



## CINEMATIC RENDERING TECHNOLOGY VS. VOLUMETRIC RENDERING TECHNOLOGY IN MAXILLOFACIAL TRAUMA- A REVIEW.

### Traumatology

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### ABSTRACT

Cinematic rendering technology (CRT) is a novel three dimensional(3D) visual in Computed Tomography(CT) available for viewing the complex anatomy and pathoanatomy. This is widely used for forensic examinations. CRT has its advantages in treatment planning. The mechanism used in this technique is the usage of lighting model which allows to produce photorealistic 3D images from two dimensional data. The other techniques like Volume rendering(VRT) has its disadvantages. However, the article emphasis the advantages of CRT in comparison with VRT in Maxillofacial trauma management.

### KEYWORDS

Cinematic rendering(CRT), volume rendering(VRT), three-dimensional (3D) computed tomography (CT), ..

#### INTRODUCTION:

In Maxillofacial surgery, the diagnosis of trauma is done by clinical examination. But, the adjunct tools such as radio imaging is very important. the CT imaging is being used widely. CT scanning provides isotropic resolution enabling 2D and 3D excellent quality images. The 2D produces multiplanar reformations(MPR), whereas 3D produces surface shaded display(SSD).

#### Volume rendering Technology:

The VRT, gives a near-real time 3D images in a fast and clinically compatible manner. Hence, VRT used as the standard technique for 3D visualization of CT images. The advantages of this technique includes, the production of difficult anatomical structures of a larger body region at the same time. Also the images are coloured. However, it can also mask the anatomical information which will be the disadvantage of VRT.

VRT is a step by step process: volume formation, classification, and image projection. a)The volume formation is assembling the image data. b)The classification is the step where the types of tissue is depicted by voxels. c)The image projection is projecting individual light ray into the data. Thus, the final image comes from interaction of the light rays with voxels.

#### Cinematic rendering technology:

The development of CR was inspired by the entertainment industry based on the quality of computer animation programs in cinema, and had the aim to generate more photo-realistic representations of the human body from CT and MR image data sets. The CR technique introduces a new paradigm, enabled by recent advances in computer graphics, to render volumetric medical image data by using a physically based real-time technique.

In contrast to VRT, the colour and opacity were predefined based on the synthetic light source. Also in contrast to the step ray casting, CRT simulates the propagation of natural light with the real time rendering manner. CRT uses Monte Carlo path tracking technique which simulates the complex interplay of visible photons with the scanned anatomical depiction of the patient. It is capable of generating photorealistic and even hyper-realistic images. To render them, a stochastic process is used to simulate light transport per pixel along thousands of photon paths through the anatomical depiction of the patient.

In comparison to the artificial light sources used in Volume Rendering, the combination of multiple and, thus, more precise simulation of the photons' dispersion and the interaction of the photons with the interiors of depicted structures allows for a more realistic, more natural lighting of the rendered data. Moreover, the use of motion blur effects makes it possible to achieve fluid animation during camera movements and, with the help of depth-of-field effects, to highlight those anatomical structures that are of particular interest.

#### DISCUSSION:

CRT makes it possible to generate photorealistic, detailed 3D reconstructions of the facial bones on the basis of 2D radiological cross-sectional datas. In comparison to 3D representations produced by means of VRT that appear rather glossy and plastic-like, but images

generated using CRT come across as more realistic, sharper and more lifelike. This is especially significant in the field of maxillofacial surgery for the complex anatomical interrelationships in the skull. Thus, here in particular, 3D representations can help the surgeon to promptly spot fractures and other possible anomalies in the facial bones and to process treatment planning.

For maxillofacial trauma, CRT very important to assess the fractures as the technique has best image sharpness. It aids in finding the fracture edges and further helps surgeon for anatomical reduction. Also the extent of displacement of tilting can be precisely visualized using CRT. 3D imaging helps in implant placement for fracture reduction by assessing the adjacent anatomical structures.

This also entails the use of complex high dynamic range rendering maps to create a natural lighting environment, as opposed to the synthetic light source of VRT. The result of this difference in lighting functions available in CRT is an overall more lifelike and visually appealing 3D image, compared with a VRT, that has a focus on improving depth and shape perception.

*Dappa et al*, in their research emphasis that CRT of CT images is particularly impressive when high density and high contrast structures such as bones and contrast-enhanced vessels are to be visualized. The main innovation as compared to conventional VR appear to be the more natural and photorealistic representation of the CT image data, with an enhanced and more natural depth and shape perception. The author found no major differences with respect to arriving at clinical diagnoses, and, as far as we know, there have been no scientific studies on the subject of the added diagnostic value of CRT in comparison to VRT.

*Marwen Eid et al*, explains the advantages of CRT as the lighting effects of neighboring voxels are also taken into account and create effects such as reflections and shadowing. As such, the reflections and shadowing applied in the reconstruction algorithm are vital to conveying depth perception and relations in the through plane. Compared with the results of VRT, the more realistic light emulation of CRT, although it does not affect spatial resolution but enhances evaluation of spatial relations, particularly in the through plane.

*Gascho et al*, 19-year-old man who died from an occipito-frontal gunshot wound presented an impressive radiating fracture line where the entire sagittal suture burst due to the high intracranial pressure that arose from a near-contact shot from a 9 mm bullet fired from a Glock 17 pistol. Photorealistic depictions of the radiating fracture lines along the cranial bones were created using 3D reconstruction methods, such as the novel CRT that simulates the propagation and interaction of light when it passes through volumetric data.

The author of this research suggests this modality for another purpose here such as forensic. *Ebert et al*, says that CRT is not primarily intended for diagnostic radiologic image analysis and thus should be used primarily as a tool to deliver visual information in the form of radiologic image reports. In forensic radiology, the effect of images with a more-photorealistic appearance might influence the decision making process of a jury.

**CONCLUSION:**

This review article emphasises that CRT is an innovative post-processing way to generate 3D reconstructions from 2D datas from CT. CRT significantly increases the quality of the images in contrast to conventional VRT. The more nearly photorealistic, detailed 3D representations of the face is very essential nowadays in maxillofacial trauma management. Therefore, CRT-CT should be used as primary diagnostic tool for maxillofacial traumatic injuries.

**Figures:**



**FIGURE:1.** CRT-CT showing the skin layer of patient's face with Right Zygomatic fracture.



**FIGURE:2** CRT-CT showing the muscle layer of the face.



**FIGURE:3.** CRT-CT showing the fractured facial bones reduced and fixed three- dimensionally.

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