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Survey Paper on Various 3D View Based Retrieval Methods

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Abstract **-Many research efforts have been dedicated to 3D model retrieval in recent decades. Basically, 3D model retrieval methods can be divided into two categories such as model-based methods and view-based methods. Early works are mainly model-based methods in which low-level feature based or high-level structure-based methods are employed. Due to the high discriminative property of multi-views for 3D object representation, view-based methods have attracted much research attention. In this paper, we represent different retrieval methods and summarize the view-based 3D model methods and provide the further research trends. This paper focuses on the comparison of various 3D retrieval methods.**
Index Terms —View-Based model, Object-Based model, LFD, ED, BOVF, CMVD.

1. INTRODUCTION

Now-a-day's millions of images produced and each image requires classification in this way, by which they can occur easily and in a higher speed. Humans can classify the images more easily then computers. A simple classification system consists of a camera fixed high above the interested zone where images are captured and consequently process [1]. The procedure to classify images into several categories, based on their similarities is known as Classification. We can easily analyze or understand our surroundings by classifying the images. When image contains noisy or blurry contents then it is not always easy to classify an image. User deal with a database in the classification system and that database contains some patterns or images which are predefined or which are going to be classified. Image classification always is a critical but an important task for many applications. The main objective of an image classification is to recognize the feature in an image. Generally classification is done by computer, which classifies images with the help of
different mathematical techniques. Classification will be made according to the following steps which shows in figure 1-

Definition of Classification Classes
Classification classes always depend on the objective and property of the image and it must be clearly defined.

Selection of Features
Features of classes differ from one class to another. Different properties should be used to fix the differences between the classes.

Sampling of Training Data
It is necessary to sample the training data to obtain correct decision rule.

Estimation of Universal Statistics
Several classification methods will be compared with the data, from which most suitable method will be selected.

Classification Method
Appropriate classification method will be used on the data.
Some methods which we will discuss in this paper are - Light Field Descriptor (LFD), Elevation Descriptor (ED), Bag-of-Visual-Features (BoVF), and Compact Multi-View-Descriptor (CMVD).

Verification of Result
At last final result will be verified.

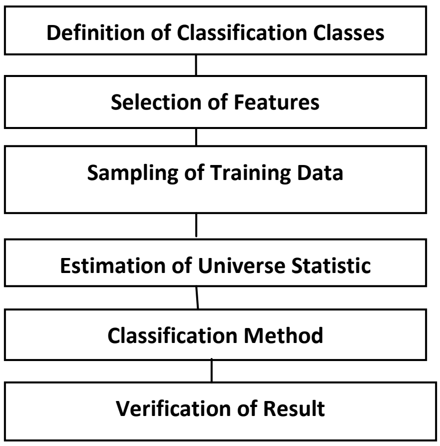

Figure-1: Steps of Classification

Basically image retrieval is based on 2-D and 3-D models.Today, 3D models are used in a wide variety of fields. 3D modelling is the process of developing a mathematical representation of any surface of object. The

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development of 3D modelling and digitizing technologies has made the model generating process much easier. Also, through the Internet, users can download a large number of free 3Dmodels from all over the world. 3D model retrieval methods can be divided into two categories: model-based methods and view-based methods.

Many research have been done in the field of view-based 3-D object retrieval methods because of the highly discriminative property of multiviews for 3-D object representation. Typically, 3D object retrieval and recognition approaches can be divided into two paradigms: model-based and view-based. Early methods are mainly model-based, which require 3D models to be available explicitly [2] [3], in which low-level feature-based methods (e.g. the geometric moment, surface distribution, volumetric descriptor, and surface geometry or high-level structure-based methods are employed. Due to the requirement of 3D models, these methods are limited in the practical applications.

Figure 2 show how 3-D model works. The availability of the number of views may vary; more number of views will be helpful for giving mere details regarding the object to be retrieved. The 3D model information may not be available in such cases. This paradigm is of great practical importance. For example, users can capture some photos with different views for the visual search of an interesting object. The retrieval of 3D objects is typically accomplished by matching the views of the query object to the views of objects in database.

In this paper section 2, examine the related *survey work* that shows which classification method is most suitable. Section 3 defines various view-based 3D retrieval methods. Finally Section 4 concludes the paper.

