DWT, DCT and SVD based Digital Image Watermarking

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Abstract: With the rapid development of multimedia and computer technology, images, audio, text and video can be more easily produced, processed as well as stored by digital devices in recent years. To conceal data in transmitting message for preventing the illegal copying or to protect the secret is very important. Data encryption and information hiding schemes are developed to protect the secret data. In this paper, digital image watermarking algorithm based on DWT, DCT and SVD has been proposed in which Arnold transform has been applied to watermark image in order to ensure the watermark robustness. Experimental results show the algorithm is robust to the common image process such as JPEG compression and other attacks like noise and filters.

Keywords: DCT, DWT, SVD, PSNR, MSE, NC.

I. INTRODUCTION

Since Internet is a public transmission way and it is widely applied in many applications, we can send and receive digital data, such as images, by connected networks, with the recent growth of communication technologies. At the end of the 20th century, information network technology was widely used all over the world and it was greatly convenient for resource sharing and exchange between people. However, it was followed by many serious problems. However, many new issues such as security of digital information transmission and copyright protection of digital products also emerge in the meantime. How to prevent digital products from copyright infringement, piracy and alteration without permission have become many nations' concerns needing to be resolved urgently. Data encryption methods make the secret data into meaningless bits. On the other hand, information hiding techniques hides the message into a meaningful multimedia data.

Watermarking is the process of embedding data into a multimedia element such as an image, audio or video file for the purpose of authentication . This embedded data can later be extracted from, or detected in, the multimedia for security purposes. A watermarking algorithm consists of the watermark structure, an embedding algorithm, and an extraction or detection algorithm. Watermarks can be embedded in the pixel domain or a transform domain. In multimedia applications, embedded watermarks should be invisible, robust, and have a high capacity. In the classification of watermarking schemes, an important criterion is the type of information needed by the detector. The requirements for digital watermarks in these scenarios are different, in general. Identification of the origin of content requires the embedding of a single watermark into the content at the source of distribution. To trace illegal copies, a unique watermark is needed based on the location or identity of the recipient in the multimedia network. In both of these applications, non-blind schemes are appropriate as watermark extraction or detection needs to take place in special laboratory environment only when there is a dispute regarding the ownership of content.

II. NEED OF WATERMARKING

Watermarking methods are based on the human visual system in which it cannot be recognized due to tiny difference. In these techniques, the cover-image is used to hide the secret information and the stego-image is the cover- image with the secret data embedded inside. It hides the secret information in general files secretly first and then transmits these files through network, because they look the same as general files, they can escape from the attention of illegal intercepters easily and therefore the secret information is not easy to be attacked.

III. WORKING DOMAINS

Currently, there are two most popular digital watermarking technologies including the Methods in Time Domain and Methods in Transformation Domain. Methods in the former one can be implemented more simply, but the robustness is poorer, while methods in the latter one are more popular with their stronger anti-attack functions. The typical Transformation-Domain Methods are mostly based on the domain of Discrete Fourier Transform (DFT), Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT), etc. Recently, some researchers began to make use of Singular Value Decomposition (SVD) to embed a watermark[1]. SVD is a compression technique that can be used in a wide range of applications where data may be organized in a matrix representation. With the increasing use of SVD, the digital watermarking

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Internet of Things and Connected Technologies Rajiv Misra,Nishtha Kesswani,Muttukrishnan Rajarajan,Veeravalli Bharadwaj,Ashok Patel,2021-05-29 This book presents the recent research adoption of a variety of enabling wireless communication technologies like RFID tags BLE ZigBee etc and embedded sensor and actuator nodes and various protocols like CoAP MQTT DNS etc that has made Internet of things IoT to step out of its infancy to become smart things Now smart sensors can collaborate directly with the machine without human involvement to automate decision making or to control a task Smart technologies including green electronics green radios fuzzy neural approaches and intelligent signal processing techniques play important roles in the developments of the wearable healthcare systems In the proceedings of 5th International Conference on Internet of Things and Connected Technologies ICIoTCT 2020 brought out research works on the advances in the Internet of things IoT and connected technologies various protocols standards etc This conference aimed at providing a forum to discuss the recent advances in enabling technologies and applications for IoT **Medical Image Watermarking** Amit Kumar Singh,Basant Kumar,Ghanshyam Singh,Anand Mohan,2017-08-11 This book presents medical image watermarking techniques and algorithms for telemedicine and other emerging applications This book emphasizes on medical image watermarking to ensure the authenticity of transmitted medical information It begins with an introduction of digital watermarking important characteristics novel applications different watermarking attacks and standard benchmark tools This book also covers spatial and transform domain medical image watermarking techniques and their merits and limitations The authors have developed improved novel watermarking techniques for telemedicine applications that offer higher robustness better perceptual quality and increased embedding capacity and secure watermark The suggested methods may find potential applications in the prevention of patient identity theft and health data management issues which is a growing concern in telemedicine applications This book provides a sound platform for understanding the medical image watermarking paradigm for researchers in the field and advanced level students Industry professionals working in this field as well as other emerging applications demanding robust and secure watermarking will find this book useful as a reference

