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Review on Visualization Techniques for Medical Data and Its Application.

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ABSTRACT

The idea behind this paper is to focus the review on visualization techniques for medical data and its applications of information visualization and scientific visualization methods for any types of real-time data. Many works related to the field of computer graphics, and computer visualizations are presents. The paper deals, how to improve the quality in the images or objects, removing the noises from images, and graphically represent any graphical inputs. The main goal of our review work is to show few efficient rendering techniques for medical images and geometric primitives. Finally, this review work provides to further development of higher-dimensional data into the field of computer visualization techniques.

Keywords: Information visualization, Scientific visualization, Volume rendering, Surface rendering, Image based rendering.

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INTRODUCTION

Visualization is methods of reconstructing abstract business or scientific data images that can help in understanding the meaning to the data. Visualization is any techniques for creating objects, images, graphics or animation to communicate a message. Visualization through visual imaging has been on an effective way to communicate both abstract and concrete ideas. Visualization today has been constantly developing applications in scientific applications, education, all fields of engineering, interactive multimedia and medical sciences, etc.

Visualization further divided into two major areas: information visualization or data and scientific visualization [14]. Information visualization is an extension field at the crossroads of mathematics, computer science & engineering, perception science and engineering. It's also covering every discipline that shares principles with visualization, ranging from signal processing to imaging and from computer graphics to statistic's analysis. The information visualization concentrates more practical applications with help of computer graphics programs for selecting, transforming, and representing abstract information in a form that facilitates human activity for exploration and understanding of the information.

The key difference between scientific visualization and information visualization is that information visualization is often applied to data that is not generated by scientific investigation. Some examples are graphical representations of data for business process, all kinds of government, newspapers, periodical's issues and social networking and media. In information visualization, we describe information analysis is an essential part of the applied research work and issues solving in industry.

The most common important data analysis methods are visualization (histograms, scatter plots, tree maps, surface graphs, etc.), statistics (hypothesis test, regression, etc.), data mining or association mining and machine learning process. Information visualization is also a hypothesis generation system, which can be, and is typically followed by more analytical or formal analysis, such as statistical hypothesis testing. Typically information visualization the following methods and techniques are used to represent the data. Cladogram, Dendrogram, Information visualization reference model, Graph drawing, Heat map, Hyperbolic Tree, Multidimensional scaling, Parallel coordinates, Problem solving environment, and Tree mapping. Scientific visualization is the transformation, selection, or representation of data from simulations or investigates, with an implicit or explicit geometric structure, to allow the exploration, analysis, and understanding with the data. Scientific visualization focuses and emphasizes the representation of higher-order data using primarily graphics and animation techniques. It is a very important part of computer visualization and maybe the first one, as the visualization of experiments and phenomena as old as science itself. Scientific visualization is traditional one, which is considering the like flow visualization, medical visualization, texture visualization, and chemical visualization. There are several different techniques to visualize scientific data, with isosurface reconstruction and direct volume rendering being the more common.

The main motivation behind this paper is to review the different visualization methods and describe each of the some important visualization methods. This paper is organized as follows: Section II explored diverse reviews works on visualization techniques to relate in this proposal. Section III concludes the paper.

RELATED WORKS

In this section we are present to describe some the works in field of computer visualization. There are two major categories consider in visualization techniques such as information visualization and scientific visualizations.

The review on vector field visualization and its applications have discussed [1]. This work described more on flow visualization, tensor visualization; texture based visualization, direct volume rendering methods, concepts of geometry visualization and summarized development idea of parallel & algorithms.

A survey of various techniques and applications in 3D distance fields has described [2], how find the distance and close to the any object within the specific domain. Also found very good methods to find in the field of computer graphics, computer vision, and physics, image processing.

This study demonstrated fact by describing results in medicine, remote sensing, astronomy, and biology [3]. They have structured the following various related work based on the underlying numerical algorithm. They are also given solution for issues of displaying number of colors in unsupervised segmentation problem when are inputting the multi-parameter values.

The important applications of engineering using unstructured hexahedron meshes for numerical problems have presented [4]. Described volume visualization of unstructured hexahedron meshes is challenging due to the tri-linear variation of scalar fields inside the cells or grids.

The comparative studies on various 3D vector field visualization as user study point of view [1, 5]. Researchers described many methods has identified and integrated to visualize 3D Vector fields. They are given idea how to create stream tubes, stream lines, stereoscopic and mono-scope viewing.

