3DSEARCH

INDEX

TOPIC **PAGE NO.**

1. **Intoduction……………………………………………………….**
2. **2D vs 3D model………………………………………………….**
3. **Search Engine/Searching……………………………………….**
4. **3d model search engines……………………………………….**
5. **Query interface in 3d searching……………………………….**
6. **Types of 3d searching………………………………………….**

6.1 Searching by text only……………………….

6.2 Searching by shape…………………………..

6.3 Searching by 3d model……………………….

6.3.1 Search result by previous search………

6.4 Searching by combined queries…………………………….

7. Query processing performance…………………………………

8. Matching method……………………………………………….

9. Example of 3d Searching……………………………………….

10. Advantages of 3d Searching……………………………………

11. Disadvantages of 3d Searching……………………………….

12. Conclusion……………………………………………………….

13. Refrences……………………………………………………….

Introduction

3D SEARCHING

Advances in computing power combined with interactive modeling software, which lets users create images as queries for searches, have made 3Dsearch technology possible.

Methodology used involves the following steps

" Query formulation
" Search process
" Search result

QUERY FORMULATION

True 3D search systems offer two principal ways to formulate a query: Users can select objects from a catalog of images based on product groupings, such as gears or sofas; or they can utilize a drawing program to create a picture of the object they are looking for. or example, Princeton's 3D search engine uses an application to let users draw a 2D or 3D representation of the object they want to find.

The above picture shows the query interface of a 3D search system.

SEARCH PROCESS

The 3D-search system uses algorithms to convert the selected or drawn image-based query into a mathematical model that describes the features of the object being sought. This converts drawings and objects into a form that computers can work with. The search system then compares the mathematical description of the drawn or selected object to those of 3D objects stored in a database, looking for similarities in the described features.

The key to the way computer programs look for 3D objects is the voxel (volume pixel). A voxel is a set of graphical data-such as position, color, and density-that defines the smallest cubeshaped building block of a 3D image. Computers can display 3D images only in two dimensions. To do this, 3D rendering software takes an object and slices it into 2D cross sections. The cross sections consist of pixels (picture elements), which are single points in a 2D image. To render the 3D image on a 2D screen, the computer determines how to display the 2D cross sections stacked on top of each other, using the applicable interpixel and interslice distances to position them properly. The computer interpolates data to fill in interslice gaps and create a solid image.

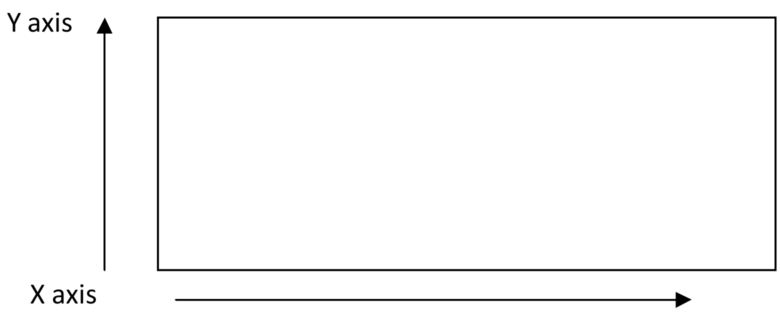
3D MODEL

Non-textual data type is the 3D model, the basic building block of many operations in 3D computer graphics applications. 3D models are used in, for example, Computer Aided Design (CAD): a designer uses a 3D modeling tool to create a 3D representation (i.e. a 3D model) of a new product. This model can then for example be visualized in different colors and lighting conditions. It can also serve as a blueprint for guiding the subsequent manufacturing process. Because creating such a high quality 3D model takes a lot of time and effort, it would be beneficial to have the option of re-using and possibly adapting existing 3D models.

2. 2D model vs 3D model

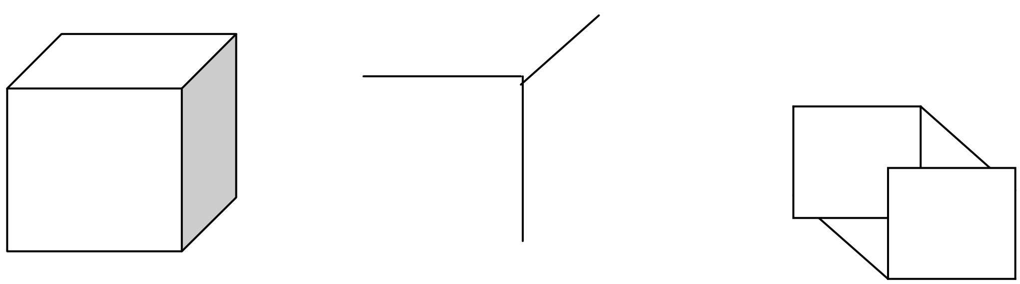
2D model is a model having only 2 dimensions or we can say a model that can be represented by the two axis X and Y axis.

If we draw a rectangle on a paper than it is the 2D model as it can be draw by using only two axis X and Y.



In the above diagram we have seen that the rectangle is being represented by the x and Y axis.

On the other hand if we talk about the 3D model than these models are represented by using three axis X,Y and Z.



In the previous diagram we have seen that a cube is a 3D object which is being represented by 3 axis X, Y, Z.

3. Search Engines/Searching

Search engines is a tool which is use to search the required data on the base of our submitted query.