Intelligent Wavelet Based Techniques for Advanced Multimedia Applications Rajiv Singh,Swati Nigam,Amit Kumar Singh,Mohamed Elhoseny,2020-02-27 This book contains high quality research articles and reviews that promote research and reflect the most recent advances in intelligent wavelet based techniques for advanced multimedia applications as well as other emerging areas In recent time wavelet transforms have become useful in many signal image and video processing applications especially for multimedia security and surveillance A few applications of wavelets in security and surveillance are watermarking fusion steganography object detection tracking motion recognition and intention recognition etc Wavelets are well capable of analyzing signal image and video at different resolution levels popularly known as multiresolution analysis The multiresolution analysis is advantageous in multimedia security and surveillance applications It provides

flexibility in selection of different resolution levels that leads to better accuracy Furthermore recently sparse representation has become an advancement to analyze wavelet coefficients It is observed that wavelet transforms possess the invariance property which makes them suitable for many vision applications This book provides a concise overview of the current state of the art and disseminates some of the novel and exciting ideas and techniques In addition it is also helpful for the senior undergraduate and graduate students researcher academicians IT professional and providers citizens customers as well as policy makers working in this area as well as other emerging applications demanding state of the art wavelet based multimedia applications   6th EAI International Conference on Big Data Innovation for Sustainable Cognitive Computing Anandakumar Haldorai,Arulmurugan Ramu,Sudha Mohanram,2024-05-30 This book features the proceedings of the 6th EAI International Conference on Big Data Innovation for Sustainable Cognitive Computing BDCC 2023 The papers feature detail on cognitive computing and its self learning systems that use data mining pattern recognition and natural language processing NLP to mirror the way the human brain works This international conference focuses on technologies from knowledge representation techniques and natural language processing algorithms to dynamic learning approaches Topics covered include Data Science for Cognitive Analysis Real Time Ubiquitous Data Science Platform for Privacy Preserving Data Science and Internet Based Cognitive Platform   Data Fusion Techniques and Applications for Smart Healthcare Amit Kumar Singh,Stefano Berretti,2024-03-12 Medical data exists in several formats from structured data and medical reports to 1D signals 2D images 3D volumes or even higher dimensional data such as temporal 3D sequences Healthcare experts can make auscultation reports in text format electrocardiograms can be printed in time series format x rays saved as images volume can be provided through angiography temporal information by echocardiograms and 4D information extracted through flow MRI Another typical source of variability is the existence of data from different time points such as pre and post treatment for instance These large and highly diverse amounts of information need to be organized and mined in an appropriate way so that meaningful information can be extracted New multimodal data fusion techniques are able to combine salient information into one single source to ensure better diagnostic accuracy and assessment Data Fusion Techniques and Applications for Smart Healthcare covers cutting edge research from both academia and industry with a particular emphasis on recent advances in algorithms and applications that involve combining multiple sources of medical information This book can be used as a reference for practicing engineers scientists and researchers It will also be useful for graduate students and practitioners from government and industry as well as healthcare technology professionals working on state of the art information fusion solutions for healthcare applications Presents broad coverage of applied case studies using data fusion techniques to mine organize and interpret medical data Investigates how data fusion techniques offer a new solution for dealing with massive amounts of medical data coming from diverse sources and multiple formats Focuses on identifying challenges solutions and new directions that will be useful for graduate students researchers and practitioners from

