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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

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Video steganography using Redundant Discrete Wavelet Transform And QR Factorization

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Abstract

Internet simplified digital data transfer. This data needs to be secured; so securing digital data becomes an important concern. There are different techniques for data security, namely, cryptography, watermarking and steganography.

Steganography provides security for data by embedding it into a cover and concealing it.

There are different steganography approaches were proposed. These approaches differ in the type of the cover and the secret data, the size of the secret data that can be embedded and the algorithm's robustness to keep the secret data safe against attacks.

In this thesis, a steganography technique is introduced. This technique depends on Stationary Wavelet Transform (SWT) and hybrid-matrix decomposition techniques (Singular Value Decomposition (SVD) and QR factorization) to conceal a video in another video. The SWT is one of the Redundant Discrete Wavelet Transform (RDWT) implementations.

A gray-scale video is used as a secret message. One resolution SWT is applied for the secret video frames. Three- resolutions 3D SWT is then applied on the Y channel of the video frames, resulting in eight sub-bands. One of the sub-bands is selected to be decomposed into two matrices using QR factorization. QR factorization is applied also for the LLL sub-band of the secret video. The R matrix of the cover video is then calculated using the modified singular matrix. The cover sub-band is also re-calculated using the modified R matrix. Inverse 3D SWT is then applied. This results in the stego-video.

The performance of the algorithm was measured using the Peak Signal to Noise Ratio (PSNR) and Structural Similarity Index Measure (SSIM) for the cover and secret videos. The algorithm successfully hid a secret image in a cover video and also was able to successfully hid a video of the same size as the

cover video; the hiding capacity is 100%. Different parameters were tested (the resolution level, the alpha value, the used sub-band and the used mother wavelet) to detect the best values that derive the best performance in terms of PSNR and SSIM. The algorithm achieved a high SSIM value that reached 0.97 for video hiding and 0.99 for image hiding. And also achieved a high PSNR value that reached 68.8 for video hiding and 74 for image hiding, proving that the proposed algorithm's imperceptibility is very high. The comparative analysis shows that the proposed algorithm achieved higher imperceptibility than the other state-of-the-art algorithms regarding the average PSNR. The enhanced version of the proposed method is more robust against different types of attacks.

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List of Abbreviations

Abbreviation	Stands for
AVI	**A**udio **V**ideo **I**nterleave
CWT	**C**ontinuous **W**avelet **T**ransform
DCT	**D**iscrete **C**osine **T**ransform
DFT	**D**iscrete **F**ourier **T**ransform
DNA	**D**eoxyribo**n**ucleic **A**cid
DWT	**D**iscrete **W**avelet **T**ransform
HSV	**H**ue-**S**aturation-**V**alue
IOT	**I**nternet **O**f **T**hings
IWT	**I**nteger **W**avelet **T**ransform
LSB	**L**east **S**ignificant **B**it
LU	**L**ower-**U**pper
LWT	**L**ifting **W**avelet **T**ransform
MSB	**M**ost **S**ignificant **B**it
MSE	**M**ean **S**quare **E**rror
NCC	**N**ormalized **C**ross-**C**orrelation
PSNR	**P**eak **S**ignal to **N**oise **R**atio
PVD	**P**ixel **V**alue **D**ifferencing
QIM	**Q**uantization **I**ndex **M**odulation
RGB	**R**ed-**G**reen-**B**lue
RIWT	**R**edundant **I**nteger **W**avelet **T**ransform
ROI	**R**egions **O**f **I**nterest
RSA	**R**ivest–**S**hamir–**A**dleman
SVD	**S**ingular **V**alue **D**ecomposition
YCbCr	**Y** luminance, **C**hroma: **b**lue, **C**hroma: **r**ed

List of Publications

1) El-Shahed, Reham A., Al-Berry, M. N., Ebeid, Hala M. and Shedeed, Howida A., “Video Steganography using 3D Stationary Wavelet Transform”, Proceedings of the 11th International Conference on Informatics & Systems (INFOS 2018)
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5) El-Shahed, Reham A., Al-Berry, M. N., Ebeid, Hala M. and Shedeed, Howida A., “Image hiding using upper-lower decomposition technique”. International Journal of Intelligent

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6) El-Shahed, Reham A., Al-Berry, M. N., Ebeid, Hala M. and Shedeed, Howida A., "Image hiding using QR factorization and discrete wavelet decomposition techniques". Future computing and informatics journal, Volume 6, Issue 2, 2021