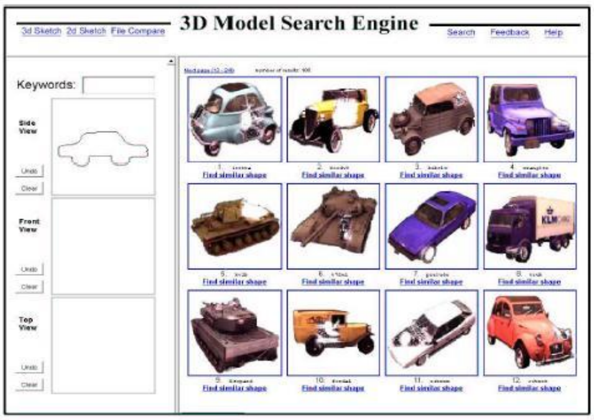


Figure2: Show how 3D model works

Literature Review

Meng Wang, Yue Gao, Ke Lu, Yong Rui in "View-Based Discriminative Probabilistic Modelling for 3D Object Retrieval and Recognition," proposes a 3D object retrieval and recognition approach using discriminative probabilistic modelling. It builds GMMs based on the views of each object and then accomplishes retrieval and recognition based on the distance between GMMs. To train the GMMs, first, the GMMs for each object are adapted from a set of global models with the maximum likelihood principle. Then, a further adaption step is performed to minimize the soft *k*- NN classification error rate on labelled data, which is able to enhance the discriminative ability of the GMMs. The GMMs that are with different numbers of Gaussian components are combined with the objective of minimizing the distances of objects that belong to the same class and maximizing the distances of objects that belong to different classes[4].

Yue Gao Jinhui Tang, Richang Hong, Shuicheng Yan,Qionghai Dai Naiyao Zhang,and Tat-Seng Chua in "Camera Constraint-Free View-Based 3-D Object Retrieval" proposes a camera constraint-free view-based (CCFV) 3-D object retrieval algorithm, which requires no camera constraint for view capturing of all 3-D objects. In this framework, all 3- D objects (including the query object) can be described by a set of views from any direction. The CCFV model is generated on the basis of the query model by combining the positive matching model and the negative matching model. The CCFV can search 3-D objects with the query of any view set captured by any camera arrays. That is, no camera constraint is required. Therefore, call this framework is called "camera constraint-free" [5].

Qinkun Xiao, Haiyun Wang Feili, Yue Gao in "3DObject retrieval based on a graph model descriptor"Proposes a new 3D object retrieval approach based on A novel graph model descriptor and a fast grap- Matching method. Here methodology is made up of Two steps. Firstly, a Bayesian network light field Descriptor (BLD) is built, based on graph model Learning, to overcome the disadvantages of the existing view-based methods. The 3D object is put into the light field, multi-view images are obtained; and then features of the new multi-view images are extracted. Based on the extracted features, a Bayesian network learning algorithm is used to construct the BLD. Secondly, the 3D object is efficiently retrieved, based on graph model matching and learning from relevant feedback [2].

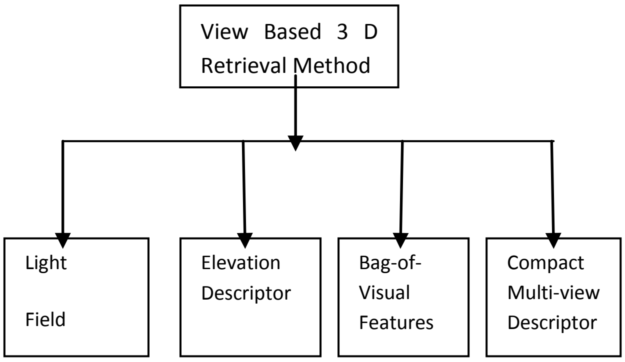
K. Lu, N. He, and J. Xue in "Content-based similarity for 3D model retrieval and classification," proposes mutual information distance measurement to perform the similarity comparison of 3D objects and tested with a 3D model retrieval and classification prototype, and the experimental evaluation demonstrates satisfactory retrieval results and classification accuracy [6].

J.Assfalg, Marco Bertini, Alberto Del Bimbo in "Content-based 3D model retrieval using spin image signature," presented a new method for 3-D content-based retrieval based on Spin Image Signatures. The method develops from the Spin Images approach, originally conceived for the purpose of 3-D object recognition, but defines new solutions to obtain a more concise, yet effective, description. Experimental results reported have shown that the Spin Image Signatures approach is well suited for the purpose of 3-D model retrieval and provides superior performance with respect to the other methods in the literature particularly at medium-high resolutions. It also showed good insensitivity to geometric deformations like bending and relaxing of the model mesh [7].

