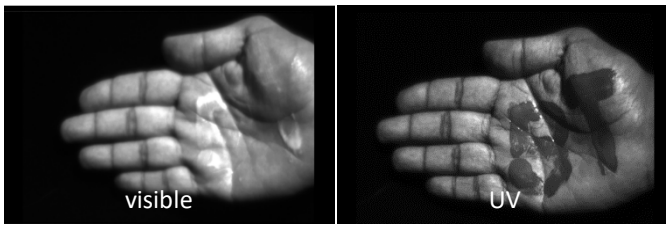
GhostCam : Making the invisible visible….

Context:

Human eye is only sensitive to a small spectrum of light radiation (400-800nm). However, in many cases, perceiving a wider spectrum can be a real opportunity to better understand a scene. Indeed, whether it is for the measurement of physical parameters, or the tracking of targets in poor visibility conditions, additional information on different spectra is a real added value. Nevertheless, some companies offer multi-modal cameras that combine either adaptive filters with a broadband sensor or the combination of several sensors (visible, IR,...). But these systems are passive and only deliver one or more images in different frequency bands.

Examples of ultra-violet or Infrared imaging



Sun creme in UV (right). In integral light the sun creme is invisible (left)

The visible light image (left) shows mostly fog; the SWIR image (right) reveals detail through the fog. SWIR technology detects reflected light at wavelengths that the human eye cannot see, in bands on the electromagnetic spectrum between the visible and thermal. (https://spinoff.nasa.gov/Spinoff2010/ip_2.html)

In this thesis, we aim to develop a smart camera integrating several sensors (Visible, IR, UV) as well as a processing unit to analyze in real time the different spectral images. The objective is to design an intelligent camera with a perception strategy according to the scene and conditions of capture. The first of the scientific challenges of this thesis will be the fusion of images obtained from different sensors with different resolutions. To achieve this, we could consider deep-learning methods that have shown their effectiveness. Unfortunately, these techniques are computationally intensive and are often not compliant with the constraints of an embedded system. This will be the second scientific challenge of this thesis. The final envisaged prototype looks like this type of camera (figure on right).

Keywords: Multimodal vision, Deep learning, Embedded system, Data fusion

Laboratory:

This thesis will take place at the Institut Pascal in Clermont-Ferrand and more precisely within the DREAM team (dream.ispr-ip.fr). This team is specialized in embedded vision system integration and has a good skill in deep neural network integration on embedded targets.

Profile:

- Master in the field of Computer Science, Computer Engineering, Electrical Engineering, Mathematics or related field;
- Technical assets: Exposure to image processing and computer vision (real-time systems is a plus),
- Experience with python (Tensorflow/Pytorch on GPUs) and VHDL,
- Knowledge about neural networks and deep learning,
- Javascript/Typescript, Linux, source-code management (git).
- Good communications skills, both written (English) and oral (English or French).

We offer:

- A research position in a dynamic environment (https://sites.uclouvain.be/ispgroup/Main/HomePage and https://pilab.be/), working on leading-edge technologies, with numerous international contacts.
- The opportunity to regularly interact with other researchers investigating CNNs for a variety of applications (biomedical, industrial vision).
- A three-year contract to be started mandatorily September 2019
- The University offers a fixed term contract up to 3 years in total, full time (40 hrs/week). The candidates have a student status (in the framework of a 36 months PhD studies program).

Salary and Social Security

- Salary: 1500€ Net/Month after tax.
- You benefit from social security for the employed. You and your employer pay your contributions that are directly deducted from your salary each month.
- This position is funded by the region "Auvergne Rhône-Alpes" and the European Regional Development Fund (ERDF)

Further Information

Interested candidates should send their application in English and the application should include the following information:

- A full CV
- List of two referees, including details (name and email address, etc)
- Publication list
- Transcript of all modules and results from university-level courses taken
- Research statement and topics of particular interest to the candidate (300 words).

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