Towards a Robust Patch Based Multi-View Stereo Technique for Textureless and Occluded 3D Reconstruction

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Abstract : Patch based reconstruction methods have been and still are one of the top performing approaches to 3D reconstruction to date. Their local approach to refining the position and orientation of a patch, free of global minimisation and independent of surface smoothness, make patch based methods extremely powerful in recovering fine grained detail of an objects surface. However, patch based approaches still fail to faithfully reconstruct textureless or highly occluded surface regions thus though performing well under lab conditions, deteriorate in industrial or real world situations. They are also computationally expensive. Current patch based methods generate point clouds with holes in texturesless or occluded regions that require expensive energy minimisation techniques to fill and interpolate a high fidelity reconstruction. Such shortcomings hinder the adaptation of the methods for industrial applications where object surfaces are often highly textureless and the speed of reconstruction is an important factor. This paper presents on-going work towards a multi-resolution approach to address the problems, utilizing particle swarm optimisation to reconstruct high fidelity geometry, and increasing robustness to textureless features through an adapted approach to the normalised cross correlation. The work also aims to speed up the reconstruction using advances in GPU technologies and remove the need for costly initialization and expansion. Through the combination of these enhancements, it is the intention of this work to create denser patch clouds even in textureless regions within a reasonable time. Initial results show the potential of such an approach to construct denser point clouds with a comparable accuracy to that of the current top-performing algorithms.

Keywords : 3D reconstruction, multiview stereo, particle swarm optimisation, photo consistency

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