government academia industry and healthcare **Computational Methods and Data Engineering** Vijendra Singh,Vijayan K. Asari,Sanjay Kumar,R. B. Patel,2020-11-04 This book gathers selected high quality research papers from the International Conference on Computational Methods and Data Engineering ICMDE 2020 held at SRM University Sonipat Delhi NCR India Focusing on cutting edge technologies and the most dynamic areas of computational intelligence and data engineering the respective contributions address topics including collective intelligence intelligent transportation systems fuzzy systems data privacy and security data mining data warehousing big data analytics cloud computing natural language processing swarm intelligence and speech processing **Advanced Informatics for Computing Research** Ashish Kumar Luhach,Dharm Singh Jat,Kamarul Bin Ghazali Hawari,Xiao-Zhi Gao,Pawan Lingras,2019-09-16 This two volume set CCIS 1075 and CCIS 1076 constitutes the refereed proceedings of the Third International Conference on Advanced Informatics for Computing Research ICAICR 2019 held in Shimla India in June 2019 The 78 revised full papers presented were carefully reviewed and selected from 382 submissions The papers are organized in topical sections on computing methodologies hardware information systems networks software and its engineering *Communication and Computing Systems* B.M.K. Prasad,Krishna Kant Singh,Neelam Ruhil,Karan Singh,Richard O'Kennedy,2017-02-15 This book is a collection of accepted papers that were presented at the International Conference on Communication and Computing Systems ICCCS 2016 Dronacharya College of Engineering Gurgaon September 9 11 2016 The purpose of the conference was to provide a platform for interaction between scientists from industry academia and other areas of society to discuss the current advancements in the field of communication and computing systems The papers submitted to the proceedings were peer reviewed by 2 3 expert referees This volume contains 5 main subject areas 1 Signal and Image Processing 2 Communication Computer Networks 3 Soft Computing Intelligent System Machine Vision and Artificial Neural Network 4 VLSI Embedded System 5 Software Engineering and Emerging Technologies **Proceedings of the International Conference on Signal, Networks, Computing, and Systems** Daya K. Lobiyal,Durga Prasad Mohapatra,Atulya Nagar,Manmath N. Sahoo,2016-10-13 The book is a collection of high quality peer reviewed research papers presented in the first International Conference on Signal Networks Computing and Systems ICSNCS 2016 held at Jawaharlal Nehru University New Delhi India during February 25 27 2016 The book is organized in to two volumes and primarily focuses on theory and applications in the broad areas of communication technology computer science and information security The book aims to bring together the latest scientific research works of academic scientists professors research scholars and students in the areas of signal networks computing and systems detailing the practical challenges encountered and the solutions adopted Blockchain for Information Security and Privacy Udai Pratap Rao,Piyush Kumar Shukla,Chandan Trivedi,Sweta Gupta,Zelalem Sintayehu Shibeshi,2021-12-01 Distributed and peer to peer P2P applications are increasing daily and cyberattacks are constantly adopting new mechanisms to threaten the security and privacy of users in these Internet of Things IoT environments

Blockchain a decentralized cryptographic based technology is a promising element for IoT security in manufacturing finance healthcare supply chain identity management e governance defence education banking and trading Blockchain has the potential to secure IoT through repetition changeless capacity and encryption Blockchain for Information Security and Privacy provides essential knowledge of blockchain usage in the mainstream areas of security trust and privacy in decentralized domains This book is a source of technical information regarding blockchain oriented software and applications It provides tools to researchers and developers in both computing and software engineering to develop solutions and automated systems that can promote security trust and privacy in cyberspace FEATURES Applying blockchain based secured data management in confidential cyberdefense applications Securing online voting systems using blockchain Safeguarding electronic healthcare record EHR management using blockchain Impacting security and privacy in digital identity management Using blockchain based security and privacy for smart contracts By providing an overview of blockchain technology application domains in IoT e g vehicle web power web cloud internet and edge computing this book features side by side comparisons of modern methods toward secure and privacy preserving blockchain technology It also examines safety objectives efficiency limitations computational complexity and communication overhead of various applications using blockchain This book also addresses the combination of blockchain and industrial IoT It explores novel various levels of information sharing systems *Innovation in Medicine and Healthcare* Yen-Wei Chen,Satoshi Tanaka,Robert J. Howlett,Lakhmi C. Jain,2025-03-06 This book presents the proceedings of the KES International Conferences on Innovation in Medicine and Healthcare KES InMed 24 held in Madeira Portugal on June 19 21 2024 Covering a number of key areas including digital IT architecture in healthcare advanced ICT for medicine and healthcare biomedical engineering trends research and technologies and healthcare support systems this book is a valuable resource for researchers managers industrialists and anyone wishing to gain an overview of the latest research in these fields **Recent Trends in Information and Communication Technology** Faisal Saeed,Nadhmi Gazem,Srikanta Patnaik,Ali Saleh Saed Balaid,Fathey Mohammed,2017-05-24 This book presents 94 papers from the 2nd International Conference of Reliable Information and Communication Technology 2017 IRICT 2017 held in Johor Malaysia on April 23 24 2017 Focusing on the latest ICT innovations for data engineering the book presents several hot research topics including advances in big data analysis techniques and applications mobile networks applications and usability reliable communication systems advances in computer vision artificial intelligence and soft computing reliable health informatics and cloud computing environments e learning acceptance models recent trends in knowledge management and software engineering security issues in the cyber world as well as society and information technology **Soft Computing: Theories and Applications** Millie Pant,Kanad Ray,Tarun K. Sharma,Sanyog Rawat,Anirban Bandyopadhyay,2017-11-23 This book focuses on soft computing and its applications to solve real life problems occurring in different domains ranging from medical and health care supply chain

