

Automatic Recovery of the 3D Structure of a Scene Observed with a "Handheld Camera"

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Abstract

The methods presented in this project [1, 2] concern the automatic recovery of the 3D structure of a scene which has been filmed by a camera, for instance a hand-held camcorder. Specifically, the methods developed allow for a fully automatic reconstruction of an observed scene, the "user" being required only to acquire the images of the scene.

The problem is not a new one, and has been known since the beginning of the 1980's as the "Structure from Motion" (SfM) problem. However, few, if any, industrially applicable solutions have been provided so far, which is due to several reasons: First of all, the SfM-field is intimately related to a broad range of advanced mathematical fields, in particular projective geometry, optimisation, matrix theory, functional analysis and more, appealing primarily to researchers within the more theoretical branches of mathematics. On the other hand, real world systems get highly complex and the applications have to take a lot of different exceptions, also known as "degenerate configurations", into account. Thus, in order to get a system to work in production, substantial design and engineering efforts have to be invested in the process.

The specific advantage of the present system is its ability to handle an unprecedented amount of different types of scenes within a unified framework, in particular the ultimately difficult case of complex indoor environments. Generally speaking, this opens up for a broad range of applications which we denote by the common term "virtualisation".

References

- [1] Nicolas Guilbert, "A Systems Approach to the Structure from Motion Problem", Licentiate Thesis, Lund Institute of Technology, 2004.
- [2] Code Download Area: <http://www.maths.lth.se/~nicolas/playground.html>