CHAPTER 55

TECHNOLOGY
COMPUTER ENGINEERING

Doctoral Theses

01. AGARWAL (Saurabh)
Design and Analysis of Image Forensic Techniques.
Supervisor : Dr. Satish Chand
Th 22857

Abstract
(Verified)

The digital images are quite popular due to their capability to convey meaningful information in a compact and easy form; however, their contents can easily be manipulated by the freely available image editing softwares. Such instances create a necessity of forensic analysis of an image that can provide its processing history. In this thesis, we have proposed one technique for median filtering detection and three techniques for image forgery detection. The proposed median filtering detection technique is based on higher order differences and Markov model. In our proposed image forgery detection techniques, we have exploited statistical properties of the images. Various approaches have been evolved to detect image forgery that are based on camera fingerprints, lighting/shadow, statistical information, etc. These approaches highlights the statistical irregularities in the forged images. In first proposed image forgery detection technique, features are extracted using Markov model in shift invariant transform domain and the SVM classifier is used to classify the pristine and fake images. In the second technique, the standard deviation filter is used to highlight the abrupt changes and features are extracted using RIC-LBP texture operator. In this technique, we also analyze the effect of color models on the performance of image forgery detection. It is found that combining the features of multiple color models can improve the image forgery detection performance. In this technique, we have used SRDA classifier to classify the pristine and fake images. In our last proposed technique, we have used higher order Local binary pattern texture operator to detect image forgery. This technique has been applied separately on the copy-move forged images and spliced forged images and its detection accuracy has been found almost same for both type of forgery i.e. copy-move and splicing. We have evaluated the performance of our proposed techniques on multiple databases.

Contents

1. Introduction 2. Literatue review 3. Image databases 4. Median filtering detection using higher order difference 5. Image forgery detection using markov features in UWT domain 6. Image forgery detection using texture operator 7. Image forgery detection using higher order local binary pattern 8. Conclusion and future scope. References. Publications.

02. BANSAL (Priti)
Application of Model Based and Combinatorial Interaction Testing to Software Systems
Supervisor : Prof. Sangeeta Sabharwal
Th 23143

Abstract
(Verified)

Software systems and web applications are heavily used in critical fields like finance, medical etc. The presence of bugs in these systems can cause serious damages. Software systems / web applications today are built by integrating reusable components of software developed by different companies, according to the business needs. Interaction among components is often complex and abundant, which may lead to interaction faults since the components may not be designed keeping in mind the final product. The heterogeneous execution environments of web applications further accrue to its complexity. It is therefore important to test them properly. Hence, it is important to adopt a testing technique that is effective and efficient. This thesis mainly focuses on two types of testing: Model based testing (MBT) of web applications and Combinatorial interaction testing (CIT) of component based systems and web applications. In this thesis 1) a modeling notation is proposed to model the navigation behavior of web application for the purpose of testing by integrating two techniques namely MBT and combinatorial strategy, and 2) a loop testing criteria is proposed that solves path explosion problem during test sequence generation. During CIT, it is important to generate a minimal set of test cases (test set) for efficient use of testing resources. However, generating a minimal set of test cases/Covering Array is an NP-complete problem. In this thesis, a greedy based Genetic Algorithm (GA) and a greedy based Artificial Bee Colony Algorithm (ABC) is proposed to generate Covering Array (CA)/Mixed Covering Array (MCA)/Variable Strength Covering Array (VSCA). After implementing the greedy based GA and greedy based ABC approach, it has been found that these approaches could generate smaller or comparable CA/MCA/VSCA as compared to the existing state-of-the-art algorithms.

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1. Introduction 2. Literature survey 3. Modeling the navigation behavior of dynamic web applications 4. A Model based approach to test case generation for testing the navigation behavior of dynamic web applications 5. Construction of optimal covering array and mixed covering arrays for pair-wise testing using genetic algorithm 6. Construction of optimal covering array and mixed covering arrays for pair-wise testing using genetic algorithm 7. Construction of optimal variable strength covering array for combinatorial interaction testing using genetic algorithm 8. Application of artificial bee colony algorithm to construct optimal covering arrays for pair-wise testing 9. Conclusion and future work. List of publications. References.