Most of the online information exists in the form of text, which is why the large stand the most popular search engines are text-based. Forerunners in this area are large text-based general search engines such as Google and AltaVista .There also exist specialized search engines for textual information. Examples are Cite Seer, a search engine for scientist papers, and Homepage Search.

Because these sites are index text, their query interfaces are usually text-based as well. This means that user-entered text keywords have to be matched to an index of the text database. In this thesis, we will not investigate text query interfaces and matching methods in detail, but instead rely on existing work to select an appropriate matching method for our text query interface. We refer the interested reader to the large body of work in the indexing and matching of text documents.

Subject indices such as Yahoo are no search engines because no search is performed: links to web pages are organized into a hierarchy (either manually or automatically), which the user can browse. This kind of interface is often used for accessing 3D model collections.

The world-wide web is changing the way we find and use information. It provides access to a vast amount of text and image data on every conceivable topic. Unfortunately, the sheer quantity of information can make it difficult to quickly find what you are looking for. To aid in this search, many search engines exist that index large portions of the web. They typically provide a search interface based on text keywords: a user enters some descriptive keywords after which web pages containing these keywords are returned. Examples of popular text-based search engines are Google and AltaVista.

However, the web does not just contain text pages, but a lot of non-textual data as well, such as images, sound files, or CAD models. Many so-called specialized search engines targeting these specific kinds of data have been developed. Perhaps the biggest such search engine is Google Image Search, which indexes hundreds of millions of images. Other examples are Find Sounds, a search engine for sound files, and Mesh Nose a search engine for 3D models. Many of these specialized search engines take advantage of the fact that even though the indexed objects are of a non-textual type, often they are annotated with descriptive text. The search engine then simply tries to match the user-entered keywords to this descriptive text.

As above shown that Google is a search engine which provides the search result on the basis of a text query. “Wikipedia” is written in the text box as a search topic of which the information is required.

Search engine provides the result according to the query which is fired. and as in Google if we want to select any kind of image then the Google image search engine provides the image search result. When any query is fired or the topic which we want to search is written in the text box then the search results related to that topic will be displayed.

Bt sometimes text based search engine could not provide the results which are needed, mainly in image search the result does not match with the image what we are searching, so an another process is introduced by which the image can be searched on the basis on a 2d shape or a 3d shape which is known as 3d searching.

4. 3D Model Search engines

As the number of 3D models available on the Web grows, there is an increasing need for a search engine to help people and find them. Unfortunately, traditional text-based search techniques are not always effective for 3D data. In this, we investigate new shape-based search methods. The key challenges are to develop query methods simple enough for novice users and matching algorithms robust enough to work for arbitrary polygonal models. We present a web-based search engine system that supports queries based on 3D sketches, 2D sketches, 3D models, and/or text keywords. For the shape-based queries, we have developed a new matching algorithm that uses spherical harmonics to compute discriminating similarity measures without requiring repair of model degeneracies or alignment of orientations.

Many web sites allow users to find 3D models. Examples are online repository sites, such as 3D Cafe and Avalon, or 3D modeling company sites, such as Cache force and Viewpoint. Other sites, such as CadLib and Mesh-Nose, index multiple 3D model collections. These sites can be classified according to the ways available to the user for searching the database.

5. QUERY INTERFACE IN 3D SEARCHING

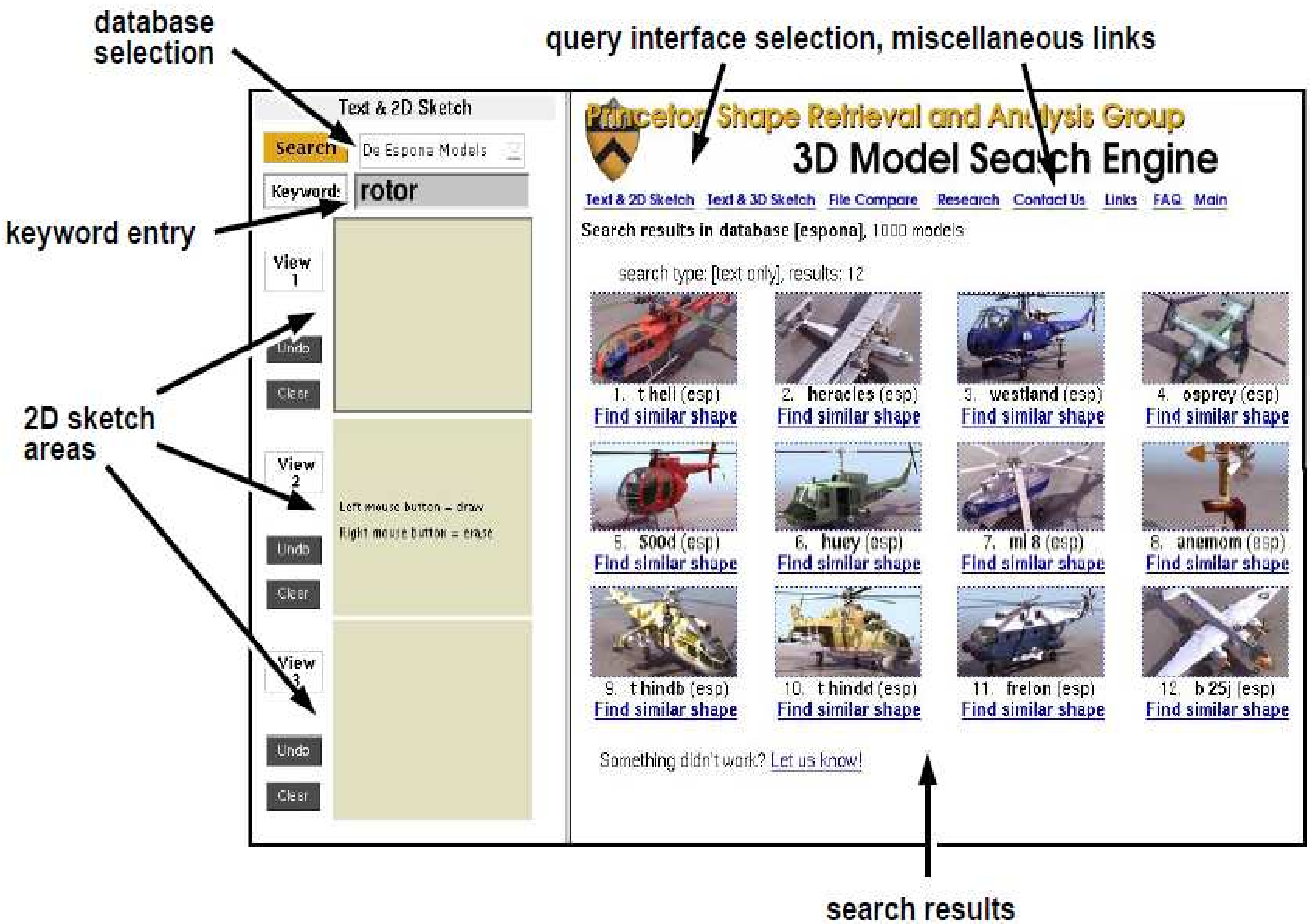
Every searching process is based on some input queries which may be in different – different forms like in may be in textual form, 2D and 3D image form.