management and image processing to cryptanalysis It presents the proceedings of International Conference on Soft Computing Theories and Applications SoCTA 2016 offering significant insights into soft computing for teachers and researchers and inspiring more and more researchers to work in the field of soft computing The term soft computing represents an umbrella term for computational techniques like fuzzy logic neural networks and nature inspired algorithms In the past few decades there has been an exponential rise in the application of soft computing techniques for solving complex and intricate problems arising in different spheres of life The versatility of these techniques has made them a favorite among scientists and researchers working in diverse areas SoCTA is the first international conference being organized at Amity University Rajasthan AUR Jaipur The objective of SoCTA 2016 is to provide a common platform to researchers academicians scientists and industrialists working in the area of soft computing to share and exchange their views and ideas on the theory and application of soft computing techniques in multi disciplinary areas The aim of the conference is to bring together young and experienced researchers academicians scientists and industrialists for the exchange of knowledge SoCTA especially encourages the young researchers at the beginning of their career to participate in this conference and present their work on this platform   *International Advanced Researches & Engineering Congress 2017 Proceeding Book* Recep HALICIOGLU,Hediye KIRLI AKIN,Yusuf FEDAI,2017-12-29 INTERNATIONAL WORKSHOPS at IAREC 17 This book inclueds English main and Turkish languages International Workshop on Mechanical Engineering International Workshop on Mechatronics Engineering International Workshop on Energy Systems Engineering International Workshop on Automotive Engineering and Aerospace Engineering International Workshop on Material Engineering International Workshop on Manufacturing Engineering International Workshop on Physics Engineering International Workshop on Electrical and Electronics Engineering International Workshop on Computer Engineering and Software Engineering International Workshop on Chemical Engineering International Workshop on Textile Engineering International Workshop on Architecture International Workshop on Civil Engineering International Workshop on Geomatics Engineering International Workshop on Industrial Engineering International Workshop on Food Engineering International Workshop on Aquaculture Engineering International Workshop on Agriculture Engineering International Workshop on Mathematics Engineering International Workshop on Bioengineering Engineering International Workshop on Biomedical Engineering International Workshop on Genetic Engineering International Workshop on Environmental Engineering International Workshop on Other Engineering Science   **Cyberspace Safety and Security** Jaideep Vaidya,Xiao Zhang,Jin Li,2020-01-03 The two volumes LNCS 11982 and 11983 constitute the proceedings of the 11th International Symposium on Cyberspace Safety and Security CSS 2019 held in Guangzhou China in December 2019 The 61 full papers and 40 short papers presented were carefully reviewed and selected from 235 submissions The papers cover a broad range of topics in the field of cyberspace safety and security such as authentication access control availability integrity privacy confidentiality dependability and sustainability issues of

cyberspace They are organized in the following topical sections network security system security information security privacy preservation machine learning and security cyberspace safety big data and security and cloud and security **Advances in Intelligent Networking and Collaborative Systems** Fatos Xhafa,Leonard Barolli,Michal Greguš,2018-08-25 This book provides the latest research findings and discusses from both theoretical and practical perspectives innovative research methods and development techniques related to intelligent social networks and collaborative systems intelligent networking systems mobile collaborative systems and secure intelligent cloud systems It also presents the synergies among various paradigms in such a multi disciplinary field of intelligent collaborative systems With the rapid development of the Internet we are experiencing a shift from the traditional sharing of information and applications as the main purpose of the Web to an emergent paradigm which locates people at the very centre of networks and exploits the value of individuals connections relations and collaboration Social networks are also playing a major role in the dynamics and structure of intelligent Web based networking and collaborative systems Virtual campuses virtual communities and organizations strongly leverage intelligent networking and collaborative systems by means of a great variety of formal and informal electronic relations such as business to business peer to peer and various types of online collaborative learning interactions including the emerging e learning systems This has resulted in entangled systems that need to be managed efficiently and autonomously In addition the latest powerful technologies based on grid and wireless infrastructure as well as cloud computing are currently enhancing collaborative and networking applications significantly but are also facing new issues and challenges The principal purpose of the research and development community is to stimulate research that will lead to the creation of responsive environments for networking and in the longer term the development of adaptive secure mobile and intuitive intelligent systems for collaborative work and learning **Proceedings of the 2023 3rd International Conference on Education, Information Management and Service Science (EIMSS 2023)** Guiyun Guan,Christian Kahl,Bootheina Majoul,Deepanjali Mishra,2023-10-29 This is an open access book Amidst the advancement of modern science and technology especially the development of information technology our society has entered a stage of highly developed information technology We should do our utmost to utilize the achievements yielded by scientific and technological innovation vigorously promote the informatization of education management and provide quality services for education and teaching The importance of information technology education in educational management simply cannot be overstated Educational management is closely related to college education and teaching Only through good educational management can education and teaching proceed smoothly The realization of education management information is conducive to the propulsion of high efficiency in school management as well as to the smooth implementation of teaching objectives and better participation of students and parents in school management Informationization is the mainstream of the world s economic development while informationization of teaching management is the product of adapting to the demand of time development We educational