03.   Khanduja (Vidhi)
Design and Analysis of Watermarking Techniques for Web Databases to Enhance Robustness and Fragility.
Supervisors : Prof.. Shampa Chakraverty and Prof. O. P. Verma
Th 22859

Abstract
(Verified)

Given the rich information content of digital databases and the ready availability of advanced technologies to communicate them through the world-wide-web and modify them with relative ease, it is imperative to protect them against potential misuse. Among Technological Protection Measures, digital watermarking has proven to be effective for the protection of multimedia content and digital databases. This thesis is motivated by a strong need to enhance the qualitative performance of watermarking digital web databases in the form of relational, object-relational (ORDBs) and Decision Systems (DS), keeing in view four major security aspects: Ownership proof, Tamper Detection, Information Recovery and Authentication. To protect ORDBs, we first develop a generic scheme to augment ownership proof with tamper detection by the sequential application of a robust watermarks followed by a fragile watermark. Secondly, to protect DS, we develop a fragile watermarking scheme that detects even the slightest changes made to the DS resulting in concomitant changes in classificatory information derived from it, including reducts and rules. Towards the third quality objective, we illustrate the use of watermark as an information carrier to recover lost information by encapsulating the granular information in pivotal attributes obtained by clustering them. We achieve our fourth objective towards database authentication by utilizing voice biometrics to generate a

Gaussian Mixture Model of MFCC features which is then used to create a robust watermark, thus allowing us to authenticate the senders of database content providers. Our fifth qualitative goal led us to develop a fast statistical method to embed a robust watermark with optimized strength of security and efficiency in relational databases, using the Bacteria Foraging Algorithm. To fulfill our final goal of watermarking databases that cannot withstand any distortions, we embed a watermark using a secure, tuple re-ordering technique.

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1. Introduction 2. Literature survey 3. Word - A generic watermarking model for object relational databases 4. Fragile watermarking of decision system using rough set theory 5. Multiple watermarking scheme for information recovery and ownership proof 6. Biometric authentication in web databases 7. Statistical robust watermarking using bacterial foraging algorithm 8. A Distortion-free robust watermarking scheme 9. Conclusions and future scope. Appendix. References. List of Publication.

04.   RAJEEV KUMAR
Design and Analysis of Steganography Techniques
Supervisor : Dr. Satish Chand
Th 22861

Abstract
(Verified)

Internet is a popular medium for communication; however, the data transmitted over internet is vulnerable as it is an insecure channel. To address this problem, in this thesis, we have proposed six new reversible data hiding schemes using following approaches: Pixel Intensity Segmentation, Human Visual System, Pixel Value Adjusting feature, Combinatorial Strategy, Bit Flipping strategy, and Move to Front coding for LZW codes. Our first scheme which is based on pixel intensity segmentation works in two phases to avoid uneven modification to pixel value so that the better image quality is achieved. Our second scheme is a generalization of the first scheme which takes into account the characteristics of Human Visual System while hiding the secret data. Our third scheme uses Pixel Value Adjusting feature and embeds the secret data by identifying the embeddable pixels based on their even and oddness in two phases. Our fourth scheme is based on combinatorial approach. It changes the pixel value for embedding the secret data by at most 1 and embeds three bits of the secret data in a pair of pixels. The fifth scheme is based on bit flipping approach which basically flips the first LSB of the pixels to embed the secret data. Our sixth scheme is generalization of high- performance, data-hiding Lempel–Ziv–Welch (HPDH-LZW) scheme which hides the secret data in LZW codes. This scheme modifies the Move to Front (MTF) encoding technique to hide the secret data and also optimally utilizes the resultant LZW codes to embed the secret data.

Contents

1. Introduction 2. Literature review 3. Reversible data hiding scheme based on pixel intensity segmentation and HVS 4. Reversible data hiding scheme using pixel value adjusting feature 5. A Reversible high capacity data hiding scheme using combinatorial strategy 6. Reversible data hiding scheme using bit flipping strategy 7. An Optimal high capacity reversible data hiding scheme using move to front coding for LZW codes 8. Conclusion and future scope. References. List of publications.

