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FINGERPRINT IMAGE IDENTIFICATION FOR CRIME DETECTION

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Abstract
With the introduction of biometrics technology which is an advanced computer techniques now widely adopted as a front line security measure for both identity verification and crime detection, and also others an effective crime deterrent. In an increasingly digital world, reliable personal authentication has become an important human computer interface activity. Fingerprint recognition could be very complex pattern recognition problem. It is difficult to design accurate algorithms that are capable of extracting prolific features and comparing them in a robust way, especially in poor quality fingerprint images and when low-cost acquisition devices with small area are adopted. There is a greatest misconception that the fingerprint recognition is a fully solved problem considering it was one of the first applications of all amongst machine pattern recognition. A fingerprint is the feature pattern on the finger. It is proved through strong evidences that each fingerprint is almost unique in nature. Each individual retains his own fingerprints with the permanent and durable uniqueness. Hence fingerprints are being adapted for identification and forensic investigation. The fingerprint recognition problem can be grouped into two sub-categories: one is termed as fingerprint verification and while the other is termed as fingerprint identification. Additionally, apart from the manual approach of fingerprint recognition by the experts, fingerprint recognition here is usually referred as AFRS (Automatic Fingerprint Recognition System), which is drastically program-based. The proposed system presents the variation of Fast Fourier Transform on finger print recognition by fast fingerprint minutiae extraction and recognition algorithm that improves the clarity between the ridge and valley structures of the supposed to be provided finger print images in accordance with the frequency as well as the orientation of the local ridges and extracting correct minutiae.

Key Words: Binarization, Segmentation, Minutiae Extraction, Minutiae marking

.1. INTRODUCTION

In today's computer era, one of the most commonly used biometric systems id fingerprint which is used for personal identification as well as verification among all other biometric system. Throughout the world, it is one of the most acceptable biometric system due to it fast, secure and cost efficient method for personal identification. The components required for biometric generation as well as identification is discussed as below: Fingerprint Sensor: It is a device that is used to extract the input data of the finger. With respect to functionality and application different optical sensors are used. Feature

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Extraction: Different algorithms are used for feature extraction out of the captured fingerprint data. Database: All the extracted features are stored in a database in particular format. This database is used for fingerprint verification as well identification. Decision Making: Finally, decision making algorithms are used for feature matching from the database.

Fingerprint is the most interesting and oldest human identity used for recognition of individual. In the early twentieth century, fingerprint was formally accepted as valid signs of identity by law-enforcement agencies. The criminal identification activities face a series of photographic challenges to the crime scenes. These images can also be extremely fragile so hard to see. The background color or texture can easily overlap thin details. Curved, reflective or irregular surfaces may appear resist attempts to record all the details in one show. After all, pieces that need proof can often be difficult, if not impossible. In most cases under these circumstances, conventional photographic techniques have been successfully used to record such evidence discovered on the scene.

One of the most important application of fingerprint identification on crime scene. The image obtained from crime spot are of two types, one is patent fingerprint samples and latent fingerprint samples. Among them, patent fingerprints are visible by our naked eye. In latent fingerprint image the extracted images are invisible and very difficult to perceive. Many research works have been done to extract fingerprint accurately but still there are some drawbacks that should be eliminated. Many image enhancements. The crime scene fingerprint is somehow noisy or partial and very difficult to identify.

With the introduction of biometrics technology which is an advanced computer techniques now widely adopted as a front line security measure for both identity verification and crime detection, and also others an effective crime deterrent. In an increasingly digital world, reliable personal authentication has become an important human computer interface activity. Fingerprint recognition could be very complex pattern recognition problem. It is difficult to design accurate algorithms that are capable of extracting prolific features and comparing them in a robust way, especially in poor quality fingerprint images and when low-cost acquisition devices with small area are adopted. There is a greatest misconception that the

2. Literature Survey

The goal of the segmentation algorithm is to decompose the latent fingerprint image into two parts Foreground and background. The foreground consists of the fingerprint and the background consists of the noise or unwanted region. A few methods on latent fingerprint segmentation [1,2,3,4,5,6,7,8,10] have been purposed. In Zhang et al. [5], the author used the Adaptive Total Variation Model for fingerprint image decomposition and feature selection of the multiscale image. In this model, they used a total variant model with L1 fidelity denoted by,

