Abstract

In the recent era of secure digital communication, information forensics become one of the most promising research topics. Steganography and Steganalysis are two most important research wings under information forensics paradigm. Steganography, the word originated from Greek mythology, literally means covered writing. On the other hand, steganalysis is the art and science of detecting messages or estimating potentially hidden information from observed data. In this thesis, various new steganographic algorithms are proposed in order to enhance steganographic security.

In this work, firstly multiple bit plane image steganography is considered. It is observed from the recent literature that multiple bit plane replacement methods perform better than single bit plane replacement against structural asymmetry based targeted attack. But they become vulnerable against blind attacks due to large additive noise during embedding. In this context, two novel algorithms are proposed to reduce the additive noise in multiple bit plane steganography.

However multiple bit plane steganographic schemes are quite vulnerable from targeted attacks based on order statistics. As a countermeasure, a few statistical restoration techniques are proposed in the literature. But their schemes are not well suited for images with non-Gaussian histogram. To overcome this limitation, a novel statistical restoration scheme is proposed in this thesis. In addition, an interesting algorithm based on pixel swapping is also presented in this work, which restores image histogram inherently.

The main drawback of the statistical based scheme is the extra noise added during restoration. To meet this challenge, two adaptive schemes on pixel swapping are suggested for reducing the embedding noise.

In another approach, the steganographic security against blind attacks is enhanced by separating embedding domain from channel domain. A few algorithms exploiting this feature have been reported earlier in the block DCT domain. But they suffer from a very low embedding rate and high bit error rate (BER), in particular when JPEG quality for embedding is relatively low (about 50%). In this thesis, a new technique has been advanced with improved performances in the block DCT space. The technique is further extended in the spatial domain also.

Keywords: Steganography, steganalysis, least significant bit replacement, embedding noise, structural asymmetry, targeted steganalysis, blind steganalysis, statistical restoration, adaptive embedding, randomized hiding, embedding domain, channel domain, domain separation.