3D Shape Search

Background

Models of 3D shape are very important in the modern world. They are used in product design and manufacture, 3D printing, computer graphics and object recognition. Typically, a 3D object is represented by a triangulated mesh describing the object (Figure 1). There exist large databases of such objects, for example on the Web, in the product catalogues of companies, and in libraries such as Google's 3Dwarehouse. 3D models can also be rapidly created by hand-held scanners and even from multiple photographs. We would like to be able to search these collections by similarity and shape features in the same way that we can search the Web for related pages.

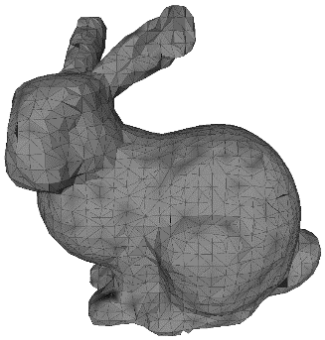

Figure 1

Project

Previous work on this problem at York [1] has shown how shape signatures can be extracted from both surface meshes and point clouds representing 3D shape. These signatures are related to the way waves travel across the surface of the object, and we have shown that these have state-of-the-art performance on shape databases such as SHREC [2,3]. The framework is flexible but so far has been aimed only at articulated objects.

The goal of the research is to extend this framework to address the general problem of searching for a particular object in a 3D database, i.e. to create a 'shape google' where we can query an object model and recover the most similar objects according to their shape and other criteria such as the important of particular types of variation. There are a number of ways the framework can be improved to meet this goal, for example by addressing the problem of pose variation and by including some machine learning element to learn feature variations.

In summary, the aims of the PhD are

- Develop a 'shape google' for general purpose shape recovery from a database.
- Extend the shape signature framework to understand pose variation, articulation and noise.
- Introduce machine learning to the problem to improve shape recall.

[1] **Feature Encoding of Spectral Signatures for 3D Non-Rigid Shape Retrieval**, FA Limberger, RC Wilson *Proceedings of the British Machine Vision Conference*, 56.1-56.13

[2] **SHREC 2010 : robust large-scale shape retrieval benchmark**, AM Bronstein et al, *3DOR* 2010.

[3] **Shrec'12 track: Generic 3d shape retrieval**, B Li et al., *3DOR* 2012,