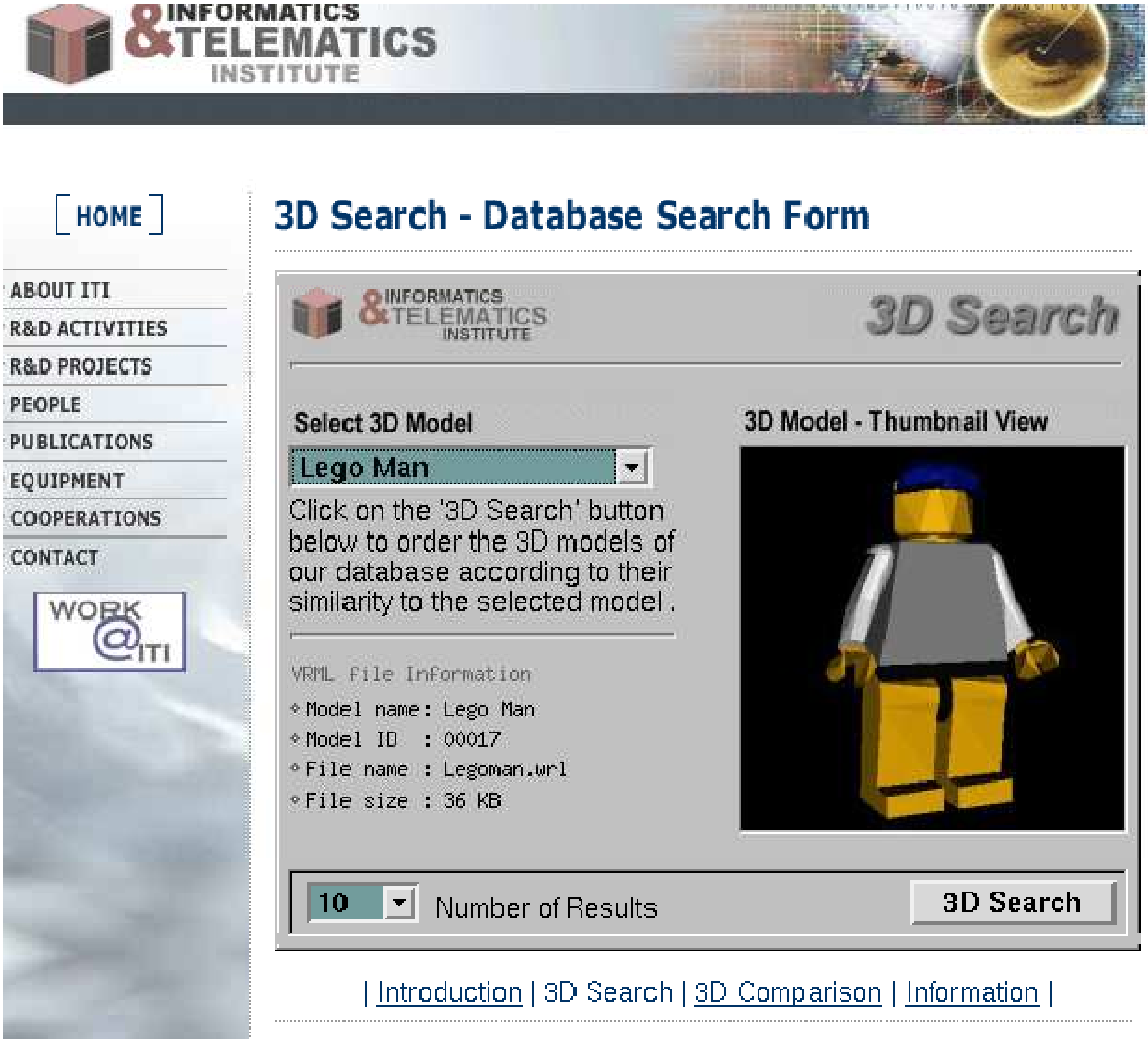
Searching focuses on query interfaces for our 3D model search engine, and their corresponding model/query representations and matching methods. 3D models typically contain textual, appearance (color, texture) and shape information, which can all be queried. We investigated query interfaces based on text keywords, 3D shape, 2D freeform sketches, and 2D structural input (i.e. sets of parts), and their associated matching methods. We now describe each query interface in more detail, which can also be known as types of 3d searching-

