



Título de la Tesis Doctoral: Integrating Hyperspectral Imaging and Photogrammetry for the Generation of Spectrally Enriched 3D Models

Director/es: José Luís Lerma García

Resumen:

This research investigates a new approach for integrating hyperspectral imaging with photogrammetric reconstruction to produce 3D models that contain both geometric precision and rich spectral information. The central idea is to use the visible range of hyperspectral imagery as the photogrammetric reference for generating an accurate 3D model, and then to remap the remaining spectral bands back into the model based on their pixel-level correspondences.

Conventional photogrammetry captures structure and color through traditional RGB imagery but lacks detailed spectral information. Hyperspectral cameras, in contrast, capture reflectance across hundreds of narrow bands, offering material-specific insights. By aligning hyperspectral data spatially and geometrically through photogrammetric processing, this research seeks to bridge the gap between geometry and spectral analysis.

The workflow will first employ the visible bands of the hyperspectral cube to reconstruct geometry using standard photogrammetric methods. Once the camera poses and dense point cloud are established, the corresponding pixels from all spectral bands will be projected onto the 3D geometry, assigning a full spectral signature to each point. The result will be a spectrally-enhanced point cloud and textured mesh where each surface element retains its reflectance spectrum.

This method has transformative potential for cultural heritage documentation, remote sensing, and material sciences, enabling non-destructive visualization and analysis of surfaces beyond visible light. The project will focus on developing robust co-registration, radiometric calibration, and data fusion algorithms to ensure spatial accuracy and spectral fidelity, resulting in a replicable framework for high-dimensional 3D spectral reconstruction.

Medios disponibles: This research is supported by Global Digital Heritage (GDH), which will provide access to hyperspectral and photogrammetric camera systems, UAV platforms, and high-performance computing resources for data processing and analysis. GDH's expertise and infrastructure ensure full technical capacity for spectral data acquisition, 3D reconstruction, and large-scale computational workflows.

Bibliografía:

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