

## **Character property method for Arabic text steganography with biometric multifactor authentication using liveness detection**

### **ABSTRACT**

Arabic text steganography (ATS) offers a potential opportunity in hiding secret information in characters and features. The combination with any other security sub discipline such as cryptography usually will enhance its level of security. However, it is limited in its ability to optimize embedded data capacity with a high perceptual transparency level that will also not raise suspicion when written. Besides that, other concerns are active attacks by intruders which are a crucial security issue in the transmission of the shared secret key that enables the receiver to extract the secret information. Also, such attacks can be affected through a fake identity that allows the receiver to modify the secret information thus degrading its integrity. To overcome these drawbacks, we propose a hybrid ATS with biometric multi factor authentication (BMA), which uses liveness detection using fingerprints and heartbeat sensors as the authentication factors. We propose a new ATS method, the Character Property method (CPM) which uses the basic properties of the Arabic Text such as dots, calligraphy typographical proportions, and sharp-edges to hide the secret message using a table index mapping technique to optimize data capacity with high perceptual transparency to avert suspicion. The results for the biometric authentication showed that the proposed method correctly authenticates users, having a false rejection rate of only 4%, and a 0% false acceptance rate. As for liveness detection, the results were significant where the proposed method correctly detected live subjects compared to a fingerprint only biometric authentication approach, which had a high acceptance of fake inputs. BMA was implemented through a custom Arduino smartwatch with a fingerprint and heartbeat sensor as a ‘proof-of-concept’ device which increased the capacity in hiding the secret message up to 23.5% compared to the previous methods. Given our Arabic Character Properties method (CPM) did not affect the stego-text appearance, its 1.0 Jaro Similarity score was compared to the other methods proving high transparency of the stego-text, in addition to higher security regarding user authentication using BMA with liveness detection.

**Keyword:** Arabic text steganography; Biometric multifactor authentication; Information hiding