6. TYPES OF 3D SEARCHING

6.1 SEARCHING BY TEXT ONLY:

Other sites index 3D models using only text. Examples are CADlib, Mesh-Nose, and the National Design Repository, which index multiple 3D model collections. CADlib indexes a description, filename, id number, etc., of each CAD model. Mesh Nose simply indexes text that was found on the web pages of several 3D model repository sites. The National Design Repository allows searches by text keyword (querying the part name or filename), and by file type and size, or by browsing through directories.


database selection
query interface selection, miscellaneous links
keyword entry
2D sketch areas
search results
Text & 2D Sketch
Search
De Espona Models
Keyword:
rotor
View 1
Undo
Clear
View 2
Left mouse button = draw
Right mouse button = erase
View 3
Princeton Shape Retrieval and Analysis Group
3D Model Search Engine
Text & 2D Sketch Text & 3D Sketch File Compare Research Contact Us Links FAQ Main
Search results in database [espona], 1000 models
search type: [text only], results: 12
1. t hell (esp) Find similar shape
2. heracles (esp) Find similar shape
3. westland (esp) Find similar shape
4. osprey (esp) Find similar shape
5. 500d (esp) Find similar shape
6. huey (esp) Find similar shape
7. mi 8 (esp) Find similar shape
8. anemom (esp) Find similar shape
9. t hindb (esp) Find similar shape
10. t hindd (esp) Find similar shape
11. frelon (esp) Find similar shape
12. b 25j (esp) Find similar shape
Something didn't work? Let us know!



As in the above example on ITI's 3d model search site the search result of Lego Man is shown on the basis of text query which is executed.

6.2 SEARCHING BY SHAPE:

3D search engine sites also allow searching based on shape and or shape features. For example, at the "Shape Sifter" site of Heriot-Watt University, the user can select from a long list of shape features, such as surface area, bounding box diagonal length, and convex hull volume, and perform a search with conditions on these features. The search is in a CAD test database with 102 L-shaped blocks and several transformed versions of about 20 other models. Figure shows an example in which a CAD part is submitted as a shape query. In the online demo of the commercial system "Alexandria" the user can set weights of individual model attributes (for example geometry, "angular geometry, "distributions," and color") to be used in matching, and search in a database of 4,500 commercial models. In the experimental system Ogden IV, the user can choose between matching grid-based and rotation invariant feature descriptors at several different grid resolutions, and search a database of 1,500 VRML models, which are not available for download. Figure shows an example shape search starting from a random model. At the experimental site 3D Shape Retrieval Engine" of Utrecht University the user can pick a query model by number, and one of three matching methods(Gaussian curvature, Normal variations, Midpoints) and one of three test databases.