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TV-L1. The Weight coefficient in the TV-L1 model Adjusted accordingly with L1 fidelity that depends on the background noise level.TV-L1 model decomposes the fingerprint image in cartoon and texture. The cartoon contains a piecewise smooth component and texture contains the texture component of a fingerprint image.ATV does not give good results for ugly latent fingerprints. In Lai et al [6], the Purposed Novel Directional total variation (DTV) model for latent fingerprint detection and segmentation. In the DTV model, the author includes a special parameter in TV computation that is special –dependent texture orientation. This parameter is appropriate for an image with oriented textures.DTV not segments multiple overlapped fingerprints. Zhang et al. [4], Purposed Adaptive Directional Total Variation (ADTV) model that takes the advantages of both Adaptive Total Variation Model and Directional total variation.ADTV model used for latent fingerprint enhancement and segmentation. It used orientation and scale two features for image segmentation. It decomposed the fingerprint image into two parts texture and cartoon. The texture contains the fingerprint part while the cartoon contains the structured noise (Character, stain, line, arch, speckle, etc.).ADTV is incapable of handling the overlapped fingerprints region. Xue et al.[7], purposed fingerprint image segmentation based on a combined method, that combines statistical characteristics of gray with orientation field information. To calculate the fingerprint block direction the author used multi-polar blocking and Gabor filter. To calculate the statistical characteristic of gray the author used five indicators Mean value, contrast, variance, low second-order movement, and high second-order movement but this method is not appropriate for too wet and too dry fingerprint image. Short. Et al.[8], purposed Ridge template correlation methods for latent fingerprint segmentation. This method increases the accuracy of latent fingerprint segmentation and reduces the fingerprint area that is detected as a fingerprint from 60.7% to 33.6% of the total fingerprint image. It used a Hough-based method for the detection of structured noise such as line and removes it from the fingerprint image. It also reduces false minutiae detection considered as foreground and true minutiae considered as background from 1.41% to 0.29%. When detection of false minutiae is high its gives wrong segmentation results. Choi et al.[3], purposed automatic extraction of latent fingerprint based on a combined method that uses frequency features and ridge orientation. Ridge frequency of latent fingerprint is found by the local Fourier analysis method and a similar pattern of ridge fingerprint is found by the tensor method. In this model, the foreground area is

3. System Analysis

3.1 Existing System

Fingerprints in the crime scene plays an important role to identify the criminal involved in the crime. Crime scene images (CSI) are images taken from the crime spot. When crime is occurred, the investigator

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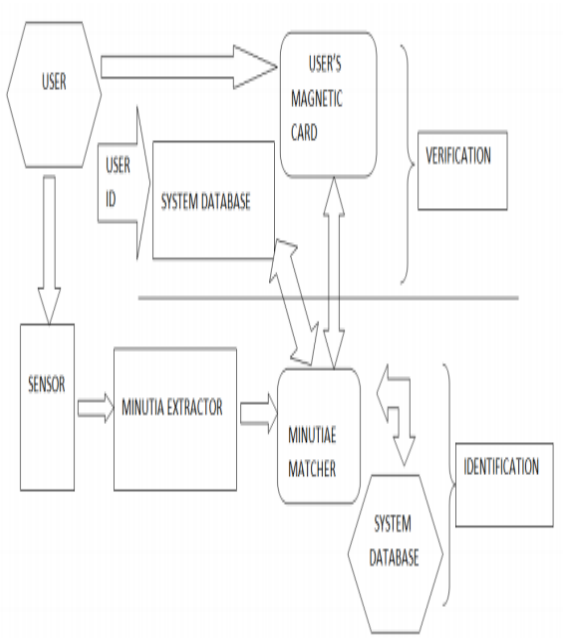
takes both latent and patent sample of fingerprints left behind. The patent fingerprints are visible by naked eye, so they are simply photographed. But latent fingerprints are invisible and these samples are more difficult to perceptible. These samples can be lifted through different techniques. The use of cyanoacrylate vapours which sticks to prints and make them visible in the present of normal light. This method is much difficult, so normally in crime scene, the investigators apply a fine dusting powder (aluminium dust or black granular) to the surface in which fingerprints to be extracted. The dust actually sticks to the fingerprint then they use clear tape to lift the fingerprint. After the lifting the fingerprints, the prints are scanned and saved in the digital image form. The fingerprints taken from the crime scene is unintentionally made and these images are noisy or partial prints and difficult to identify.

