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

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

This study focuses on the simultaneous evaluation of temperature and emissivity with multispectral infrared thermography (IRT). It leans on the study and development of an IRT simulator able to address 3D scene in static or dynamic configuration. The sensitivity of 4 different temperature and emissivity joint estimation methods are then evaluated.

**IRT Simulator through the radiosity method**

**View factor**

Geometrical coefficient for radiative exchange between two diffuse elements

\[
F_{1,2} = \int_{A_2} \frac{\cos(\vartheta_1) \cos(\vartheta_2)}{r^2} dA_1 dA_2
\]

**Radiosity equation**

\[
B_{k,\Delta \lambda_i} = M_{k,\Delta \lambda_i} + \sum_{j=1,j \neq k}^{N} V_{kj} F_{kj} B_{j,\Delta \lambda_i}
\]

**Conclusion and perspectives**

- User-friendly graphical interface
- Python interpreter for user-case scenarios
- Geometrical coefficient for radiative exchange between two diffuse elements

**3D Model**

A target with 4 different materials properties

**Fig. 2:** (a) Spectral emissivity distribution of 4 artificial materials for the target in the 7.5μm – 13μm bandwidth

**Fig. 3:** Temperature estimation for the 4 different methods

**Fig. 4:** Emissivity estimation for the 4 different methods

**Results**

- Non linear optimization
- Multi-temperature
- Bayesian (Monte-Carlo Markov Chain (MCMC))

**Bibliography**