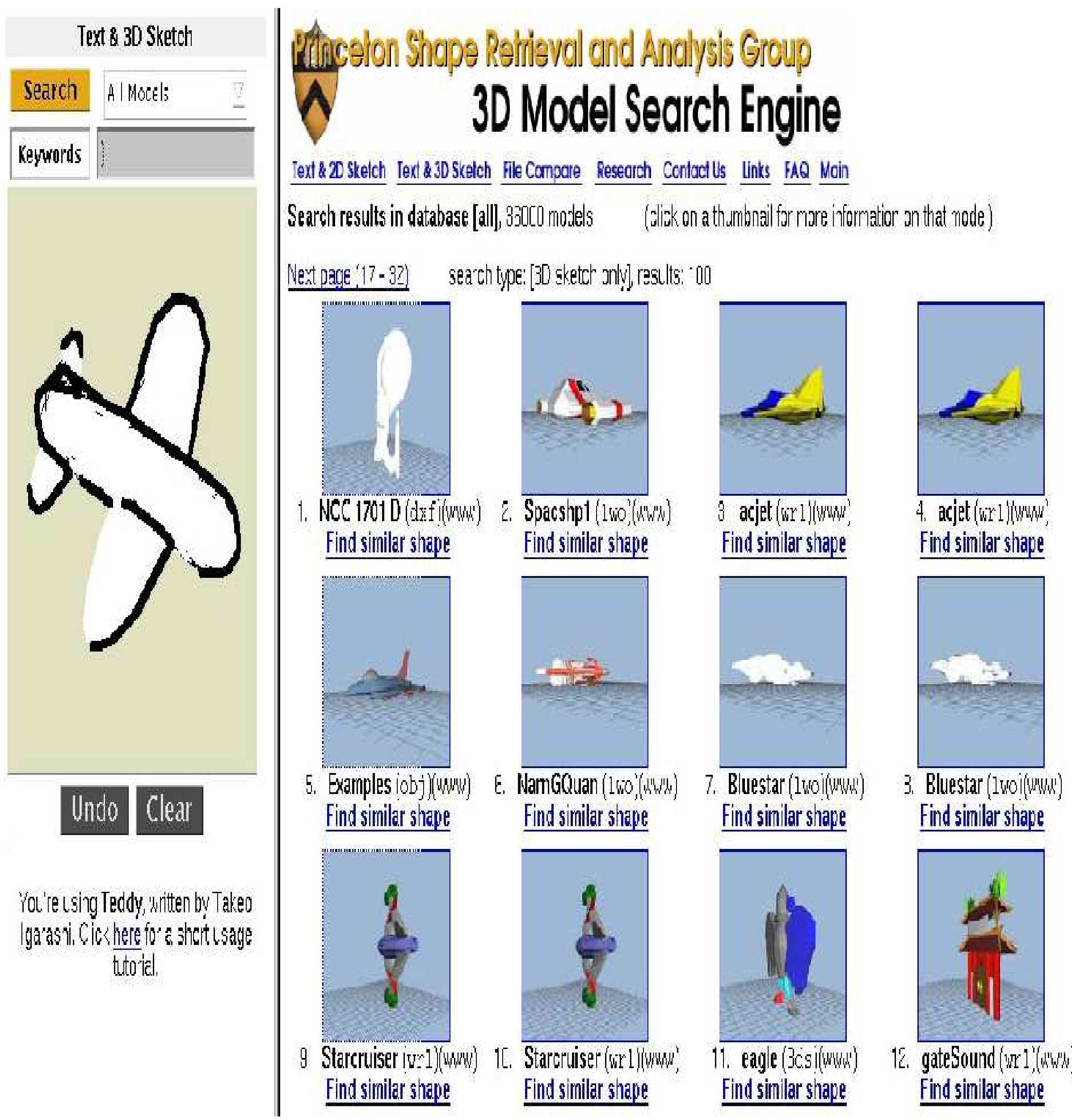


Figure-1

Figure-1 shows an example in which a CAD part is submitted as a shape query.