3.2 Proposed System

The CNN uses successive convolutional layers with a non-linear ReLu function for storing the features of an image having a specific dimension. Max pooling layers are used for down sampling. The fully connected layer multiplies the input by a matrix with sigmoid activation function and adds to a bias vector which contains the feature map. The images obtained from the crime scene are called crime scene images (CSI). These images play important role and used as evidence in criminal cases. The fingerprint information contained in the images collected directly from the crime scene may be partial or tough to identify. This can lead to fingerprint images of bad or low quality. Due to the low quality of fingerprint image to another systematic image feature, the early fingerprint image quality may be of exterior value of identification. To moderate this problem, the fingerprint allows performing image pre-processing, to feature mark up and identification analysis. Segmentation is a first step in image enhancement which converting low-level image processing transforming a gray scale image into high-level image description in terms of features, objects and scenes.

SYSTEM ARCHITECTURE:



3.2 Modules Description

Pre processing stage:-

Again pre processing stage is divided in to three sub stages such as:-i) image enhancement ii) image binarization iii) image segmentation. For image

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enhancement we used two methods such as:- histogram equalization and Fourier transform. After enhancing the image we need to binaries the image for that we used the locally adaptive threshold method. For image segmentation we preferred a three-step approach such as :- i) block direction estimation ii) segmentation by direction intensity iii) Region of Interest (ROI) extraction by Morphological operations.

Minutia extraction:-

Minutia extraction stage is divided in to two sub stages such as:-i) fingerprint ridge thinning and ii) minutia marking We used iterative parallel thinning algorithm for minutia extraction stage. Ridge thinning is used to used to eliminate the redundant pixels of the ridges 16 till the ridges are of one pixel wide.The minutia marking is quite simple task. Here crossing number (CN) concept is used.

3.3 Feasibility Study

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

Three key considerations involved in the feasibility analysis are,

3.4. Economic Feasibility

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased

3.5 Operational Feasibility

Are you into the production of “things”? Perhaps, your answer would be yes. We naturally don’t call them things; instead, we call them products, services, or systems. Using the term “things” sounds foreign because you can’t just drop them into an area without touching them. They need to be connected to an existing service or business. These “things” are an extension of the organization where they are produced.

3.6 Technical Feasibility

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system

3.7 Social Feasibility

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training

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the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it.

His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system

4. System Requirements Specification

4.1 Introduction

The project involved analyzing the design of few applications so as to make the application more users friendly. To do so, it was really important to keep the navigations from one screen to the other well ordered and at the same time reducing the amount of typing the user needs to do. In order to make the application more accessible, the browser version had to be chosen so that it is compatible with most of the Browsers

4.2 Purpose

In order to make the application more accessible, the browser version had to be chosen so that it is compatible with most of the Browsers.

4.3 Functional Requirements

For developing the application, the following are the Software Requirements:

1. Python
2. anaconda

Operating Systems supported

1. Windows 7
2. Windows XP
3. Windows 8

Technologies and Languages used to Develop

1. Python

Debugger and Emulator

- Any Browser (Particularly Chrome)

Hardware Requirements

For developing the application the following are the Hardware Requirements:

- Processor: Pentium IV or higher
- RAM: 256 MB

Space on Hard Disk: minimum 512MB

4.4 Non Functional Requirements

- Any Browser (Particularly Chrome)

4.5 Input & Output Design

4.5.1 Input design :

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps and keeping the process simple.

The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things:

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- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.

Methods for preparing input validations and steps to follow when error occur

OBJECTIVES

1.Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system.

2.It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities.

3.When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus the objective of input design is to create an input layout that is easy to follow

4.5.2 OUTPUT DESIGN

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is designed so that people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements.

2.Select methods for presenting information.

3.Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.

- Convey information about past activities, current status or projections of the
- Future.
- Signal important events, opportunities, problems, or warnings.
- Trigger an action.

Confirm an action

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Operating Systems supported

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5. Windows XP
6. Windows 8

Technologies and Languages used to Develop

Python

5. System Design

The purpose of the design phase is to plan a solution of the problem specified by their requirement document. This phase is the first step in moving from the problem domain to the solution domain. In other words, starting with what is needed, design takes us towardhow to satisfy the needs.The design of a system is perhaps the most critical factoraffection the quality of the software; it has a major impact on the later phase, particularlytesting, maintenance.The output of this phase is the design document.This document issimilar to a blueprint for the solution and is used later during implementation, testing andmaintenance.The design activity is often divided into two separate phases System DesignandDetailedDesign.

System Design also called top-level design aims to identify the modules that should be inthe system, the specifications of these modules, and how they interact with each other toproduce the desired results.At the end of the system design all the major data structures,file formats, output formats, andthe major modulesin thesystemandtheir specificationsaredecided.

During, Detailed Design, the internal logic of each of the modules specified in system designis decided. During this phase, the details of the data of a module are usually specified in ahigh-level design description language, which is independent of the target language in whichthesoftware will eventuallybe implemented.

