

Research on blind watermarking techniques for 3D models applied in medical data

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Abstract: This study investigates blind watermarking techniques for 3D medical models, addressing the critical need for data authentication and copyright protection in healthcare. The research focuses on developing a robust, imperceptible watermarking method that embeds ownership information directly into the geometric structure of 3D models without requiring the original data for extraction. Key challenges include preserving diagnostic integrity while ensuring resilience against common attacks such as mesh simplification, noise addition, and geometric transformations. The proposed technique leverages modifications to vertex coordinates or topological features, balancing watermark capacity with minimal distortion. Experimental results on various medical datasets, including CT and MRI-derived models, demonstrate high imperceptibility and strong robustness against malicious and non-malicious manipulations. The findings confirm that blind watermarking can effectively secure sensitive medical 3D data, facilitating secure sharing and storage in telemedicine and collaborative healthcare environments. This work contributes a practical solution for intellectual property protection and tamper detection in the rapidly expanding field of medical 3D imaging.

Keywords: invisible watermarking, 3D model, medical data, watermarking technique