3D COLOUR MESH DETAIL ENHANCEMENT DRIVEN FROM 2D TEXTURE EDGE INFORMATION

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Abstract

This work details the use of information commonly contained within the 2D texture map, of a colour 3D capture, as a driver to add additional geometric detail to the underlying 3D shape mesh. A novel combination of established 2D image processing operations and uniform mesh re-sampling facilitates the recovery of additional surface relief detail information which is then added a displacement bump map to the underlying mesh. The technique is demonstrated by enhancing shape from silhouette derived 3D surface captures.

1 Introduction

Several common low-cost 3D capture approaches now capture colour surface information in addition to the underlying 3D surface geometry at a given level of detail [e.g. 3]. However, the resulting 2D texture map often contains considerably more localised surface relief detail than the actual resulting 3D shape mesh (Fig. 1). Recent work on surface texturing has concentrated solely on texturing surfaces with 2D information [1] or cases where explicit 3D information is present [2]. Here we enhance 3D surface models generated via a low-cost shape from silhouette approach (based on [3]) using additional surface detail present in the corresponding 2D texture map.

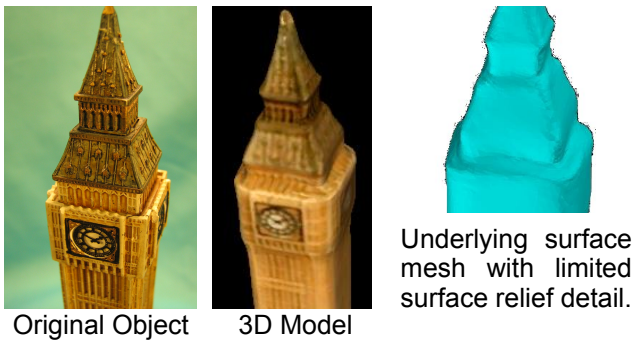

Figure 1: Colour 3D model and corresponding surface mesh.

2 2D Texture Detail Extraction

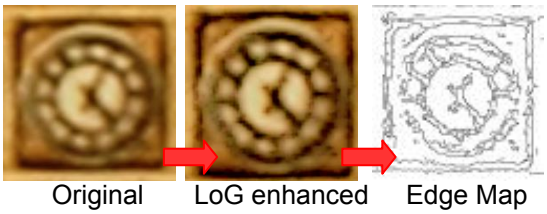

Figure 2: Detail enhancement and subsequent extraction.

A key principle of this work is the extraction of detail present in the 2D texture map. Here, as a simple exemplar, we extract the key edge information present in the texture map via a two stage process of edge enhancement (Laplacian of Gaussian subtraction) and extraction via Canny (Fig. 2).

3 3D Mesh Processing

Several steps of mesh processing facilitate the addition of displacement mapping corresponding to this extracted texture detail. The captured mesh is first re-sampled to a uniform polygon size at a sample density corresponding to the required level of accuracy in detail addition. To prevent the over-enhancement of existing 3D detail, blade edge detection is performed on this re-sampled mesh to identify areas where detail addition will be suppressed. The extracted 2D texture detail is then added to the remaining areas as a weighted vertex displacement (in the normal direction) at corresponding mesh positions. Mild smoothing then aims to remove any texture alignment artefacts introduced.

4 Results

We present two examples of this technique (Fig. 3 & 4) to illustrate its application to real 3D surface models .

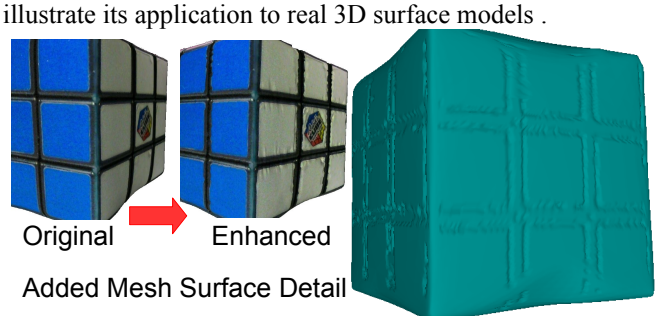

Figure 3: Enhanced surface detail on cube example

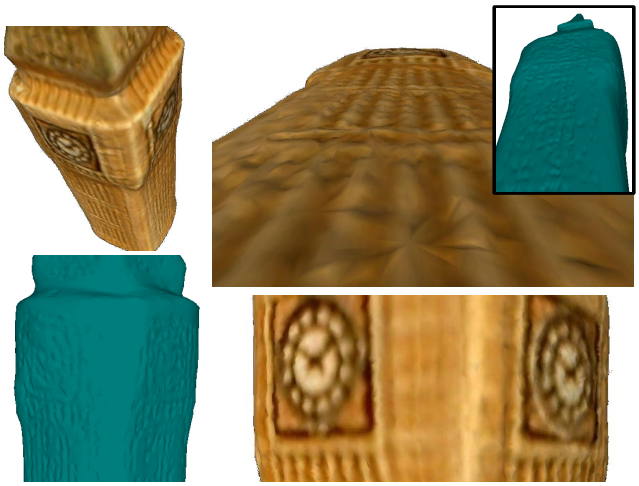

Figure 4: Enhanced surface detail on tower example

5 Conclusions & Future Work

From the results we can see successfully enhancement of 3D surface detail though the use of this technique although some mild noise artefacts remain (Fig. 3 & 4).

Further work will investigate geometrically driven 2D information extraction via robust shape fitting techniques in-conjunction with the automatic recovery of the relative displacement direction and the consideration of non-geometric natural texture surface relief detail.

References

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