Here focused on design of 2D time varying vector fields, discussed about how to generate path line, streamline, singularity path and bifurcation of 2D vector fields [1, 5, and 6]. In this work described on non-topological structures and topological structures, time varying concepts. Provided brief description of how the frameworks work on 2D time varying vector fields.

Analysis on development of high-speed volume rendering systems that combination of 3D texture mapping algorithms and parallel processing methods for multiple high resolution images with medical data in form of CT scan and MRI have discussed [7].

The review on various efficient visualization techniques for range distribution query in scientific visualization has described [8]. Presented the various methods for integral distribution volume in medical data and how the communication cost added to the work load.

The work carry out on the various issues in texture based function visualization have been proposed [1, 5, 6, 9]. This paper discussed and presents texture adaption techniques for fuzzy features visualizations of 3D vector field. Demonstrated two information measures in 3D vector field and noise texture methods.

The survey on classification of information visualization and visual data mining techniques, which is focuses on the data types to visualized, also described the visualization techniques, and the interaction and distortion technique have discussed [10]. Summarized benefited of visual data exploration process.

In this work focused about that can help to overcome both previous issues like systems performance, quality of output. Discussed on to make a fast and accurately illumination of line segments they exploited the texture mapping capabilities of modern graphics hardware [11]. They demonstrated some new shading technique to make many stream lines distributed throughout a vector field.

Highlight the various concepts of encrypting and decrypting image using some efficient computer visualization techniques has projected [12]. Described systematic approach like image encryption and decryption used MATLab tool. Work was discussed various algorithms with implementation.

Another earlier works related to visualization techniques is discussing about 3D visualization for fast display of vector fields using illuminated streams lines [1, 5, 6, and 13]. We are present various illumination methods with real-time examples. Also discussed how improving the quality and realism of images.

Overviews of computer graphics and its applications with some studies have described [14]. Demonstrate basic concepts of information visualization and scientific visualization techniques for real-time example. Also describe various visualization tools and software's.

The various kinds of edge compression techniques for visualization of dense directed graphs with real-time examples and concepts of various internal decompositions with all edges have projected [15]. That work based on network diagrams, directed graphs and power graph analysis with case studies.

Overview on sort first workload for distribution for parallel volume rendering projected [16]. Presents data scale sort first distributions can be performed. The researchers expressed the following concepts like load balancing, volumetric shadowing, and visibility culling concepts with result analysis of some the medical data.

The study of various volume rendering methods and how to gradient estimate unstructured meshes data sets has been discussed [17]. Discuss on various related works such projections methods, cell projects, ray casting methods, linear gradient constructions with some experimental results.

The survey on the various work related to medical data sets in field of visualization have demonstrated [18]. Mainly focused on vector image representation based piece wise smooth sub-division surfaces. The researchers expressed more on multi resolution data sets, discontinuous level images and different level sets.

The discussing comparative studies and visualization techniques to carry out medical data sets such as 3DCT, MRI, and various scanning parameters with case studies have presented [19]. Expressed some work on quality resolution of medical data sets. The focused multiple image view and edge comparison with help of supporting tools.

Here projected various case studies on neurosurgical techniques for deeper brain stimulation lead placement for images [19, 20]. The study described a magnetic resonance imaging (MRI)guided, robotically actuated stereotactic neural intervention system for deep brain stimulation procedure, which offers the potential of reducing procedure duration while improving targeting accuracy and enhancing safety.

Comparative studies of the brain's white matter structure through visual abstraction and multi-scale images has done [21]. The implementation demonstrated an interactive and continuous transition between the original one and the abstracted representation via various scale levels of similarity. Presents complete structure inside the brains.

Here demonstrated very first and efficient visualization tool that combination of path lines from blood flow and wall level thickness information [22]. The developed a GPU-based implementation of our visualizations which facilitates wall thickness analysis of the data through real-time rendering process and flexible interactive data exploration mechanisms. Finally, all research work related to various visualization techniques have discussed in this paper.

CONCLUSION

Various visualization techniques have been presented in this paper for further research work. We are described and analyzed many previous works, which were done in the field of computer graphics and visualization topics and medical sciences. The focus of this paper is to review on visualization techniques and its applications of information visualization and scientific visualization methods for any types of real-time data. We are provided, how to improve the quality in the images or objects, removing the noises from images, and graphically represent any graphical inputs or medical images. Our proposed work identified few efficient rendering techniques for medical images and geometric primitives. Finally, this review work provided to further development of higher dimensional data in the field of computer visualization techniques.

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