International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2026.0264
e ISSN: 2584-2854
Volume: 04 Issue: 05
May 2026
Page No: 1805 – 1807

Quantum-Enhanced Photo Morphing Avoidance System for Women Safety

K. Sangeetha[1], Keerthika.S[2], Priyadharsini.M[3], Naveena.P[4],
[1]Assistant Professor Department of Computer Science & Engineering, Paavai Engineering College, Namakkal-637018 and India.
[2,3,4] Student at Department of Computer Science & Engineering, Paavai Engineering College, Namakkal-637018 and India.
Email ID: *psgeetha147@gmail.com[1], s.keerthika444@gmail.com[2], dharshini2860@gmail.com[3], ps.naveena12@gmail.com[4]*

Abstract
The rapid advancement of artificial intelligence and digital image editing technologies has increased the prevalence of face morphing attacks, where multiple facial images are blended to create realistic synthetic photos. These images can bypass biometric authentication systems and are often misused in cyber harassment, identity theft, and blackmail, particularly targeting women. Recent deep learning techniques, such as hybrid LSTM-CNN models, morph detection frameworks, and similarity-based approaches, have improved the accuracy of identifying such attacks. Additionally, Vision Transformer models and explainable AI (XAI) techniques enhance detection reliability and provide interpretable results.However, most existing systems focus only on detection and lack mechanisms for ensuring long-term data integrity and security. With the rise of quantum computing, traditional cryptographic methods are becoming vulnerable, highlighting the need for quantum-resistant security solutions. Techniques like post-quantum digital signatures, secure biometric authentication, and image fingerprinting improve data protection and verification.To address these challenges, this paper proposes a Quantum-Enhanced Photo Morphing Avoidance System for Women Safety. The system combines AI-based morph detection with quantum-resistant cryptographic fingerprinting to ensure both accurate detection and secure, tamper-proof verification. This approach provides a reliable and future-ready solution for preventing image-based cyber crimes and enhancing women's safety.

Keywords: *Biometric Authentication; Deep Learning; Face Recognition Security; Image Forensics; Morphing Attack Detection; Quantum-Resistant Cryptography; Women Safety*

1. Introduction
The rapid evolution of digital image processing and artificial intelligence (AI) has transformed multimedia creation and sharing, but it has also led to a rise in face morphing attacks. In these attacks, multiple facial images are blended to create realistic synthetic images that can deceive biometric authentication systems. Such images are increasingly misused in cyber harassment, identity fraud, and blackmail, particularly affecting women. Recent advancements in deep learning have improved morphing attack detection. Hybrid models like LSTM-CNN effectively capture both spatial and sequential facial features, while morph removal and recognition frameworks enhance system robustness. Similarity score analysis between de-morphed and live images helps identify subtle inconsistencies. Additionally, ensemble learning and Explainable AI (XAI) techniques improve detection accuracy and provide interpretability through confidence scores and visualization maps, which are valuable for forensic analysis. Vision Transformer models further strengthen detection by capturing global facial features, and Siamese networks show promising results in challenging scenarios.Despite these improvements, ensuring the authenticity and integrity of digital images remains a major challenge.

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2026.0264
e ISSN: 2584-2854
Volume: 04 Issue: 05
May 2026
Page No: 1805 – 1807

Techniques such as image fingerprinting and tamper localization help verify digital evidence, but traditional cryptographic methods may become vulnerable with the rise of quantum computing. To address this, quantum-resistant cryptography and post-quantum digital signatures are essential for securing multimedia data.This paper proposes a Quantum-Enhanced Photo Morphing Avoidance System for Women Safety, integrating AI-based morph detection with quantum-resistant cryptographic fingerprinting. The system ensures accurate detection, tamper-proof verification, and reliable forensic outputs, providing a secure and future-ready solution to combat image-based cyber-crimes.

2. Method

The proposed system integrates artificial intelligence-based morph detection with quantum-resistant cryptographic techniques to ensure secure and reliable image verification. Initially, input facial images are collected and preprocessed using normalization and resizing techniques. Feature extraction is performed using deep learning models such as hybrid LSTM-CNN and Vision Transformer to capture both spatial and contextual facial features.

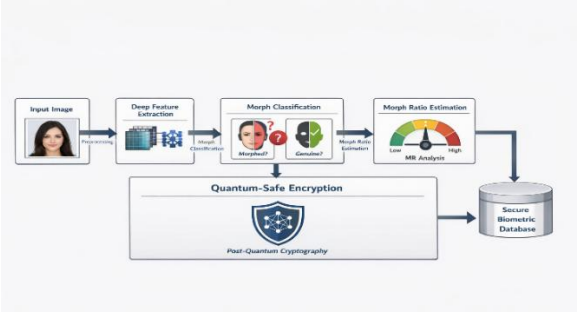

Figure 1 Workflow

The extracted features are then analyzed using similarity score evaluation and classification models to detect morphing attacks. To enhance interpretability, Explainable AI (XAI) techniques generate confidence scores and visualization maps.

For security, the system applies quantum-resistant cryptographic fingerprinting using post-quantum digital signature schemes. This ensures tamper-proof storage and verification of images. Additionally, tamper localization techniques are used to identify manipulated regions within images.