Insystemdesignthefocusisonidentifyingthe modules,whereasduringdetaileddesignthe focus is on designing the logic for each of the modules.In other works, in system

designtheattentionisonwhatcomponentsare needed,whileindetaileddesignhowthecomp onentscanbe implemented insoftwareis the issue.

Design is concerned with identifying software components specifying relationships amongcomponents. Specifying software structure and providing blue print for the document phase.Modularity is one of the desirable properties of large systems. It implies that the system isdivided into several parts. In such a manner, the interaction between parts is minimal clearlyspecified.

During the system design activities, Developers bridge the gap between the requirementsspecification, produced

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during requirements elicitation and analysis, and the system that isdelivered to theuser.

Design is the place where the quality is fostered in development. Software design is aprocessthroughwhichrequirementsaretranslatedintoarepresentationofsoftware

5.5 UML Diagrams (9 types)

Any complex system is best understood by making some kind of diagrams or pictures. These diagrams have a better impact on our understanding. If we look around, we will realize that the diagrams are not a new concept but it is used widely in different forms in different industries.

We prepare UML diagrams to understand the system in a better and simple way. A single diagram is not enough to cover all the aspects of the system. UML defines various kinds of diagrams to cover most of the aspects of a system. You can also create your own set of diagrams to meet your requirements. Diagrams are generally made in an incremental and iterative way.

There are two broad categories of diagrams and they are again divided into subcategories –

Structural Diagrams

Behavioral Diagrams

Structural Diagrams

The structural diagrams represent the static aspect of the system. These static aspects represent those parts of a diagram, which forms the main structure and are therefore stable.

These static parts are represented by classes, interfaces, objects, components, and nodes. The four structural diagrams are −

Class diagram

Object diagram

Component diagram

Deployment diagram

Class Diagram

Class diagrams are the most common diagrams used in UML. Class diagram consists of classes, interfaces, associations, and collaboration. Class diagrams basically represent the object-oriented view of a system, which is static in nature. Active class is used in a class diagram to represent the concurrency of the system.

Class diagram represents the object orientation of a system. Hence, it is generally used for development purpose. isis the most widely used diagram at the time of system construction.

Object Diagram

Object diagrams can be described as an instance of class diagram. Thus, these diagrams are more close to real-life scenarios where we implement a system. Object diagrams are a set of objects and their relationship is just like class diagrams. They also represent the static view of the system.

The usage of object diagrams is similar to class diagrams but they are used to build prototype of a system from a

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practical perspective.

Component Diagram

Component diagrams represent a set of components and their relationships. These components consist of classes, interfaces, or collaborations. Component diagrams represent the implementation view of a system. During the design phase, software artifacts (classes, interfaces, etc.) of a system are arranged in different groups depending upon their relationship. Now, these groups are known as components. Finally, it can be said component diagrams are used to visualize the implementation.

Deployment Diagram

Deployment diagrams are a set of nodes and their relationships. These nodes are physical entities where the components are deployed. Deployment diagrams are used for visualizing the deployment view of a system. This is generally used by the deployment team. Note − If the above descriptions and usages are observed carefully then it is very clear that all the diagrams have some relationship with one another. Component diagrams are dependent upon the classes, interfaces, etc. which are part of class/object diagram. Again, the deployment diagram is dependent upon the components, which are used to make component diagrams.

Behavioral Diagrams

Any system can have two aspects, static and dynamic. So, a model is considered as complete when both the aspects are fully covered.

Behavioral diagrams basically capture the dynamic aspect of a system. Dynamic aspect can be further described as the changing/moving parts of a system.

UML has the following five types of behavioral diagrams −

Use case diagram
Sequence diagram
Collaboration diagram
Statechart diagram
Activity diagram

6. Implementation

Pre processing stage:-

Again pre processing stage is divided in to three sub stages such as:-i) image enhancement ii) image binarization iii) image segmentation. For image enhancement we used two methods such as:- histogram equalization and Fourier transform. After enhancing the image we need to binaries the image for that
we used the locally adaptive threshold method. For image segmentation we preferred a three-step approach such as :- i) block direction estimation ii) segmentation by direction intensity iii) Region of Interest (ROI) extraction by Morphological operations.

Minutia extraction:-

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one pixel wide.The minutia marking is quite simple task. Here crossing number (CN) concept is used.

