FRAME SELECTION BASED ON MODIFIED ENTROPY AND OBJECT MOTION FOR SECURED DATA HIDING IN VIDEOS

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SUPERVISOR'S DECLARATION

We hereby declare that we have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

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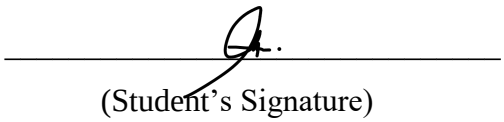
I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.



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ABSTRAK

Pertumbuhan teknologi internet menjadikan teknik penyembunyian maklumat menjadi komunikasi yang popular. Video telah digunakan secara meluas sebagai media untuk menyembunyikan kewujudan komunikasi dengan menyembunyikan mesej. Video sering dimampatkan untuk mengurangkan muatan penyimpanan dan penghantaran dengan mengorbankan kualiti yang lebih rendah kerana masalah berkaitan jalur lebar. Video memberikan ruang tersembunyi tambahan di dalam data video. Kaedah pemampatan telah banyak digunakan dalam aplikasi multimedia. Maklumat penyembunyian berdasarkan bit akan hilang kerana pemampatan. Mesej penyembunyian yang sedia ada menumpukan pada ketidaklihatan dan muatan mesej tersembunyi. Dalam praktiknya, mesej tersembunyi tidak memerlukan sejumlah besar bit. Oleh itu, sangat penting untuk mengembangkan teknik penyembunyian maklumat yang memerlukan muatan terhad mesej tersembunyi tetapi boleh tahan terhadap pemampatan. Penyelidikan ini mencadangkan teknik pemilihan bingkai berdasarkan gerakan objek dan entropi yang diubah dalam steganografi video. Pergerakan objek dalam bingkai video ditentukan oleh vektor gerakan mendatar dan menegak. Bingkai video yang mempunyai gerakan objek dihitung dengan entropi yang diubah. Bingkai entropi yang diubahsuai paling rendah dipilih untuk menyembunyikan mesej rahsia. Skema yang dicadangkan memasukkan data bersama dengan gerakan objek dengan mengubah pekali Discrete Cosine Transform (DCT) dalam bingkai video. Enam pekali DCT dipilih pada frekuensi tengah menggunakan kesan DCT-psikovisual penyembunyian mesej. Satu mesej disematkan dengan mengubah pekali DCT tengah menggunakan algoritma yang dicadangkan. Frekuensi tengah mempunyai kapasiti bersembunyi yang besar dan secara relatifnya tidak memberikan kesan yang signifikan terhadap pembinaan semula video. Pilihan bingkai yang dicadangkan memberikan keselamatan tambahan di mana data tersembunyi sukar dikesan. Steganografi video yang dicadangkan mencapai penyimpangan persepsi yang kurang pada mata manusia. Hasil eksperimen menunjukkan bahawa skema tersebut mencapai kekuatan pemulihan mesej yang baik dari segi Bit Error Rate (BER) dan Normalized Cross-Correlation (NC). Hasil eksperimen menunjukkan bahawa skema yang dicadangkan menunjukkan penigkatan nilai SSIM sekitar 1.21% daripada skema lain. Nilai purata PSNR dan SSIM untuk empat belas video menunjukkan sekitar 49.67 dB dan 0.989. Mesej yang dipulihkan dari skema steganografi yang dicadangkan boleh tahan di bawah pemampatan video. Skema yang dicadangkan juga mencapai ketahanan pemulihan mesej yang baik di bawah pemampatan H.264 dari segi NC dan BER. Purata nilai pemulihan mesej NC dan BER di bawah pemampatan H.264 adalah sekitar 0.95 dan 0.2.

ABSTRACT

The growth of internet technology makes hiding information techniques become popular communication. Video has been widely used as media for concealing communication existence by hiding messages. Videos are often compressed to reduce storage and transmission payload at the expense of lower quality due to bandwidth-related issues. Videos provide additional hidden-space in the video data. Compression methods have been widely applied in multimedia applications. The hiding information based on least significant bits will be lost due to compression. The existing hiding messages focus on the imperceptibility and payload of hidden messages. In practice, the hidden message does not require a large amount of bits. Thus, it is vital to develop a hiding information technique that requires a limited payload of hidden messages but it can be resistant against compression. This research proposed a frame selection technique based on object motion and modified entropy in video steganography. The object motions in the video frame were determined by horizontal and vertical motion vectors. The video frames that had object motion were computed by modified entropy. The lowest modified entropy frames were selected for concealing a secret message. The proposed scheme embedded data along with the object motion by modifying Discrete Cosine Transform (DCT) coefficients in the video frames. Six DCT coefficients were selected in the middle frequency using DCT-psychovisual effects of hiding messages. A message was embedded by modifying middle DCT coefficients using the proposed algorithm. The middle frequencies had a large hiding capacity and it relatively did not any give significant effect to the video reconstruction. The proposed frame selections provided additional security where the hidden data were difficult to be detected. The proposed video steganography achieved less perceptual distortion to the human eyes. The experimental results showed that the scheme achieved good robustness of message recovery in terms of Bit Error Rate (BER) and Normalised Cross-Correlation (NC). The experimental results showed that the proposed scheme improved SSIM value of about 1.21% than other existing schemes. The average PSNR and SSIM values for fourteen videos are about 49.67 dB and 0.989, respectively. The recovered message of the proposed steganography scheme can be resistant under video compression. The proposed scheme also achieved good robustness of message recovery under H.264 compression in terms of NC and BER. The average NC and BER values of message recovery under H.264 compression are about 0.95 and 0.2 respectively.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

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