05.   SHARAMA (Chayanika)
Applications of Soft Computing and Other Techniques in Software Testing.
Supervisor : Prof. Sangeeta Sabharwal and Dr. Ritu Sibal
Th 22862

Abstract
(Verified)

In today's world, computer software has become an inseparable part of our lives. This is because over the years computing has evolved from numerical computing to text computing and information processing. The advent of the World Wide Web is also increasing the penetration of computers in our everyday lives; therefore the need of the hour is to produce quality software with lower failure probability. One of the primary activities for ensuring quality of software is Software Testing. Testing is done to ensure that the software performs its intended functions conforming to the requirements in Software Requirement Specification document. In the past, several researchers have proposed methods for addressing issues and challenges in software testing. This research mainly focuses on developing approaches and techniques for solving issues encountered during Software Testing using soft computing and other techniques. This research presents the applications of Genetic Algorithm (GA), micro-GA and cuckoo search algorithm in Software Testing. A GA based approach for prioritization of test case scenarios using model based testing has been proposed. Test case scenarios derived from the UML Activity Diagram, State Chart Diagram and source code are prioritized using the proposed approach. An effort is also made to find a solution to the Class Integration Test Order (CITO) problem using a GA based approach. Results of the proposed approach to the CITO problem are also compared with the existing graph based and Meta-heuristic techniques. Finally Fault Tree Analysis has been used to identify undesired events of a web application. A metric called Fault Vulnerability Metric (FVM) is also proposed for measuring fault vulnerability/testability of a web application.

Contents

06.   THAKUR (Hardeo Kumar)
Study of Evolving Relation Between Patterns in Dynamic Graph.
Supervisor : Dr. Anand Gupata
Th 22860

Abstract
(Not Verified)

In the present dissertation the concept of multi-aspect mining in periodic subgraphs has been proposed and further these subgraphs have been mined and analyzed. Also further, the work has been extended to mine and analyze a class of periodic subgraphs referred as evolution (regular) subgraph, which is a special type of periodic subgraph following a rule of repetition. We have first presented claims establishing the relationships between different aspects of periodic subgraphs in a dynamic graph. These claims are verified and mathematically proved. The relationships are utilized to mine pair of related periodic aspect subgraphs simultaneously by the proposed framework (PPPF). The framework (PPPF) is able to mine two related aspects; primary and secondary aspect of a periodic subgraph where the primary aspect is independent and the secondary aspect are dependent. The periodic subgraphs so obtained from the macroscopic study of dynamic graphs have been intriguing. So, we further analyze the network properties and behavior of so obtained periodic subgraphs at microscopic level. Therefore, for better understanding of these periodic subgraphs some significant measures are identified to analyze the periodic subgraph on few application domains. The measures are a combination of well known (formal) and newly introduced (informal) measure. Similar to multi-aspect periodic subgraph, we have first established a relationship between different aspect of evolution (regular) subgraph on a dynamic graph and it is presented as claims which are mathematically proved as well. Such established relations are utilized to mine multi-aspect evolution subgraphs. Hence, a framework is proposed to mine multi-aspect evolution (regular) subgraphs. The framework is able to mine all possible types of evolution (regular) subgraphs on a given type of

dynamic graph. Furthermore, we have identified some significant measures concerning evolution subgraphs to analyze evolution (regular) subgraphs.

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1. Introduction 2. State of the art 3. Relation between periodic patterns 4. Analysis of periodic patterns 5. Relation between regular patterns 6. Analysis of regular patterns 7. Conclusions and future work. References. List of Publications. Appendix.

07.   WADHWA (Pooja)
Tracking Dynamic Radicalization in Online Social Networks.
Supervisor : Dr. M. P. S. Bhatia
Th 22863

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1. Introduction 2. Literature survery of radicalization in online social networks 3. Approach for classification of messages using security association rules 4. Approach for visualizing online radicalization 5. Classification of twitter messages using security association rules 6. Measuring radicalization in online social networks 7. Conclusion and future scope. References. Publications