Abstract

This Dissertation refers to the Computer Vision field; namely, to the Three-Dimensional (3D) Reconstruction. There has been considerable investment made by the scientific community, specially in the recent decades, in developing computational methodologies for obtaining the 3D shape of real structures, from acquired images of the same ones. Applications of these methodologies, range several fields, like industry, medicine, virtual reality, security, among others.

In the work developed in this Dissertation two main methodologies were studied, which are commonly used in 3D structure reconstruction: SFM - Structure From Motion and GVC - Generalized Voxel Coloring, both inserted in the Active Vision techniques group. The main purpose of this study was to consider methodologies that allow obtaining the 3D shape of structures, without imposing several restrictions on the relative motion between the camera(s) used and the structure.

SFM methodology uses the referred relative motion, to make assumptions about the 3D shape of the structure: by knowing the trajectories of structure’s points in the image’s plain, this method allows determining the 3D shape and motion that better describes most of the trajectories of those points.

GVC methodology belongs to the 3D structure volumetric reconstruction methods. Having as starting point a set of correctly calibrated images, this method reconstructs the 3D shape of the structure being analyzed, as well as the coloration of reconstructed 3D geometrical model.

Because the main purpose of this project was to develop a 3D human body external structures reconstruction, two computational platforms were developed: Stereo Vision and 3D Builder. These platforms allow the 3D reconstruction of structures using SFM and GVC methodologies, in which several functions where integrated: image strong points detection and matching, epipolar geometry determination, image rectification, camera calibration, image segmentation, volumetric reconstruction and polygonal mesh construction and smoothing.