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# Sensitivity of different methods for simultaneous evaluation of emissivity and temperature through multispectral infrared thermography simulation

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Latest improvements on uncooled infrared cameras has brought new opportunities for noninvasive diagnostics in the Civil Engineering's field. However, the main challenge for using infrared cameras as a thermal monitoring tool is to convert the radiative fluxes received by the infrared camera to temperature. In fact, such conversion faces the lack of knowledge of the radiatives properties of the targeted scene. In particular, the emissivity of the targeted object plays a major role in this conversion process. As a consequence, differents emissivity and temperature separation methods have been developed in the literature. However, those methods have been subjected to different controversy, due to their range of application for some or their material sensibility for others [2]. Moreover, some methods have been developed in the airborne or satellite context and the inherein hypothesis may not be applicable for in-situ measurements at ground level. The objective of this study is to compare these emissivity and temperature separation methods and their usage for in-situ measurements.

In order to compare different emissivity and temperature separation methods, the radiative balance of a virtual target made of 4 distinct materials with known radiatives properties have been computed through a simulation tool developed in our laboratory. This simulation tool developed in C++ with the OpenGL API computes the radiative balance of a 3D scene through the progressive radiosity algorithm, implemented on the Graphics Processing Unit (GPU). An implementation of the SMARTS2 [1] algorithm enables the software to modelize the sky and sun contributions into the scene in order to consider in-situ measurements. Moreover, a physically based sensor model has been implemented to consider different noises during the acquisition
process.

Once the images of the target have been simulated, the different emissivity and temperature separation methods are applied to retrieve back the true temperature and true emissivity of the materials in the scene based on the images measurements. The radiative measurement model and hypothesis considered in this study will be firstly presented. Then, the target and the simulation tool is introduced and the different methods for retrieving the emissivity and the temperature along with their performances are presented. Finally, perspectives around the development of new methods for emissivity and temperature separation are enonciated.

References

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