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# Automatic Palm Reader Using Scale-invariant feature transform (SIFT) Algorithm

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**Abstract- Palm reading is a practice used very well in Indian astrology and Roman fortune-telling. It is a fun activity performed all over the world. This application aims to know about a human's health condition by analyzing the palm of our hand. Palm reading is used to discover about the character traits of a person. Palm reading is also advantageous for the medical field people. Palm reading has attained importance in identifying about the disease an individual is suffering from. At present there are less number of mobile applications that allow palm reading to be done automatically and efficiently. This study aspire at creating an application which could be run as a mobile application and which aims at developing an effective algorithm. Automatic Palm reading is a mobile application which uses fuzzy logic and data interpretation for the prediction of health related status and about the person's behavior. Palm reading algorithm makes use of image processing operations like an adaptive threshold method to segment the palm image from background, extract the fingers and calculate their length, extract the principal palm lines by applying regression to generate joint and continuous edge lines. Based on the information gathered from the palm lines, our application predicts health related information like whether the person is suffering or has symptoms leading to heart disease, lung disease, etc. by using fuzzy logic.**

*Keywords — **Android, health, Java, Library, mobile application, Palm reading.***

## I. INTRODUCTION

Palm Reading is a traditional practice which is done in India and China. Ancient records of the frescoes in ruins of India and words given by Brahmans has proved that palm reading was very well liked in India at that time. Chiromancy is another name for palmistry. Palmistry is not only used to read one's hand or palm, it is also includes reading of arm, finger and fingernail. By analyzing one's hand or palm, finger, fingernail, arm we are able to identify about the character traits, health, wisdom, marriage and many other aspects of a person.

Now-a-days people prefer investing time in mobile applications. At present, there are lacks of mobile applications that allow palm reading to be done efficiently. So we proposed to develop a mobile application that works effectively and efficiently. Automatic Palm Reading is a mobile application which will be used to learn a person's fortune, future and personality. Automatic Palm Reading is based on Android platform. Palm reading is help in Medical field.

The design, implementation, and use of biomedical information systems in the form of computer – aided decision support have become essential and popular. Medical scientists discovered that the hand can be used as an indicator for medical problems and the palm is the reflection of activities going on brain. The purpose of this application is to design and implement a decision support model for healthcare on the basis of medical palmistry to diagnose the diseases.

Flow of Automatic Palm Reader system is starts with capturing of the palm image and extracting the principle palm lines. Various image processing techniques are used for noise removing and sharpen the image which are helpful on the input images to get a clear sharpened image without noise. This helps in the extraction of the palm lines. The palm lines provide patterns that can be compared to past findings in predicting the illnesses. Fuzzy Inference System is an important phase of Automatic palm reader system which is used to map input with desired output with logical relations. This is used for observing illnesses as it saves time and effort and provides brief information about the person's health status. The rest of the paper is structured into 7 sections. In section 2 and 3, literature review of the related work is presented. In section 4, the proposed methodology is presented and details regarding the algorithm to be used are explained. In section 5conclusion has been included, in section 6, the future is mentioned.

## II. RELATED WORK

According to **"**An Efficient Automatic Palm Reading Algorithm and its Mobile Applications Development**"** [1]

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research paper published by, Department of Electronic and Information Engineering and written by Kwan-Pui Leung and N.F. Law studied from The Hong Kong Polytechnic University in the year 2016. This study aimed at developing an effective palm-reading algorithm, which can run in an Android platform efficiently. Java Library and Java languages were used for this application development.

According to research paper " Palm Image Segmentation by Using Edge Detection " written by Ms. Nadiya Khan, Ms. Sonali, and Ms. Anita Khand method for segmentation of the palm image for the edge and region segmentation is provided. They used different filters on the palm image like Sobel operator, prewitt operator, Laplacian operator, Gaussian operator, Roberts operator, Motion operator, Log operator, Disk Operator, Average operator, Un-sharp operator, and they compared the result of each operator with one another they got that the best operator is the Gaussian operator to get the good result for the segmentation of the palm. For edge detection palm segmentation they used the different six techniques These are prewitt edge detector, sobel edge detector, Log edge detector, Roberts edge detector, canny edge detector, zero-cross edge detector.