7. Technology Description

PYTHON

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. An interpreted language, Python has a design philosophy that emphasizes code readability (notably using whitespace indentation to delimit code blocks rather than curly brackets or keywords), and a syntax that allows programmers to express concepts in fewer lines of code than might be used in languages such as C++or Java. It provides constructs that enable clear programming on both small and large scales. Python interpreters are available for many operating systems. CPython, the reference implementation of Python, is open source software and has a community-based development model, as do nearly all of its variant implementations. CPython is managed by the non-profit Python Software Foundation. Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object-
oriented, imperative, functional and procedu
ral, and has a large and comprehensive standard library.

Interactive Mode Programming

Invoking the interpreter without passing a script file as a parameter brings up the following prompt −

How Does A Computer Read An Image?

Consider the below image:

We can figure out that it is an image of the New York Skyline. But, can a computer find this out all on its own? The answer is no!

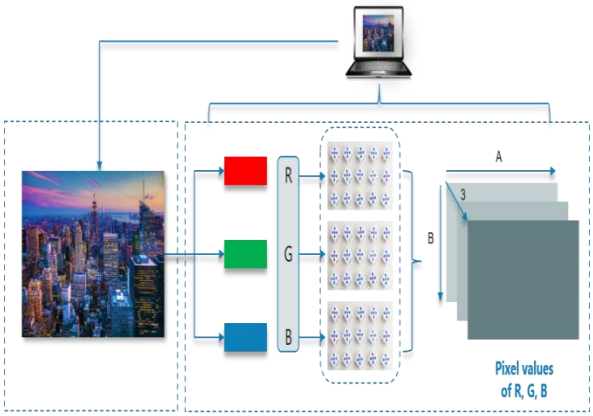
The computer reads any image as a range of values between 0 and 255.

For any color image, there are 3 primary channels – Red, green and blue. How it works is pretty simple.

A matrix is formed for every primary color and later these matrices combine to provide a Pixel value for the individual R, G, B colors.

Each element of the matrices provide data pertaining to the intensity of brightness of the pixel.

Consider the following image:



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As shown, the size of the image here can be calculated as B x A x 3.

11. Future Enhancement

The future work is to develop a high-resolution fingerprint recognition framework that better utilizes the CNN features. In future, work will be focused on enhanced of accuracy rate for partial fingerprint images.

12. Conclusion

We have proposed a new model that is a fusion of morphological and neural network approaches for latent fingerprint segmentation. The morphological method finds the fingerprint region from the large image. The fingerprint region found by morphological method divides into patches/blocks. Extract the features of each block and used these features as an input of the NN. The NN model classifies the patches into fingerprint and non-fingerprint patches. We remove the non-fingerprint patches that contain the structured noise and reconstruct the fingerprint patches for finding the original fingerprint. Our future work involves developing new algorithms for improving the accuracy of the classification and feature extraction for the segmented latent fingerprints.

Fingerprint identification system used for identifies the criminal who involved in the crime helps to automate fingerprint identification process. Pre-processing was performed with Otsu thresholding, fingerprint thinning and minutiae extraction with Cross-Number method. Feature extraction will be done by the CNN classifier. The performance of SVM and CNN based classifiers are analyzed. It is observed CNN gives better performance compared to SVM because of its deep learning ability to learn relevant features from the image. Using CNN classifier, improved fingerprint identification accuracy of 80% is achieved.

13. References

[1] H. Elouedi, W. Meliani, and Z. Elouedi, "A hybrid approach based on decision trees and clustering for breast cancer classification," in 6th International Conference of Soft Computing and Pattern Recognition (SoCPaR), 2014.

[2] F.Kharbat, H.Ghalayini, "New algorithm for Building Ontology from Existing Rules: A Case Study," in International Conference on Information Management and Engineering, 2009, pp. 12-16.

[3] P. Hamsagayathri and P. Sampath, "Performance analysis of breast cancer classification using decision tree classifier," International Journal Of Current Pharmaceutical Research (IRCPR), vol. 9, 2017.

[4] R. Sumbaly, N. Vishnusri, and S. Jeyalatha, "Diagnosis of breast cancer using decision tree data mining technique," International Journal of Computer Applications, vol. 98, no. 10, p. 0975 8887, 2014.

[5] C. P. Utomo, A. Kardina, and R. Yuliwulandari, "Breast cancer diagnosis using artificial neural networks with extreme learning techniques," International Journal of Advanced Research in Artificial Intelligence (IJARAI), vol. 3, no. 7, pp. 10–14, 2014.

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

[6] S.Jhajharia, H.K.Varshney, S.Verma, and R.Kumar, "A neural network based breast cancer prognosis model with PCA processed features," in International Conference on Advances in Computing, Communications and Informatics (ICACCI), 2016.