**ABSTRACT**

In an era marked by escalating concerns over data security and privacy, the fusion of advanced encryption techniques with biological signal processing has become crucial. Telemedicine and remote patient monitoring rely heavily on the secure transmission of biological signals, particularly those capturing cardiac activity. However, transmitting these signals over networks poses security risks and potential data loss. To address these challenges, a novel framework titled "Deep Learning-based Biological Signal Steganography with Missing Data Recovery Approach" is proposed. The framework utilizes deep learning techniques to fortify the confidentiality and integrity of bio-signal data transmissions. Hermite functions are employed for robust encryption, wherein the biosignal undergoes a forward Hermite transform before secret data bits are embedded. A cryptographic hash function generates passwords based on the encrypted signal, ensuring data integrity by detecting alterations during transmission. Upon reception, the decryption process unveils concealed information and discerns missing data blocks. To address unreliable transmission channels, a pre-trained Multilayer Perceptron Neural Network (MLPNN) predicts missing data based on surrounding intact portions of the signal, ensuring accurate reconstruction for medical analysis. Experimental validation demonstrates the framework's efficacy and robustness, with high levels of confidentiality and minimal distortion to clinical information in encrypted biosignals. Password verification mechanisms rigorously ensure data integrity, while the MLPNN showcases remarkable success rates in real-world scenarios. In summary, the proposed approach offers enhanced security through Hermite function encryption, data integrity via password generation, and missing data recovery facilitated by the MLPNN. This comprehensive solution addresses critical concerns surrounding the secure and reliable transmission of biological signals in telemedicine and remote patient monitoring applications.