

Project Proposal

1. Project Title

A search engine for 3D models of museum artefacts

2. Background – the DigiFact Project

The DigiFact (Digitization of Museum Artefacts Facilitating Search and Retrieval) project is an ongoing project within the AIC/CDVP¹ at Dublin City University. The project aims to develop a low-cost solution for digitization and indexing of multiple views of museum artefacts. It has the support of both the National Museum of Ireland (NMI) and Mitsubishi Electric Research Labs (MERL) in Cambridge, Mass, U.S.A who are developing complementary technology. Originally, the project was funded by Enterprise Ireland and this allowed 2D image-based indexing of objects and the development of a search and retrieval system on top of this. Most recently, the project has been awarded funding from the Dept of Arts, Sports and Tourism with a view to extending the work to full 3D models of museum artefacts. This will necessitate a new capture rig (currently being built in DCU) to generate full 3D models from 2D imagery and an appropriate indexing mechanism for supporting search and retrieval of 3D models.

3. Project Description

For my project, I propose to develop the 3D search engine that will be at the core of the web-based retrieval and inspection demonstration system that is one of the key objectives of DigiFact. The retrieval engine I develop will be integrated into the overall system being built and will fulfil the following requirements:

3D model representation

feature extraction from 3D models for indexing

similarity calculation between model feature vectors

calculation of similarity matrix for a large number of 3D models

real-time query-by-example: within existing similarity matrix, but also based on a previously unseen 3D model

integration of search engine into the existing DigiFact system: importing object models output from the capture rig (and other sources), interfacing with the existing GUI regarding query formation (e.g. query by sketch) and search result browsing.

Where possible, the project will leverage existing work in 3D object indexing for search & retrieval (see list of existing resources).

4. Workplan

The main steps in the work-plan are outlined below. Since the capture rig will not be operational until Jan 2007, initial work on the project will use freely available 3D model libraries (see list of existing resources). This will allow the indexing techniques to be developed without having to wait on the work in DCU. These can then be applied to real models generated with the DCU capture rig later in the project. Integration of the developed search engine with the DigiFact system is targeted for later in the project, but the design of all components will bear this in mind from the start. This will require a regular dialogue with the researchers in DCU working on the system.

Deliverables

1. Literature survey (identified online resources are a good starting point for research papers, technical reports & test data)
2. Identification of a suitable 3D model indexing method/algorithm
3. Identification and gathering of freely available test data sets and specification of a ground truth based on this

¹ Adaptive Information Cluster/Centre for Digital Video Processing

4. Initial implementation and testing of chosen method/algorithm (algorithm testing using ground truth)
5. Front-end GUI design for query-by-example of both previously seen and unseen 3D models
6. Expert user testing to gather feedback on initial implementation (testing using real users)
7. Second implementation based on user feedback
8. Initial integration into DigiFact system.

Resources to be used as starting point

3D Model Search Engine, Princeton Shape Retrieval and Analysis Group

<http://shape.cs.princeton.edu/search.html>

3D Shape Retrieval Engine, Utrecht University

<http://www.cs.uu.nl/centers/give/multimedia/>

3D geometry search technology, IBM Research

http://www.trl.ibm.com/projects/3dweb/SimSearch_e.htm