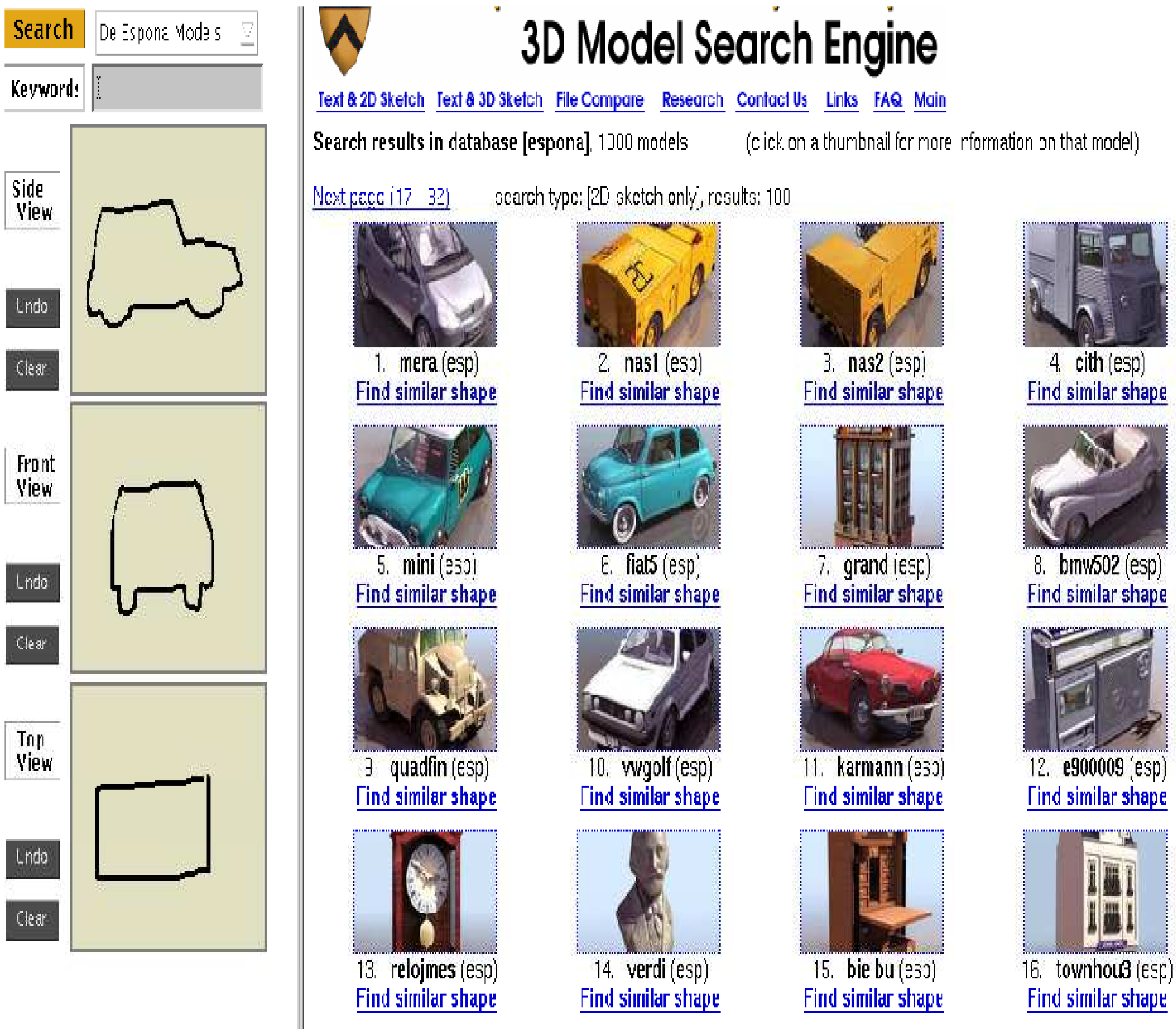
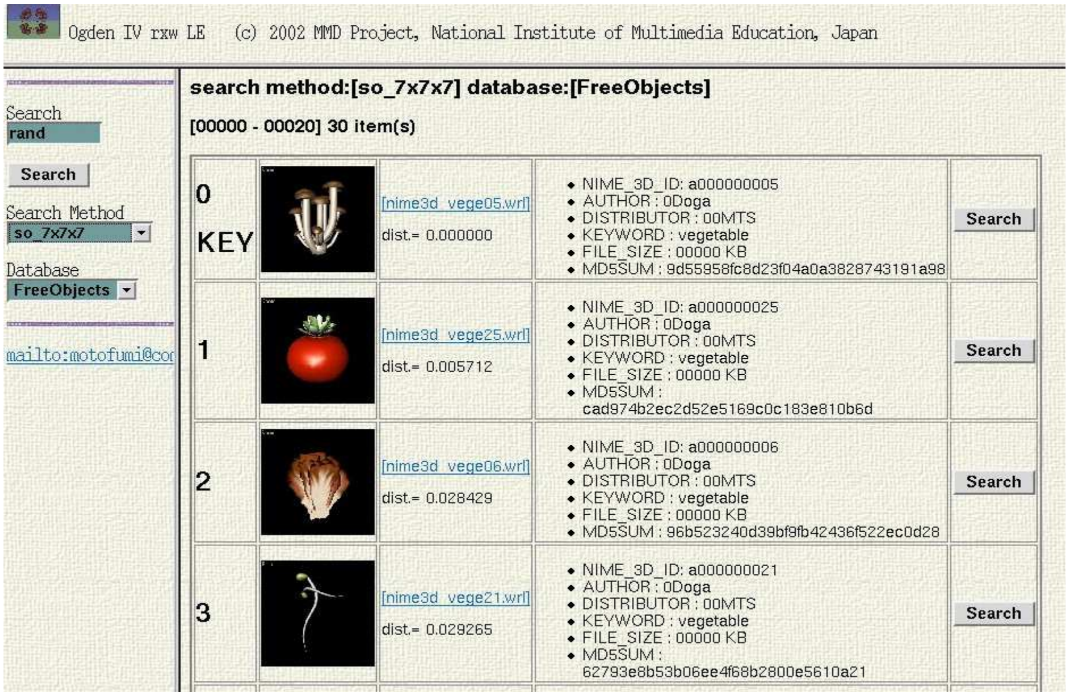


Figure-2

In figure-2 the search result is shown on the basis of a shape in which the Front view, side view and top views are submitted as the query for the desired 3d model.

