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4ᵗʰ International Conference and Expo on

Computer Graphics & Animation

September 25-26, 2017   Berlin, Germany

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3D shape matching for object modelling

3D data can be easily captured nowadays using the latest laser scanners such as Microsoft Kinect. Since the scanners have limited field of view and one part of an object may occlude another, the captured data can only cover part of the object of interest and is usually described in the local scanner centred coordinate system. This means that multiple datasets must be captured from different viewpoints. To fuse information in these datasets, they must be registered into the same coordinate system for such applications as object modelling and animation. The purpose of scan registration is to estimate an underlying transformation so that one scan can be brought into the best possible alignment with another. To this end, various techniques have been proposed, in which the feature extraction and matching (FEM) is promising due to its wide applicability to different datasets subject to different sizes of overlap, geometry, transformation, imaging noise, and clutters. In this case, the established point matches usually include a large proportion of false ones. This talk will focus on how to estimate the reliability of such point matches from which the best possible underlying transformation will be estimated. To this end, I will first show some example 3D data captured by different scanners, from which some issues can be identified that the registration of multiple scans is challenging. Then I will review the main techniques in the literature. Inspired by the AdaBoost learning techniques, various novel algorithms will be proposed, discussed and reviewed. These techniques are mainly based on the real and gentle AdaBoost respectively and include several steps: weight initialization, underlying transformation estimation in the weighted least squares sense, estimation of the average and variance of the errors of all the point matches, error normalization, and weight update and learning. Such steps are iterated until either the average error is small enough or the maximum number of iterations has been reached. Finally, the underlying transformation is re-estimated in the weighted least squares sense using the weights estimated. I will thirdly validate the proposed algorithms using various datasets captured using Minolta Vivid 700, Technical Arts 100X, and Microsoft Kinect and show the experimental results. To show the robustness of the proposed techniques different FEM methods will also be considered for the establishment of the potential point matches: signature of histograms of orientations (SHOT) and unique shape context (USC), for example. Finally, I will conclude the talk and indicate some future work.

Biography

Yonghuai Liu is Senior Lecturer in Aberystwyth University. He completed his PhD (1993-1997) and PhD (1997-2000) respectively from Northwestern Polytechnical University, P R China and The University of Hull, UK. In 1997, during his PhD, he received an Overseas Research Students (ORS) award. He also Editorial Board Member of *American Journal of Educational Research* published by Science and Education: an open access and academic publisher from 2015 and Associate Editor in several journals. His research interests, computer graphics, pattern recognition, visualization, robotics & automation, 3D imaging, analysis and its applications.

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J Comput Eng Inf Technol, an open access journal
ISSN: 2324-9307

Computer Graphics 2017
September 25-26, 2017

Volume 6, Issue 6 (Suppl)

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