According to "Diseases Diagnosis Using Medical Palmistry Fuzzy Model" research paper written by Zainab Othmanand Sarmad Saleem**,** Department of Computer Science, Science College, University of Basra, Iraqin the year 2016, The design, implementation, and use of biomedical information systems in the form of computer – aided decision support have become essential and widely used over the last two decades. Medical scientists discovered that the hand can be used as an indicator for medical problems and the palm is the reflection of activities going on brain. Database palm images for patients infected with specific disease are created from capturing live images from hospitals.

According to the research paper "EXPAR: A fuzzy rule based expert systemfor palmistry" written by Sanjay Kumar Singh, Meenakshi Sharma, Prateek Agrawal, Vishu Madaanand Amita Dhiman published in the year 2016, says that: Palmistry or chiromancy is the investigation of individual characteristics with the assistance of individual hands because our hands hold the entire story of our life. In this paper, we are going to develop the system based on fuzzy interference system to calculate the exact result of a person by extracting features of individual palm. In this work, we are going to build up a fuzzy based expert system, which provides information of particular individual based on palm features head line, heart line and life line. These extracted features further can be useful in the field of astrological as well as in medical field.

The science of Palmistry is alienated into two wide areas:

- The knowledge of Principle lines.
- The knowledge of the curves on hand.

In this paper, fuzzy logic is used to read the palm and find the characteristics of people. In this work, firstly, palm lines are extracted and further fuzzy inference system is designed with three input lines lifeline, headline and heart line. For this purpose palm, prints of various age groups arrange from 15- 40 year which includes male and female.

## III. PROPOSED METHODOLOGY

This study aimed at developing computational algorithms that allow palm reading to be performed automatically and conveniently in an Android application.

To reliably segment the palm from the background, adaptive segmentation using Otsu's thresholding technique is used with a combination of flood filling.

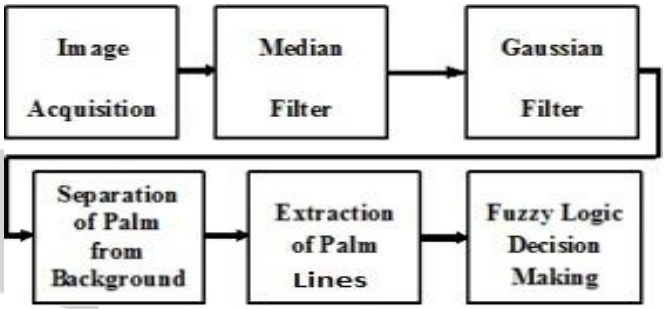


**Fig 3.1: System Working Model Segmenting the Palm from the Background**

First, the image is converted to the YUV format. We have noticed that the YUV format gives accurate segmentation results under different levels of illuminations and shadows. The palm color range was proposed as follows

$Y > 80\ 85 < U < 135\ 135 < V < 180$

Otsu's thresholding determined a threshold that maximizes the between-class variance of the background and foreground. At each intensity value, the background and the foreground was separated, and the between-class variance was calculated

$\sigma^2 = w(t)[1-w(t)][\ \mu(t)- \mu(t)]^2$

Where w (t) is the weighted sum of background, μ

(t) is the mean intensity value of background and μ f (t) is the mean intensity value of foreground.

To further filter out the background pixels and produce connected regions, flood filling was performed after thresholding. The starting point was set as the middle of the palm image, and then its 8 directions were scanned.

### A. Extracting Fingers and Computing Length

After segmenting the palm from the background, fingers were extracted with their lengths computed. This is done by first tracing the contour of the palm and enclosing it by a convex hull. Contour of the palm means the boundary adjoining the segmented palm. Border Tracing algorithm

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was used to trace the contour of the palm. Next, a convex hull enclosed the palm. Convex hull means the smallest convex polygon that could enclose all the points of the contour. Gift Wrapping algorithm proposed by Javis was applied to find the convex hull. First, the contour's vertex was identified. Next, starting from the vertex, the contour was scanned in clockwise or anti-clockwise direction. The furthest and outermost point was chosen in each row of the contour. The convex hull was traced. Finally, convexity defects of the palm were determined to locate the fingertips and finger gaps. Convexity defects are the area, which does not belong to the polygon but being enclosed by the convex hull.

