

# INDEX, MIDDLE, AND RING FINGER EXTRACTION AND IDENTIFICATION BY INDEX, MIDDLE, AND RING FINGER OUTLINES

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**Keywords:** Finger Shape Identification, Finger Shape Extraction, Locating Fingertip and Finger-to-Finger-Valley, Geometry Matching.

**Abstract:** In this study, the new technique is used to extract the index, middle and ring finger outlines. The orientations and geometrical features of these outlines are calculated and compared to identify different individuals. The techniques of database SQL searching and manipulation, image dilation, object position locating, image shifting, rotation, and interpolation are used to recognize different individuals. The hand was fixed each time when a photograph was taken, and one can assume that each time when a hand was acquired, the image was the same as the previous one. Since the photographs are the same, after the index, middle or ring fingers have been extracted from the hand image, the acquired images can be used to identify different persons.

## 1 INTRODUCTION

In this study, the new technique is used to extract the index, middle, and ring finger-outlines and to perform the person's identification. The image automatic registration technique locates the orientations and positions of the extracted finger images. In order to perform the geometrical comparison of two finger images, the centroids of the finger images need to be located. The images used in this study are the 128 by 128 images. One needs to perform the image movement to move the image to the center of the frame. Furthermore, the major axes of the finger images need to be located and we need to move the images to allow the major axes of the finger images to be in the straight position. Since every image is centered and straightened, one can perform the image geometrical comparison to identify different fingers. The above steps are performed by computer itself and no further human involvement are required. The algorithm developed in this study can identify fingers.

## 2 ACQUIRING HAND IMAGE

Figure 1 shows the acquired hand images. After further processing, one can obtain the hand-edge images. By the edge thinning direction and the hand geometry features, one can extract the fingertips and finger-to-finger-valleys, as shown in figure 2.

## 3 EXTRACTING INDEX, MIDDLE, AND RING FINGERS

After the algorithm locate the locations of the fingertips and finger-to-finger valleys, one can extract the index, middle, and ring finger. The extracted results are shown in figures 3, 4, and 5, respectively. After further processing one can obtain the fully closed finger images.



Figure 1: Acquired hand images.

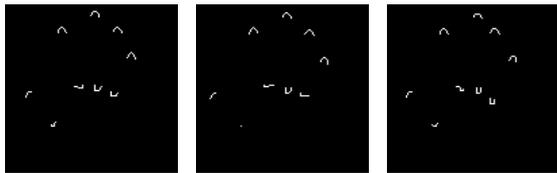


Figure 2: Extracted fingertips and finger-to-finger valleys.

#### 4 IMAGE REGISTRATION AND SUBTRACTION

In order to perform the comparison of two fingers, the centroids of the finger images need to be determined. The images used in this study are the 128 by 128 frames. One needs to perform the image movement to move image to the center of the 128 by 128 frame; i.e. one needs to shift image to allow the centroid of each image to be in location (64,64) of the frame. Furthermore, major axes of fingers need to be located and we need to move fingers to allow major axes of the fingers to be aligned to the same straight position. Since every image is shifted to the center of the 128 by 128 frame and the major axis of each image is aligned to the same vertical position, one can perform the image subtraction to determine the differences of each two fingers.

After the image movement, as mentioned previously, in the new feature-domain, every finger image would be aligned to the same straight and center position.

After image rotating, shifting, and interpolating, two finger images overlap. Since both fingers overlap, image subtraction can now be applied to compare the difference of these two fingers. By the subtracted results, one can identify different fingers.

Figure 6 shows the image subtractions of index fingers. The subtracted-data of the index fingers is shown in table 1.

#### 5 RESULTS AND CONCLUSIONS

Table 1 shows the partial comparison data on differences after performing image subtraction. The data inside the rectangular boxes in the table are the results of subtraction for genuine index finger. The other data in this table comprise the subtracted results from two different index fingers. By analyzing the date in table 1, one can conclude that the accuracy rate is 97%.

#### ACKNOWLEDGEMENTS

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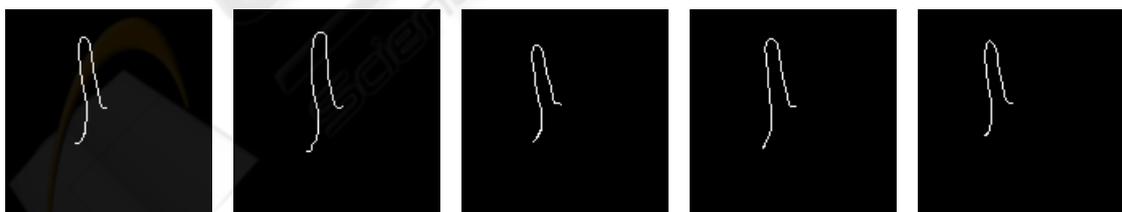


Figure 3: Extracted index fingers.

