



## **Hybrid scheme for safe speech transmission based on multiple chaotic maps, watermarking and Arnold scrambling algorithm**

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### **Abstract**

In this paper, we present a novel scheme for enhancing the security of speech information in communication systems. We build a hybridization of three approaches: Chaotic logistic and tent maps for generating an arbitrary vector by some primarily initiated values to be joined in the original speech signal, an integrated watermark image within the encrypted signal in order to verify, through decryption process, that the encrypted signal is authentic as well as does not suffer from eventual attacks, and the third approach is using an Arnold scrambling key (cat map) to spread signal samples by means of a secret key, then recuperate the original signal from samples which is not possible without this key. Obtained correlation value in the proposed scheme is closer to null which proves that original and encrypted signals are completely dissimilar. Moreover, we recovered the original speech without disturbing the quality. Numerical results of the Signal to Noise Ratio (SNR) and Correlation Coefficient (CC) reported below, and the comparison between the proposed approach to seven recently published works, also reported, reveal the superiority of the proposed scheme and validate our design to be considered amongst the best methods compared to other recently existing strong approaches.

**Keywords** Speech security . Hybrid . Chaotic . Watermarking . Arnold