B. Extracting the Three Principal Palm Lines

First, the region containing the palm lines was cropped. Next, several pre-processing operations were performed to remove noises and sharpen the image. To enhance the image contrast, histogram image became sharper and clearer. Canny edge detection could now be performed to extract the three principal palm lines[6]. In Java Library, edges are the discontinuities in an image representing sharp intensity changes. Palm lines could be regarded as edges because they appear as strong discontinuities in the palm. A pixel would be regarded as edge if its gradient magnitude exceeds particular threshold equalization was performed on the image.

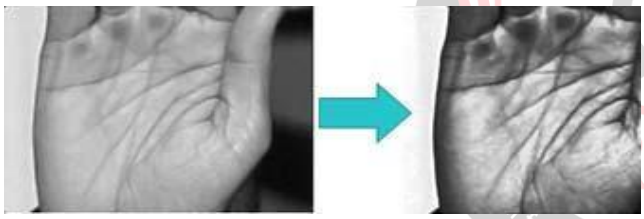

**Fig. 3.2: Palm image after histogram equalization**

Finally, the length of the palm lines was obtained using the Euclidean distance defined as,

$$L= \sqrt{(E_y-S_y)^2+(E_x-S_x)^2}$$

Where Ex and Ey are the x-coordinate and y- coordinate of the ending point, and Sx and Sy are the x-coordinate and y coordinate of the starting point respectively. The slope of the palm lines was obtained using the slope formula as,

$$M= |(E_y--S_{y)/}\,(E_x-S_x)|$$

It should be noted that the length of the palm lines was further normalized[5] using the diagonal length of the palm; and absolute value of the slope was taken because the slope of palm lines in the left palm and right palm has an opposite different sign.

C. Fuzzification

After computing the lengths of principle lines apply fuzzy logic to input data which is carried out by converting inputs into membership values of the fuzzy sets[8]. Life, head and heart line length is input variables of the fuzzy logic based system. Each line has divided in five fuzzy set very small, small, medium, large and very large as shown in Figure 3.3.

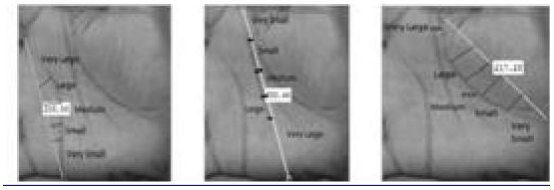

**Fig. 3.3: Fuzzification of hear line (left), head line (middle) and life line (right)**

D. Fuzzy Rule Construction

Apply Fuzzy inference controlled system which is knowledge based system stores knowledge in form of rules and performance of overall system is depends on accuracy of the rules. Each fuzzy rules are in term of if-then rules. We construct Fuzzy rule for accurate result and to make software flexible.

E. Defuzzification

For Multiple inputs we need to produce single output for that purpose we use Defuzzification[4]. Defuzzification converts fuzzy value to crisp value. In this system we used one of the defuzzification method is the centroid calculation, which returns the center of area under the curve. We also used some supported deffuzification methods: centroid, bisector, middle of maximum, largest of maximum, and smallest of maximum. We have applied centroid, bisector and middle of maximum methods on input sets and compare their ranks and produce the desired accurate output.