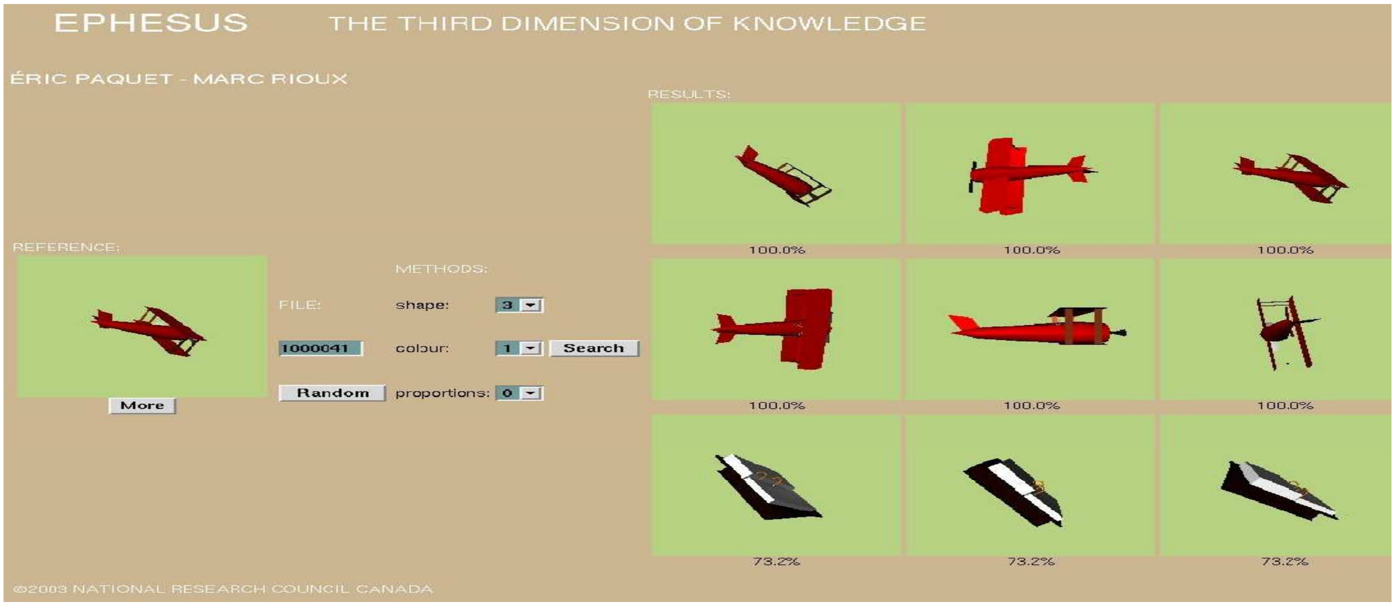


An example search using the online “Ogden IV" system

In the above image the search process is using Ogden IV system in which the searching performed randomly. And in this the user can choose between matching grid-based and rotation invariant feature descriptors at several different grid resolutions.

6.3 SEARCHING BY 3D MODEL

In this searching method of 3d model the query which is submitted is a 3d model itself.



As we can see in the above figure the query for searching an object is an 3d object and the results are shown on the basis of that object which is used in query.

In this method of 3d searching if in any case we doesn't find the result of 3d model according to our need then we use the search result of text based search or 2d model based search and these search results can be used as the query of 3d model based search.

Perhaps the simplest method to provide a 3D shape is to submit another, existing 3D model file. For the query to be effective, its shape should be close to that of the desired model. We support this type of query in two ways. First, the user can upload a local 3D model file. Second, the user can submit a database model by selecting a result of a previous search.

6.3.1 Select Result Model from Previous Search:

This search option is implemented as a "Find Similar Shape" link below each result model's thumbnail image on a results page.

Because the model's signature is already present in the signature database, the query interface only has to send a unique model identifier to the matching process. To improve the matching results, the best matches for each model may be precomputed in an on-line preprocessing step, using a more expensive matching method.

6.4 SEARCHING BY COMBINED QUERIES:

Both the 2D and 3D sketch queries can be combined with text. These combined queries were not used very often (4.4% and 0.4% of all queries, respectively), but they did generate more user interest in the search results when compared to their sketch-only counterparts (for example, 8% and 11% searches followed by at least one model download, compared to 2.4% and 3%). Given the poor performance of the sketch interfaces by themselves, we think that the improved quality of the results is mostly due to the added text keywords.

7. Query Processing Performance -

Here we report the response times of our site for the various query types and show that most queries are typically satisfied in less than a second (not counting network transmission times, and local processing times). The response time a user experiences is the sum of the time it takes for the following operations:

1. Connecting to our web server and sending query data

2. Executing a CGI script on the web server (which connects to and has to wait for the matching server)

3. Processing and matching of the query on the matching server.

4. Returning the results to the user, and

5. Rendering the results web page on the user's machine.

The time taken in steps (1) and (4) depends on the available bandwidth between the user's machine and our web server, step (5) depends on the performance of the user's machine. Step (2) adds an estimated overhead of about 1-2 seconds. We can report accurate timings for step (3): processing and matching of the query on the matching server.

Table 1 shows for each query type the average time used for processing and matching on the matching server.

These numbers show that the response time is mostly determined by the amount of query data that needs to be processed. Text and “Find Similar Shape" queries take the least time, followed by queries that involve 2D sketch (es) (for which 2D image(s) are converted to image descriptors), and queries that require the conversion of 3D models (3D sketch and file upload). In the latter case, the 3D model size dominates the total processing time. The conversion times for a few example model sizes are: 60 KB, 2,000 triangles: 4 seconds, 800 KB, 6,500 triangles: 6 seconds, 2 MB, 61,000 triangles: 13 seconds (2 MB is currently the file size limit on the file upload" feature).

The time between when a query arrives at the web server and when its results are ready is about 0.4 seconds on average. To investigate how this average time increases under increasing load, we ran two experiments in which we sent queries to our web server at a higher rate. These queries were taken from a set of 4,000 representative query type processing and matching time (in sec)

Query type	Processing and Matching time (in sec)
Text	0.22
2D Sketch	0.61
Text & 2D Sketch	0.59
3D Sketch	3.2
Text & 3D sketch	3.2
Find Similar Shape	0.36
File upload 5	5.0

Table 1: Average time for processing and

Matching for each query type

8. Matching method:

After the query model has been submitted, we have to match it to the 3D models in our database. Since these models have been downloaded from a variety of sources on the web, we cannot assume that they are closed 2-manifold meshes. Most of the models are unorganized sets of polygons, possibly with missing, wrongly-oriented, intersecting, disjoint, and/or overlapping polygons. We also cannot make any assumptions about their scale and orientation. Consequently, the matching method should be robust under model degeneracies, and invariant under similarity transformations. Rather than processing the models themselves for every match, they usually are converted to a more compact representation (a shape signature or feature vector), which can be matched more efficiently. Because ours is a real-time application, these signatures should be fast to compute (because a single one must be computed for a 3D sketch or an uploaded model file), and be fast to match. Also, the signature should be small enough such that it is practical to store tens of thousands of them. Finally the matching method should be effective.

