

A COMPUTER ANALYSIS OF STRUCTURES IN IMAGE SEQUENCES: METHODS AND APPLICATIONS

João Manuel R. S. Tavares

University of Porto, Faculty of Engineering, Dep. of Mechanical Eng. and Industrial Management
Inst. of Mechanical Eng. and Industrial Management, Lab. of Exp. Mechanics and New Materials

Rua Dr. Roberto Frias, s/n

4200-465 Porto

PORTUGAL

Email: tavares@fe.up.pt, Url: www.fe.up.pt/~tavares

ABSTRACT

The computer analysis of structures in image sequences is a very complex and challenging matter as it usually involves automatic tasks for detection, matching, tracking, motion analysis, deformation estimation as well as 3D shape reconstruction. Despite its inherent difficulties, this computational analysis provides a wide range of important applications in our society such as is the case of medical diagnosis systems, surveillance systems, tools used to develop virtual reality environments, biomechanical modeling, in addition to simulation and bioengineering systems.

As a result of the extent of the purposes of this vast process, several difficulties can arise, such as is the case of the simultaneous analysis of manifold structures, cases of temporary occlusion of the structure from the image scene or even its definitive disappearance, alterations of the viewpoints which have been taken into consideration or alternatively, of the illumination conditions, or even of the non-rigid deformations that non-rigid structures may undergo along image sequences.

In this presentation, we will provide an overview of several of the methods that we have developed in order to analyze structures in image sequences; more specifically, those which are used for the segmentation, tracking and matching of images, as well as the estimation of the deformation involved between images and the 3D shape reconstruction from images. Some application examples will be presented which take into consideration medical, face, traffic and surveillance images amongst others.

Keywords: Image Segmentation, Motion Tracking and Analysis, Matching, 3D Reconstruction, Deformable Templates, Active Contours, Point Distribution Models, Level Set Methods, Stochastic Filters, Volumetric Methods