management workers should learn from the excellent educational managers at home and abroad strive to improve their information level and synchronize with the Times In order to provide a more convenient and efficient communication platform for relevant academic researchers we organized the 2023 3rd International Conference on Education Information Management and Service Science EIMSS 2023 2023 3rd International Conference on Education Information Management and Service Science EIMSS 2023 will be held on July 21 23 2023 in Qingdao China EIMSS 2023 aims to bring together innovative academics and industrial experts in the field of Education Information Management and Service Science to a common forum The primary goal of the conference is to stimulate research and developmental activities in Education Information Management and Service Science and another goal is to facilitate the scientific exchange of information between researchers developers engineers students and practitioners working all around the world As an ideal platform for individuals to exchange views and experiences in Education Information Management Service Science and related domains the conference will convene annually We warmly invite you to participate in EIMSS 2023 and look forward to seeing you in Qingdao   Proceedings of International Conference on Network Security and Blockchain Technology Jyotsna Kumar Mandal,Biswapati Jana,Tzu-Chuen Lu,Debashis De,2023-11-28 The book is a collection of best selected research papers presented at International Conference on Network Security and Blockchain Technology ICNSBT 2023 held at Vidyasagar University Midnapore India during March 24 26 2023 The book discusses recent developments and contemporary research in cryptography network security cybersecurity and blockchain technology Authors are eminent academicians scientists researchers and scholars in their respective fields from across the world   *Proceedings of International Conference on Intelligent Computing, Information and Control Systems* A. Pasumpon Pandian,Ram Palanisamy,Klimis Ntalianis,2021-01-24 This book is a collection of papers presented at the International Conference on Intelligent Computing Information and Control Systems ICICCS 2020 It encompasses various research works that help to develop and advance the next generation intelligent computing and control systems The book integrates the computational intelligence and intelligent control systems to provide a powerful methodology for a wide range of data analytics issues in industries and societal applications The book also presents the new algorithms and methodologies for promoting advances in common intelligent computing and control methodologies including evolutionary computation artificial life virtual infrastructures fuzzy logic artificial immune systems neural networks and various neuro hybrid methodologies This book is pragmatic for researchers academicians and students dealing with mathematically intransigent problems   **Information Visualization for Intelligent Systems** Premanand Singh Chauhan,Rajesh Arya,Rajesh Kumar Chakrawarti,Elammaran Jayamani,Neelam Sharma,Romil Rawat,2025-03-05 Information Visualization for Intelligent Systems provides readers with essential insights into cutting edge advancements in machine intelligence and explores how these transformative technologies are revolutionizing data analysis and decision making in an increasingly complex world The book explores advanced computing or machine intelligence which enables

technology machines devices or algorithms to interact intelligently with their surroundings make decisions and take actions to achieve objectives Unlike natural human intelligence artificial intelligence AI is demonstrated by machines Modern advancements in high speed computing drive paradigm shifts enabling complex machine intelligence systems and novel cyber systems that utilize data to perform specific tasks While standalone cyber systems are common integrating multiple systems into cohesive intelligent structures interacting deeply with physical systems remains underexplored and primarily philosophical in existing literature These technological breakthroughs have revolutionized data generation cloud storage global information exchange and rapid computing For example machine intelligence models analyze video surveillance to identify threats support early infection detection in healthcare and enhance chemical industry processes While promising these advancements remain in their infancy offering significant potential for further development

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