Chapter - 6

Conclusion and Future Work

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CONCLUSION AND FUTURE WORK

6.1 Chapter introduction:

Digital audio watermarking has emerged as a crucial technology for securing digital data, offering protection against issues like unauthorized use, tampering, and piracy. While traditional methods exhibit limitations in reliability and robustness against various attacks, this chapter introduces a novel approach centered on deep learning techniques. The proposed system integrates the DWT and an optimized deep CNN to enhance the efficiency of audio watermarking. A primary focus of this chapter is on the significant contribution of the DCNN in selecting optimal embedding locations, crucial for achieving robustness and resilience against potential adversarial activities. Through meticulous hyper parameter tuning, performed via search location optimization, the model minimizes errors in the classifier, further fortifying its performance. The experimental results showcase the superiority of the proposed model, surpassing existing watermarking techniques in terms of BER, MSE, and SNR. Additionally, this chapter provides an insightful overview of various hybrid and novel techniques in digital audio watermarking, highlighting the efficacy of neural network architectures, particularly the DCNN, in elevating security and performance. The collective findings not only contribute to the advancement of audio watermarking but also pave the way for future developments in the secure management of digital data.

6.2 Conclusion and research significance

In conclusion, this research contributes to the advancement of digital audio watermarking by introducing a sophisticated system that leverages deep learning techniques for enhanced security and reliability, specifically addressing ownership and copyright protection challenges. The integration of DWT and an optimized DCNN proves to be a notable breakthrough. The DCNN's role in selecting optimal embedding locations, facilitated by hyper parameter tuning through search location optimization, showcases superior performance with a low BER of 0.082, MSE of 0.099, and a high SNR of 45.363. This surpasses the capabilities of existing

watermarking models, emphasizing the effectiveness of neural network architectures, particularly the DCNN, in achieving robust watermark embedding and extraction with minimal errors. The experimental results validate the proposed approach as a significant advancement in the field, providing a reliable solution for digital audio watermarking applications.

6.3 Future Scope:

The presented research opens avenues for future exploration and enhancement in the realm of digital audio watermarking. Further research could delve into the integration of additional advanced deep learning architectures, exploring their potential impact on robustness and efficiency. Investigating the applicability of bio-inspired algorithms, such as swarm intelligence and genetic algorithms, holds promise in optimizing watermarking processes. Additionally, the exploration of AI-based techniques like simulated annealing for further optimization can be a fruitful avenue. The use of cryptographic algorithms and Arnold scrambling for increased watermark security should be investigated in greater depth. The ongoing development of hybrid techniques that combine classical and modern approaches, along with the incorporation of innovative machine learning and deep learning algorithms, will likely yield more efficient solutions. As the field evolves, the focus should remain on achieving a balance among robustness, imperceptibility, and security, thereby advancing the state-of-the-art in digital audio watermarking.