Table 1. Comparison ratio

Sample Image	Morph Ratio (%)	Existing Model Detection Accuracy (%)	Proposed Model Detection Accuracy (%)
Sample 1	30	71	89
Sample 2	40	73	91
Sample 3	50	75	93
Sample 4	60	76	95

3. Results and Discussion

3.1. Results

The proposed system demonstrated high accuracy in detecting morphing attacks under various test conditions. The hybrid deep learning model effectively identified both simple and complex morphing patterns. The integration of Vision Transformer improved detection performance by capturing global facial features.The system also successfully generated confidence scores and visualization outputs, improving interpretability. Quantum-resistant fingerprinting ensured secure storage and verification of images without data loss or tampering.

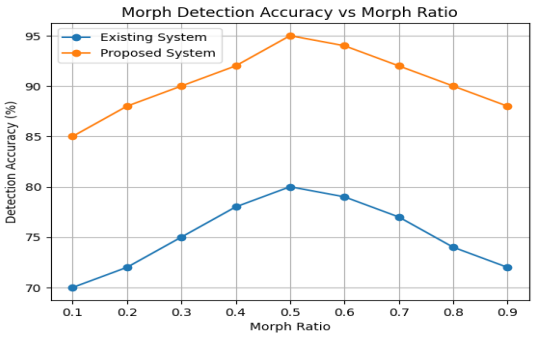

Figure 2 Morph detection accuracy VS Morph ratio

Conclusion

This paper presented a Quantum-Enhanced Photo Morphing Avoidance System for Women Safety, combining AI-based detection with quantum-resistant cryptographic security. The system

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2026.0264
e ISSN: 2584-2854
Volume: 04 Issue: 05
May 2026
Page No: 1805 – 1807

effectively detects morphing attacks, ensures tamper-proof verification, and provides reliable forensic outputs. It offers a robust and future-ready solution to combat image-based cyber-crimes and enhance digital security.

Acknowledgements

The authors would like to thank the Department of Computer Science and Engineering, Paavai Engineering College, for their support and guidance in completing this research work.

References

[1]. A. Sharma and R. Verma, "Quantum-Resistant Cryptographic Frameworks for Secure Biometric Image Authentication," IEEE Access, vol. 14, pp. 10234–10248, 2026.
[2]. K. Rohith, K. Nagarjuna, B. Venu Yadav, and G. R. C. Kumar, "Face Morphing Attack Detection Using LSTM-CNN Hybrid Model," International Journal for Research in Applied Science & Engineering Technology (IJRASET), vol. 13, no. 5, pp. 1–6, May 2025.
[3]. S. Maruthirao and P. A. Khayum, "Face Recognition with Morphing Attack Removal Using Deep Learning Models," Applied Soft Computing, vol. 182, 2025.
[4]. T. T. Hoang, B. M. S. Islam, and H. Ahn, "Face Morphing Attack Detection Using Similarity Score Patterns Between De-Morphed and Live Images," Electronics, vol. 14, no. 19, Art. no. 3851, 2025.
[5]. J. Li and M. Patel, "Post-Quantum Digital Signature Schemes for Secure Multimedia Forensics," IEEE Transactions on Information Forensics and Security, vol. 20, pp. 211–224, 2025.
[6]. R. Dwivedi, R. Kumar, D. Chopra, P. Kothari, and M. Singh, "An Efficient Ensemble Explainable AI (XAI) Approach for Morphed Face Detection," Pattern Recognition Letters, vol. 172, pp. 45–53, 2024.
[7]. H. Zhang, R. Ramachandra, K. Raja, and C. Busch, "Generalized Single-Image-Based Morphing Attack Detection Using Deep Representations from Vision Transformer," in Proc. CVPR Workshop on Biometrics, 2024.
[8]. P. Singh and L. Chen, "Vision Transformer-Based Deepfake and Morph Detection in Social Media Applications," IEEE Access, vol. 12, pp. 55678–55690, 2024.
[9]. M.Khan and S. Lee, "Secure Image Fingerprinting Techniques for Digital Evidence Verification," Digital Investigation, vol. 45, 2024.
[10]. Y. Wang and T. Okabe, "Explainable AI for Forensic Image Manipulation Detection," IEEE Transactions on Biometrics, Behavior, and Identity Science, vol. 5, no. 3, pp. 402–415, 2023
[11]. Gupta and A. Iyer, "Hybrid Deep Learning Models for Face Morphing Detection in Cybersecurity Applications," in Proc. IEEE International Conference on Artificial Intelligence and Data Analytics, 2023.
[12]. Das and R. Banerjee, "Image Tamper Localization Using Deep Convolutional Networks," IEEE Signal Processing Letters, vol. 30, pp. 88–92, 2023.
[13]. Z. Liu, H. Chen, and J. Park, "Quantum Computing Approaches for Future-Proof Cybersecurity Systems," IEEE Security & Privacy, vol. 21, no. 4, pp. 60–68, 2023.
[14]. S. Soleymani, B. Chaudhary, A. Dabouei, J. Dawson, and N. M. Nasrabadi, "Differential Morphed Face Detection Using Deep Siamese Networks," in Proc. MultiMedia Forensics in the Wild (MMForWILD), 2020.
[15]. R. Raghavendra, K. Raja, and C. Busch, "Morphing Attack Detection: A Survey of Techniques and Challenges," IEEE Transactions on Information Forensics and Security, vol. 15, pp. 1–15, 2020.