I. VIEW BASED 3 D RETRIEVAL METHOD

The main idea of view based retrieval methods is that if two 3D models look similar from all viewing angles then two 3D models are same, similar to one of the models of human object recognition. A natural application of this method is the implementation of query interfaces defining a query by one or more sketches showing the query from different views.

Basically there are four types of view based 3 D retrieval method.



A. Light Field Descriptor (LFD)

The Light Field descriptor used, for comparing similarity among 3D models. It is used in image-based rendering that represents the radiance at a given 3D point. A light field around a 3D object is a 4D function that shows the radiance at a given 3D point in a given direction. Each 4D light field of a 3D object is a collection of 2D images captured from a 2D array of cameras distributed uniformly on a sphere. The fundamental quantity in light field measurement is Radiance. It is usually denoted by L(q,f, λ**)** where the angles q (zenith) and f (azimuth) specify the direction in which the radiance is measured and λ is the wavelength. The units of radiance are: W m^{-2} nm^{-1} sr^{-1}.The main advantage of Light Field Descriptor is that it reduce the retrieval time and size. The LFD captures representative views from the vertices of a dodecahedron over a hemisphere. Then, each 3-D object is represented by ten views, i.e., LFDs. Each LFD is represented by Fourier descriptors and Zernike moments. The distance between two 3-D objects is calculated by the matching of two groups of LFDs.

B. Elevation Descriptor (ED)

The elevation descriptor is invariant to scaling and translation of 3D models and its rotation is robust. Elevation descriptor is to observe 3D model's six elevations including front elevation, plan, left side elevation, right side elevation, rear elevation and bottom elevation. These elevations express different altitude of six different visual angles from 3D model.

In the Elevation Descriptor D, 2-D gray images are used to represent each elevation view, and 3-D model comparison is based on the matching of these six elevations. This method is invariant to translation, scaling and rotation of 3-D models.

C. Bag-of-Visual-Features (BoVF)

Generally, the local features [8] [9] extracted from images are quantized into a set of visual words, where a visual word dictionary is created to generate an indexing file. By using a Bag-of-Words histogram each image can be described. This Bag-of-Words representation offers sufficient robustness against photographing variances in occlusions, viewpoints, illuminations, scales and backgrounds. Generally the SIFT features are extracted from all selected views, and a visual word dictionary is learnt to apply the bag-of-visual-words method to view-based 3D model retrieval. The bag-of-visual-words description is generated for 3D model representation. KL divergence or other distance metric can be employed to perform 3D model matching,. By using the visual words description, the detailed feature of each view can be represented well. It is discriminative for 3D model representation based on this description.

Compact Multi View Descriptor (CMVD)

In CMVD, both the depth images and binary images and are taken views representation. Then the comparison between 3D models was based on the feature matching between selected views using 2D features, such as 2D Polar-Fourier Transform, 2D Zernike Moments, and 2D Krawtchouk Moments. For the query object, the testing object rotated and found the best matched direction. To measure the distance between two objects, the minimal sum of distance from the selected rotation direction was calculated. Compact Multi-View Descriptor belongs to the category of the 2D view-based approaches and has the advantages of being high discriminative. It can work for articulated object and can be very effective for partial matching and can support a variety of queries like 2D images, hand-drawn sketches and 3D objects. This method provide a

Framework to generate a set of binary images along with a set of depth images from a 3D object. To obtain more details in 3D objects and increase the shape matching efficiency depth images are used. CMVD is a compact method it uses signifi-cantly less number of different views.

CONCLUSION

Basically image retrieval is based on 2-D and 3-D models. 3D model retrieval methods can be divided into two categories: model-based methods and view-based methods. This paper discusses about the different 3D View-based retrieval methods of object. This paper provides detailed information about the different view based methods. Main view based methods are divided into four categories such as - Light Field Descriptor (LFD), Elevation Descriptor (ED), Bag-of-Visual-Features (BoVF), and Compact Multi-View-Descriptor (CMVD). On the basis of their characteristics which we define earlier each method having their particular advantages and disadvantages. Finally we conclude that CMVD method is best method among all the four methods due to its compactness and it works on both types of images such as binary and depth images.

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