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COURSE NOTES 21

3D Visualization using Medical Data (3D Medical Visualization from Acquisition to Application)

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Three Dimensional Visualization using Medical Data: 3D Medical Visualization from Acquisition to Application

(Course Notes for SIGGRAPH 93)

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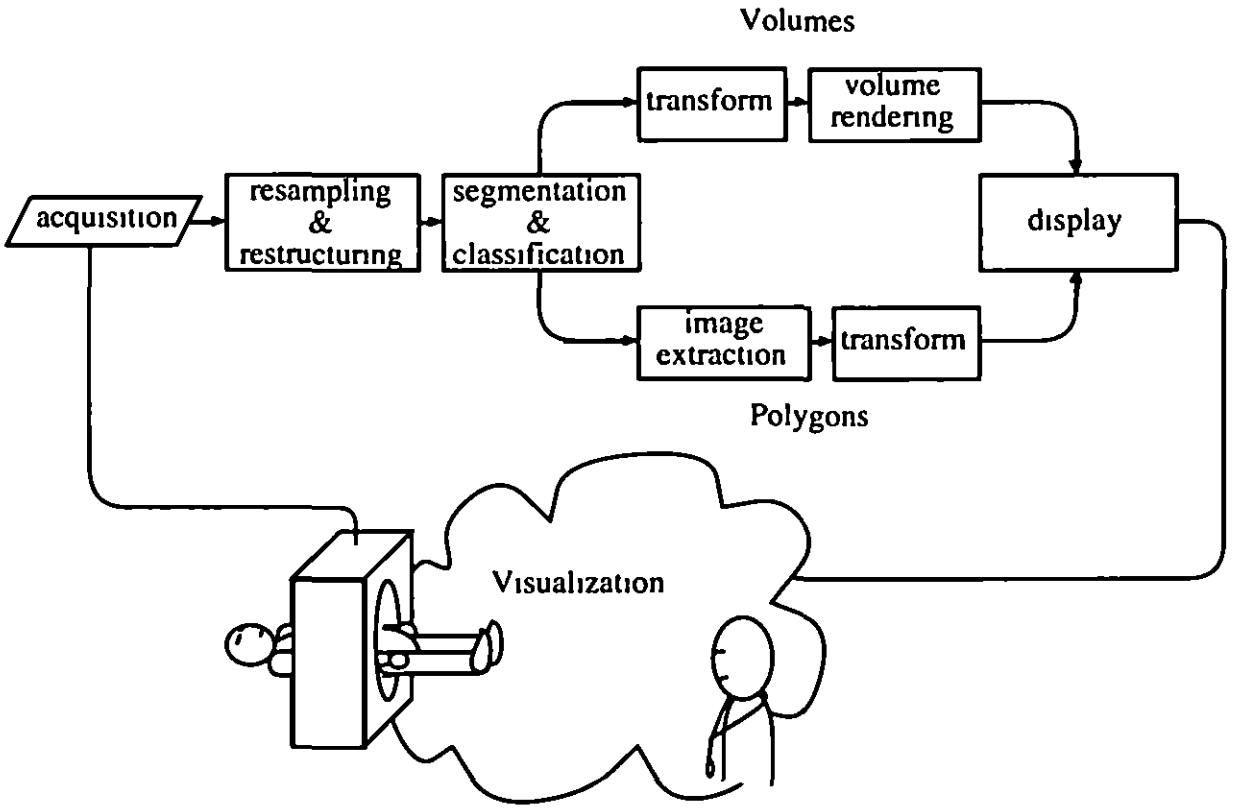
Description

This course will address current techniques for approaching the fundamental problem of medical visualization extracting information from 3D clinical data We will treat the problem as a pipeline from acquisition to display, pointing out inherent problems along the way Several examples medical of visualization in clinical studies will be presented

Abstract

This course presents a simplified medical visualization pipeline Like a graphics pipeline, there are steps throughout the procedure that are familiar, however, the beginning is image acquisition rather than geometry/modeling The segmentation/classification stages are new to graphics people but not to people familiar with image processing techniques The later half of the pipeline will cover rendering techniques commonly used in medical visualization, though perhaps in less detail than normally covered in either the introductory course or the advanced course in volume visualization A section on display systems will follow including the utilization of head-mounted display technology in medical applications

The remainder of the course is dedicated to familiarizing attendees with current directions of computer graphics in medicine, including new rendering algorithms, advanced graphics architectures, current and developing applications for this technology, and existing problems regarding accuracy, robustness, and interaction with the medical community



