

A COMPARATIVE STUDY OF FINGERPRINT MATCHING TECHNIQUES

CHAPTER 4 - Results



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# Introduction

This chapter discusses the results and findings after running both algorithms; Minutiae Matching Algorithm and Scale Invariant Feature Transform (SIFT) Algorithm. In assessing the performance and effectiveness of both algorithms, the same dataset was used and all parameters were kept the same for each algorithm.

# Results and Analysis of the data

\*\* SOMETHING INTRODUCTION HERE\*\*

# Summary of Data

The was grouped into two (2) sections namely

1. SIFT RESULTS
2. MINUTIAE RESULTS

Each of these sections had the same information, these are

1. Altercation
2. Sub Altercation
3. Match Score
4. Time Taken
5. Verdict

## Table Categories

### Altercation

This refers to the level of altercation of the target fingerprint being compared to the original fingerprint

### Sub Altercation

This refers to the further altercation of each target fingerprint, including

* CR (Cross Region Cut)
* OBL (Obliteration)
* Z-Cut

### Time Taken

Refers to the time for total completion of the algorithm from initialization to match score generation

### Match Score

Match score refers to the number of matches that were produced when images in the sub altercation category were compared to the original image.

#### Verdict

Verdict refers to the conclusion generated by each algorithm after it had completed its processing on both images. Each algorithm had different criteria for drawing a conclusion

##### Scaled Invariant Feature Transformation (SIFT)

* If the number of matches were greater than 35 ( > 35 ) **(\*\*\*FIND SOURCE FOR THIS NUMBER \*\*\*)** the fingerprint images were considered a good a match with no impact on FAR or FRR
* If the number of matches were greater than 18 but less than 35 the fingerprint images were considered a good match but with a low score meaning it could increase FAR (False Acceptance Rate)
* If the number of matches were less than 18 then the conclusion is that fingerprints do not match

The table below summarizes the relationship between verdict and match score and its impact on False Acceptance Rate (FAR) and False Rejection Rate (FRR) for Scale Invariant Feature Transformation (SIFT)

|  |  |  |  |
| --- | --- | --- | --- |
| Match Score | Verdict | Impact on FAR | Impact on FRR |
| Greater than 35 | Good Match | None | None |
| Greater than 18 but less than 35 | Match but with low score | Increase in FAR | Increase in FRR |
| Less than 18 | No Match | Increase in FAR | None |

##### Minutiae Matching Algorithm

* If the match score was greater than 7 (FIND SOURCE) the fingerprint images were considered to be a good match
* If the match score was greater than 3 but less than 7 the images were considered match with low score and could increase FAR
* If the math score was less than 3 then the fingerprint images were not considered to be a match

The table below summarizes the relationship between the match score and verdict as well as its impact on FAR and FRR

|  |  |  |  |
| --- | --- | --- | --- |
| Match Score | Verdict | Impact on FAR | Impact on FRR |
| Greater than 7 | Good Match | None | None |
| Greater than 3 but less than 7 | Match but with low score | Increase in FAR | Increase in FRR |
| Less than 3 | No Match | Increase in FAR | None |

# Results And Discussion

## Matches

After both algorithms run on the same data sample, the following results were generated as shown in the graph below:

From the graph above,

1. The percentage of good matches on SIFT were 41.78% whereas Minutiae generated good matches on 28% of the sample images
2. SIFT produced 37.56% low matches on all matches. The effect it has on False Acceptance Rate and False Rejection Rate is as follows:
   * 1. Increase in False Rejection Rate
     2. Decrease in False Acceptance Rate

Minutiae produced 15.1% low matches and samples provided. This has the following effect on False Acceptance Rate and False Rejection Rate

1. Increase in False Rejection Rate
2. Decrease in False Acceptance Rate
3. SIFT generated 20.67% low matches on the images it was provided with, having the following effects on False Acceptance Rate and False Rejection Rate.
   * 1. Decrease in False Rejection Rate
     2. Decrease in False Acceptance Rate

Minutiae produced the most amount of no matches found with 58.59% having the following effect on False Acceptance Rate and False Rejection Rate

* + - 1. Increase in False Rejection Rate
      2. Decrease in False Acceptance Rate

### Summary Table

|  |  |  |  |
| --- | --- | --- | --- |
| Algorithms | % Of Good Matches | % Of Low Matches | % Of Bad Matches |
| SIFT | 41.78 | 37.56 | 20.67 |
| Minutiae | 28 | 15.1 | 58.89 |

## Algorithm Run Time

### Cross Regional (CR) Cut

The time taken to process cross regional cuts on both algorithms is shown below in the graph

From this graph, the following observations can be made:

(GET TRENDLINE EQUATION AND ANALYSE)

* The average time to process a fingerprint image using the SIFT algorithm increases as the number of images increase
* The time to process a fingerprint image on average using the Minutiae algorithm remains the same even as the number of images increase

### Obliterated (OBL) Images

From this graph, the following observations can be made:

* The average time to process a fingerprint image using the SIFT algorithm increases as the number of images increase
* The time to process a fingerprint image on average using the Minutiae algorithm remains the same even as the number of images increase

### Z Cut Images

From this graph, the following observations can be made:

* The average time to process a fingerprint image using the SIFT algorithm increases as the number of images increase
* The time to process a fingerprint image on average using the Minutiae algorithm remains the same even as the number of images increase