In other words, the matching results should correspond to our human notion of shape similarity (this also means that the shape signature should represent significant shape features).

9. Example of 3d searching: Google earth

Google Earth is a virtual globe, map and geographical information program that was originally called Earth Viewer 3D, and was created by Keyhole, Inc, a company acquired by Google in 2004. It maps the Earth by the superimposition of images obtained from imagery, aerial and GIS 3D globe. It was available under three different licenses, 2 currently: Google Earth, a free version with limited functionality; Google Earth Plus (discontinued), which included additional features; and Google Earth Pro, which is intended for commercial use.

The product, re-released as Google Earth in 2005, is currently available for use on personal computers running Windows 2000 and above, Mac OS X 10.3.9 and above, Linux kernel: 2.6 or later (released on June 12, 2006), and FreeBSD. Google Earth is also available as a browser plug-in which was released on May 28, 2008. It was also made available for mobile viewers on the iPhone OS on October 28, 2008, as a free download from the App Store, and is available to Android users as a free app on the Android Market. In addition to releasing an updated Keyhole based client, Google also added the imagery from the Earth database to their web-based mapping software, Google Maps. The release of Google Earth in June 2005 to the public caused a more than tenfold increase in media coverage on virtual globes between 2004 and 2005 driving public interest in geospatial technologies and applications.

Google Earth displays satellite images of varying resolution of the Earth's surface, allowing users to see things like cities and houses looking perpendicularly down or at an oblique angle, you can also see the Great Wall of China, with detail. Perspective (see also bird's eye view). The degree of resolution available is based somewhat on the points of interest and popularity, but most land (except for some islands) is covered in at least 15 meters of resolution. Melbourne, Australia; Las Vegas, Nevada; and Cambridge, Cambridge shire include examples of the highest resolution, at 15 cm (6 inches). Google Earth allows users to search for addresses for some countries, enter coordinates, or simply use the mouse to browse to a location.

For large parts of the surface of the Earth only 2D images are available, from almost vertical photography. Viewing this from an oblique angle, there is perspective in the sense that objects which are horizontally far away are seen smaller, but of course it is like viewing a large photograph, not quite like a 3D view.

For other parts of the surface of the Earth 3D images of terrain and buildings are available. Google Earth uses digital elevation model (DEM) data collected by NASA's Shuttle Radar Topography Mission (SRTM) This means one can view the Grand Canyon or Mount Everest in three dimensions, instead of 2D like other areas. Since November 2006, the 3D views of many mountains, including Mount Everest, have been improved by the use of supplementary DEM data to fill the gaps in SRTM coverage.

Many people use the applications to add their own data, making them available through various sources, such as the Bulletin Board Systems (BBS) or blogs mentioned in the link section below. Google Earth is able to show all kinds of images overlaid on the surface of the earth and is also a Web Map Service client. Google Earth supports managing three-dimensional Geospatial data through Keyhole Markup Language (KML). Google Earth is simply based on 3D maps, it has the capability to show 3D buildings and structures (such as bridges), which consist of users' submissions using Sketch Up, a 3D modeling program software. In prior versions of Google Earth (before Version 4), 3D buildings were limited to a few cities

10. Advantages of 3d Searching:

There are various advantages of 3d searching .some of them are given below-

- 3d searching is very effective in the search process of 3d objects.
- It provides various searching process as well.
- Query interface is very useful term in the search process by which we can select any process for searching our model by various types of queries like text search, 2d or 3d search.
- The simplest ways for a user to submit a 3D shape are uploading

an existing 3D model file.

- Objects that have a well-defined, unique name are usually easy to find.

11. Disadvantages of 3d searching:

Some disadvantages of 3d searching are also exists:

- The searching process takes too much time in execution.
- Sometimes it is a complicated method to search a model which is required.

12. Conclusion:

In many cases 3d searching is very effective process. 3D shape query interfaces supported in our 3D model search engine. The simplest ways for a user to submit a 3D shape are uploading an existing 3D model file, and selecting a result model from a previous search. Because the average user may not have local 3D model files available, and because it may be difficult to find a 3D model with a shape close to the desired model using other search methods, we also provide a query interface with which the user can create a 3D shape query from scratch. In our initial approach, we used an existing simple 3D modeling tool called “Teddy".

However, we found that Teddy is very limited in the kinds of shapes that can be created with it: coarse, blobby shapes of genus. An evaluation of 1,000 3D sketches submitted during a period of six months showed that over 80% of all queries were exactly that: coarse blobs, not resembling any useful object. As a consequence, the user interest in the search results was very low. The percentage of 3D sketch queries resulting in at least one model download is about 5 times smaller than for the most popular query interfaces. Designing a simple 3D modeling tool with a minimal set of intuitive operations enabling the creation of interesting models is a difficult problem. Previous work in this area mostly targets graphics professionals, or at least people used to working

With 3D graphics, designing effective 3D modeling tools for the average user is an important area of future work.

The query which is used in the searching is must be near to the required model.

In the matching method the query which is submitted will be matched according to the projection of the query. And after the search process by a text query is executed then the search result cannot be matched to the desired shape then that result can be used as the query for the another search process.

13. Reference:

www.wikipedia.com

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