Simplified view of the medical visualization pipeline

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Speaker Biographies

Terry S Yoo is a Senior Research Associate in the computer science department at the University of North Carolina at Chapel Hill He is also a site coordinator for the NSF/DARPA Science and Technology Center for Computer Graphics and Scientific Visualization His research interests include medical image processing and interactive display of volumetric information Prior to his appointment at UNC he worked as a systems programmer for MCNC, as an Information Systems Designer on a data-flow signal processing machine for AT&T Technologies/Bell Labs and earlier as a member of the SIMNET project for BBN Laboratories Incorporated He received a BA in Biology from Harvard University in 1985 and a MS in Computer Science from the University of North Carolina at Chapel Hill in 1990 He is currently working on his doctoral degree in the segmentation and classification of MR images using a combined structural and statistical approach

Henry Fuchs is Federico Gil professor of computer science and adjunct professor of radiation oncology at the University of North Carolina at Chapel Hill He received a BA in Information and Computer Science from the University of California at Santa Cruz in 1970 and a pd in computer science from the University of Utah in 1975 He has been an associate editor of ACM Transactions on Graphics (1983 1988) and the guest editor of its first issue (Jan 1982) He was the chairman of the first of the Symposia on Interactive 3D Graphics (1986) co-director of the NATO Advanced Research Workshop on 3D Imaging in Medicine (1990) and co-chair of the National Science Foundation Workshop on the Future of Virtual Environments Research (1992) He received the 1992 Computer Graphics Achievement Award from ACM/SIGGRAPH and the National Computer Graphics Association Academic Award (1992) His current research interests include the application of head-mounted display technologies to problems in medicine

Elliot Fishman is the director of abdominal imaging at Johns Hopkins and a professor in the department of radiology He pioneered the use of volume rendering techniques for 3D imaging in the clinical arena His interests include using the computer to solve medical imaging problems in clinical practice His current research is in 3D imaging in radiology and the development of computer based educational training programs He received his undergraduate degree from the University of Maryland and his MD from the University of Maryland Medical School

Pat Hanrahan is an associate professor of computer science at Princeton University where he teaches computer graphics His current research involves volume rendering image synthesis and graphics systems and architectures Before joining Princeton he worked at Pixar where he developed volume rendering software and was the chief architect of the Renderman™ Interface a protocol that allows modeling programs to describe scenes for high quality rendering programs Prior to Pixar he directed the 3D computer graphics group in the Computer Graphics Laboratory at the New York Institute of Technology

Ron Kikinis is the director of the Surgical Planning Laboratory of the Department of Radiology, Brigham and Women's Hospital and Harvard Medical School, Boston, MA, and an Assistant Professor of Radiology at Harvard Medical School, as well as an Adjoint Assistant Professor of Biomedical Engineering at Boston University His interests include the development of clinical applications for image processing, computer vision and interactive rendering methods He is currently concentrating on introducing interactive computer graphics into the operating room He is the author and co-author of more than 20 peer-reviewed articles Before joining Brigham and Women's Hospital in 1988, he worked as a researcher at the ETH in Zurich and as a resident at the University Hospital in Zurich, Switzerland He received his M D from the University of Zurich, Switzerland in 1982

William E Lorensen is a Graphics Engineer in the Information Systems Laboratory at General Electric's Corporate Research and Development Center in Schenectady, New York, and is currently working on algorithms for 3D medical graphics and scientific visualization His other interests include computer animation, color graphics systems for data presentation, and object-oriented software tools He is the author or co-author of more than 50 technical articles on topics ranging from finite element pre/postprocessing, 3D medical imaging, computer animation and object-oriented design He is a co-author of "Object Oriented Modeling and Design" published by Prentice Hall Prior to joining General Electric in 1978, he was Mathematician at the US Army Benet Weapons Laboratory, where he worked on computer graphics software for structural analysis He holds a BS in Mathematics and an MS in Computer Science from Rensselaer Polytechnic Institute

Derek Ney is the director of the Advanced Medical Imaging Laboratory at Johns Hopkins, and an assistant professor in the department of radiology His work has focused on the application of advanced computer imaging techniques to radiology His current research interest include the development of high-level interactive 3D segmentation tools, the creation of generic programming tools for implementing 3D rendering algorithms, and the development of new 3D volume rendering algorithms He received his undergraduate degree in Computer Engineering from Caltech

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