# PATTERN DETECTION IN DIGITAL IMAGE

Tioh Keat Soon[1], Abd Samad Hasan Basari[2], Burairah Hussin[3]
[1,2,3]F.T.M.K., Universiti Teknikal Malaysia Melaka, Melaka, Malaysia
Email: tiohksoon@hotmail.com[1], {abdsamad[2], burairah[3]}@utem.edu.my

**ABSTRACT**

This paper describes pattern detection method that consists of enhancement of SIFT and rotation invariant face detection in digital image processing. The enhancement of SIFT is applied to duplication image detection, whereas the rotation invariant face detection is applied to inappropriate image detection. There are three contributions. Increasing speed performance of SIFT by applying binary Robert Cross edge detection in pre-processing stage. Enhance rotated face detection by applying in different optimal angle. Lastly, create a novel pattern detection method for contribution to the taxonomy of digital image processing. The comparison results of the experiment were presented and it shows that proposed solutions yield better performance.

## 1.0 INTRODUCTION

Ethic issue becomes serious nowadays. It is associated with language, action, and digital documents. One of the ethical issues in digital document is to store inappropriate digital image in company. Nowadays, network storage provides the features quickly and efficiently execute information management such as manage access to data, survivability and also control cost (T.C. Jepsen, 2004). The computer technologies today could lead to such issue. For instance, computer network storage is to provide a service to allow other computers to access and share data across the network. However, there are some people utilize company's network storage to store inappropriate images such as adult images and personal image. Besides that, managing digital image is another context in this research. Computer network storage technologies provide the advantages of flexibility but lack of intelligent feature to manage big data. There exist high-end enterprise storage systems being deployed in production environments to ensure no single point of failure, which are expensive due to customized hardware and multiple redundant components (K. Rao et. at., 2011). Improper managing digital image could lead to waste of company resources especially the high end storage with feature of data protection and backup. For instance, computer network storage allows user to manipulate data directly. The flexibility allowed the images can be easily manipulated directly by duplicate it in network storage. The unnecessary redundancy images could lead to insufficient storage capacity. Indirectly, the cost of storage is increasing every year. There are many methods to govern the digital image issue in company. One of the proposed methods is by using pattern detection techniques to manage it. It is vital for developing an intelligent system that can manage digital images in storage, which can classify inappropriate images and the duplication image in network storage. In the literature, many approaches have been proposed. The researcher (J. Wu et. al., 2013) made a comparative study of SIFT and its variants such as PCA-SIFT, GSIFT, CSFIT, SURF, and ASIFT on time consumption in 4 situations. The result shows that SIFT and CSIFT performed better in scale & rotation situations. GSIFT performed better in blur or illumination image. ASIFT performed better in affine image. The fastest speed performance is SURF. The study shows that SIFT & its variants have its own benefits to solve real-time problem based on situations. (K. Liao et. al., 2013) proposed an improvement SIFT descriptor for image matching, which contains steps normalizing elliptical neighboring region, transforming to affine scale-space, improving SIFT descriptor with polar histogram orientation bin, and integrating the mirror reflection invariant. The result shows better distinctive than original SIFT, MIFT, PCA-SIFT, GLOH, SIFT Gabor, and ZM phase. In earlier works in face detection, there are many researchers have developed real-time face detection. One of the famous and successful methods is the Viola and Jones's (P. Viola et. al., 2004) face detection

framework. The basic of the Viola and Jones's method is based on Haar feature. In order to speed up the process, Viola proposed to use integral image method. Adaboost is one of the machine learning. Viola utilizes it to classify face or non-face image. Bi Li (B. Li et. al., 2010) proposed to the rotated face detection based on viola jones's face detection. Rotated sub windows $+15^o$ and $-15^o$ were performed, the result shows high positive result compare to original viola jones's method. This achieves the objective of speed performance and invariant properties such as transition, scaling, and rotation. One of the famous and successful methods is the SIFT (D.G. Lowe, 2004). The basic of the SIFT descriptor based on 4 steps. Step 1: Gaussian Smoonth Image, Step 2: Scale Space Extrema Detection, Step 3: Accurate Keypoint Localization by removing contrast and eliminating edge, Step 4: Assign magnitude and orientation to keypoint. SIFT supports the invariant properties such as transition, scaling, and rotation. However, speed performance not so good.

**Methodology:**

Generally, this paper based on action research methodology. It consists of planning, action, observation, and reflection. During planning stage, the problems were identified in the literature review. Moreover, taxonomy of digital image was drafted and adapted with pattern detection methods. During action stage, the problem of robust rotated face detection was formulated, each step of rotation from $0^o$ to $360^o$ with added $15^o$ before performing Viola and Jones's method. Besides that, to get better speed performance of object detection, pre-processing Binary Robert Cross edge detection was applied before SIFT. To simulate the solution, MATLAB was used and images were obtained from CMU+MIT database during action stage. The experiments were observed during observation stage, the results showed better than previous researchers' method.
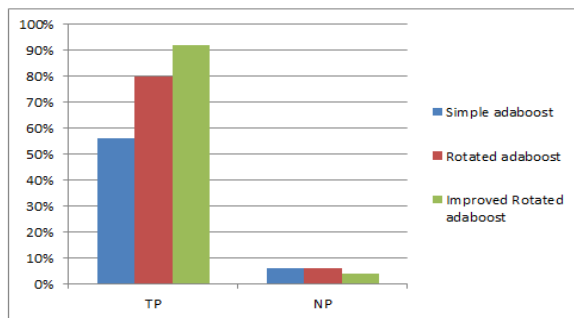
**Results:**
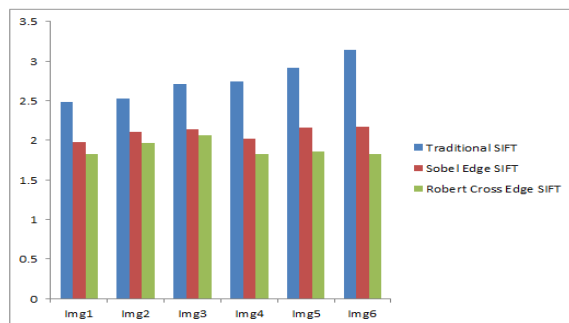


**Figure 1:** Improved Rotated Adaboost



**Figure 2:** Improved Fast SIFT Detection with Robert Cross Edge Detection

## 2.0     CONCLUSION

The novel methods have been presented for enhancement of SIFT and robust rotated face detection which increasing the speed performance of SIFT and achieving high accuracy of rotated face detection. According to the experiment results, it shows that it is outperform than other methods. Therefore, the methods are suitable to be applied to the real world problems such as image duplication and inappropriate image detection. As a result, the solution indirectly overcome ethic problem, increase capacity of storage, cost efficiency, and administration work load. With these new algorithms, it can be further applied to other applications in digital image processing. For future works, the proposed solutions can be further enhanced during processing stage or post-processing stage. There are some limitations of current proposed solutions. Log polar technique can be applied to face detection which is more robust to rotation invariant. State-of-art dimension reduction technique to further increasing speed performance of SIFT.

## ACKNOWLEDGEMENTS

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