

HIGH DYNAMIC RANGE VIDEO ANALYSIS FOR VIDEO SURVEILLANCE

Many high-level computer vision algorithms such as object and face recognition, tracking, classification, etc., are extremely sensitive to changes in the appearance of a scene produced by **drastic lighting variations**. These occur often in practical applications, e.g., day/night changes in outdoor recognition tasks; stark shadows created by objects in the scene; varying meteorological and geographical conditions in video surveillance applications employing drones; specular reflections caused by specific materials in the scene; and so on. Not surprisingly, coping with extreme lighting changes has attracted a lot of attention in the computer vision community in the past few years, where traditional approaches such as local feature extraction have been refined and empowered by a massive use of machine learning techniques. However, these methods systematically fail when their input lacks sufficient information, e.g., due to acquisition noise or saturation resulting in under-exposed or over-exposed areas of the video.

In this PhD thesis, we consider an alternative and promising approach, based on using **High Dynamic Range (HDR) video** for computer vision tasks. Indeed, HDR has the potential to overcome the instability due to lighting changes, as it can capture simultaneously details in both very bright and very dark regions and visually reproduce the whole range of luminance present in the original scene. The goal of the Ph.D. thesis is to study and test novel tools for the HDR video processing chain, when this is oriented to perform security-related computer vision tasks. Specifically, the Ph.D. candidate will explore task-optimized tone mapping operators for both compression and pre-processing of HDR video that will be analyzed by a computer vision algorithm. A special attention will be given to recent techniques like DNNs (deep neural networks) and GANs (generative adversarial networks) to design new video-processing pipelines. This Ph.D. research will be conducted at the **Laboratory of Signals and Systems (L2S), CNRS, CentraleSupélec, Université Paris-Sud, France**, in collaboration with the **WMG, University of Warwick, UK**. In particular, the candidate will build on initial work done in the two labs on visual feature extraction and tone mapping design. In addition, he/she will get access to specialized hardware such as an HDR display, novel HDR video systems and photometric probes. This research is expected to have a large impact on security related computer vision applications, and to significantly improve state-of-the-art performance in the detection of events or menaces in challenging environments, as well as for recognition and identification systems.

Keywords: High Dynamic Range, video surveillance, machine learning

Profile and skills required

We look for a candidate with **European or Swiss nationality**, having obtained a master or an equivalent diploma in engineering or applied math. The ideal candidate has an excellent record of results obtained during his/her studies, as well as solid bases in signal and image processing, machine learning and/or computer vision. A strong expertise with programming languages such as C/C++, Python and Matlab is required, as well as proficiency in English (both written and spoken). Knowledge of French is a plus.

Post description

The candidate will have a 3 year Ph.D. contract at L2S lab, France, and will have the opportunity to spend short research stays in the WMG partner lab, UK.

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