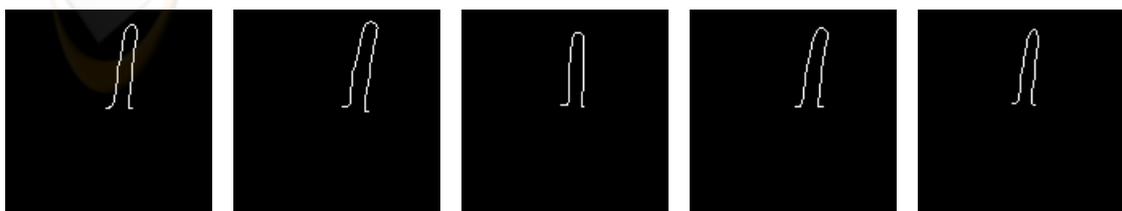


Figure 4: Extracted middle fingers.



Figure 5: Extracted ring fingers.

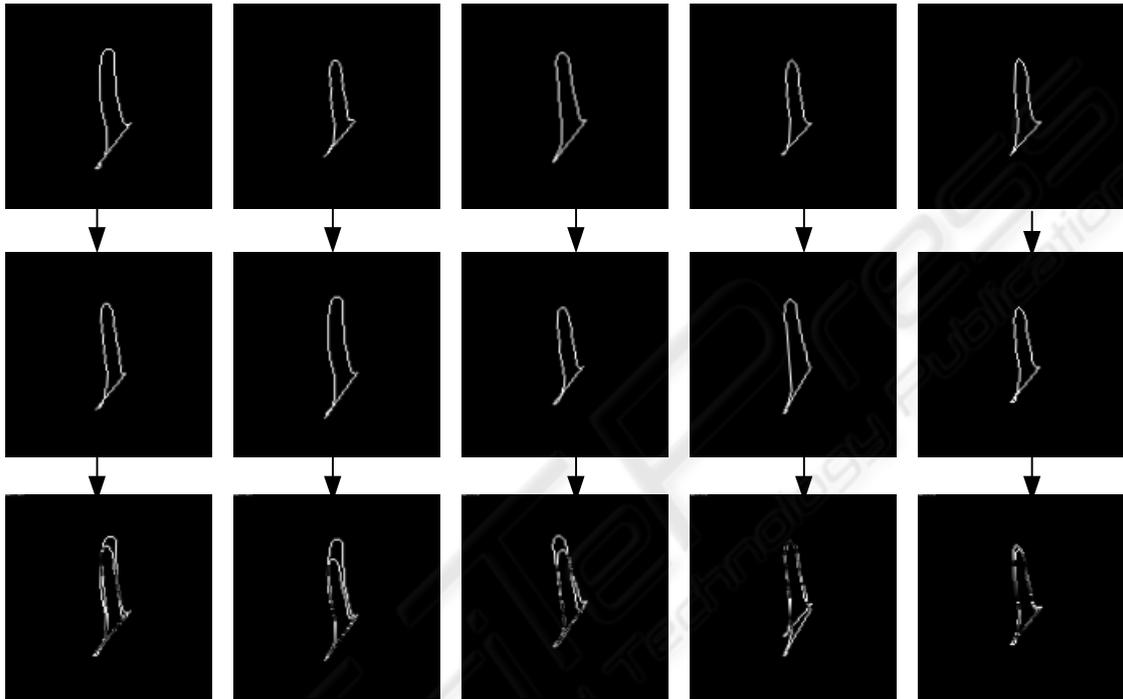


Figure 6: Index finger subtraction.

Table 1: Comparison-data of index fingers.

13606	9344	32648	35920	32057	19731	19951	20553	21518	22666	24366	23012	23208	24767
	9075	36050	39984	35514	16802	18862	17742	27583	27046	25050	19072	19944	23275
		32330	36490	31081	17812	20023	17886	21973	22145	22144	21070	21091	23797
			15355	6971	39351	40742	41120	27115	28159	34670	42610	45765	41568
				14295	45178	45510	47317	29593	29584	34317	45483	49224	43513
					39852	41553	40999	27351	26778	32646	42803	45542	42197
								28340	28836	28194	12836	12500	17419
								29746	31098	30431	14746	15300	18198
								30076	31020	30898	16496	12981	20415
											32092	34529	31320
											11496	18355	32070
												14401	34369
													31665
													28564
													31604
													27848
													10206
													11121
													14594

Comparisons of same person's index fingers