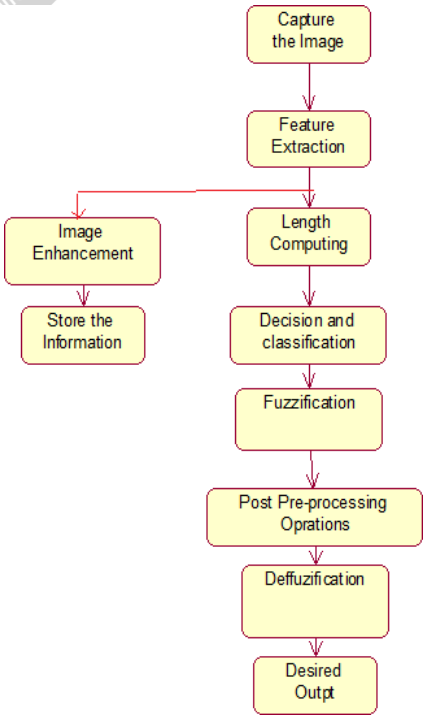


**Fig.3.4: Palm reader Working Flow**

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The methodology of palm reader divided in two parts. First part of this paper includes palm line extraction. Second part of this paper includes designing of fuzzy logic. In inference system with three inputs lifeline, headline, Fate Line and heart line. Various steps involved in design of Automatic Palm Reader follow given algorithm:

- User Login: User will create his/her profile and system will check user age should be more then 3years if not then only Birth sign will display as result.
- Image Capture: User will capture the image using any android smart phone.
- Image Pre-processing: Segmenting the palm lines and use YUV model and flood fill algorithm. To further filter out the background pixels and produce connected regions, flood filling was performed after thresholding. After feature extraction proper alignment is to be done using the Homographic matrix. Given any point in one image, in the homogeneous coordinate system [x, y, 1]^T, the corresponding point in the second image is given by

  $$[x'y',c] = H[x,y,1]^T$$
- Computing the length of the palm: first tracing the contour of the palm and make a convex hull. Border Tracing algorithm used to trace the contour of the palm. Next, a convex hull used the Gift wrapping algorithm applied to find the convex hull.
- Extract Principle lines: Several pre-processing operations were performed to remove noises and sharpen the image. Histogram equalization was performed on the image to enhance the image contrast. After filtering out the noises, contrast was enhanced and the image became sharper and clearer. For palm feature extraction Central part of the palm called as Region Of Interest (ROI) is used. Now define a co-ordinate which is used to align different palm print images. Palm ROI cropping is checking of robustness against rotation and translation of hand images. By

  $$TLx=(Centerx128)+(128*m)$$
  $$TLy=(Centery-(128*m))-128$$
- Computing the length of the palm: First tracing the contour of the palm and make a convex hull. Border Tracing algorithm used to trace the contour of the palm. Next, a convex hull used the Gift wrapping algorithm applied to find the convex hull.
- Extract Principle Lines: Several pre- processing operations were performed to remove noises and sharpen the image. Histogram equalization was performed on the image to enhance the image contrast, after filtering out the noises, contrast was enhanced and the image became sharper and clearer. After image alignment, the query image and the gallery are better aligned, and traditional algorithm applies a bank of modified Gabor filters with different orientations to palm print images, and encode the orientation into 3 bit- planes

  $G(x,y,\Delta,\Theta,\Sigma) = w/(\sqrt{2}\kappa)EXP(-(w^2/8x^2)(4x'^2 + y'^2)$

  With

  $x'=(x-x0)\cos\theta + (y-y0)$

  $\sin\theta\ y'= -(x-x0)\sin\theta + (y-y0)\cos\theta$

  And then finally score fusion is performed using this formula

  $$d=wd_{SIFT} + (1-w)\, d_{compcode}$$
- Fuzzification: Create membership function, the fuzzy sets of the input variables and their range.
- Fuzzy rule construction: Apply knowledge based Fuzzy controller (KBFC).
- Defuzzification: Apply Defuzification techniques, compare input sets, and calculate the result.
- Result generation

## IV. RESULTS AND ANALYSIS

On the development of health prediction database, continuous efforts to add more information of illnesses and palm features can help in broadening the database. In addition, verification of collected information on health prediction and fortune telling can be done with various expertise in those fields to improve on the accuracy of the database.

As this is the age of mobile technology, after the system is successfully implemented and integrated with the deciphering system, a mobile application version of the system can be developed. This new mobile application should be able to utilize the deciphering system and the phone's camera to accurately identify the user's palm features. After deciphering, the extracted features can be pushed to the database to fetch the corresponding results for the users. This helps to provide increased accuracy and more convenience for the users.

Results shown below indicate successful implementation of Student and Faculty module along with results of their important functionalities. Following figures shows the screenshots taken from the application :

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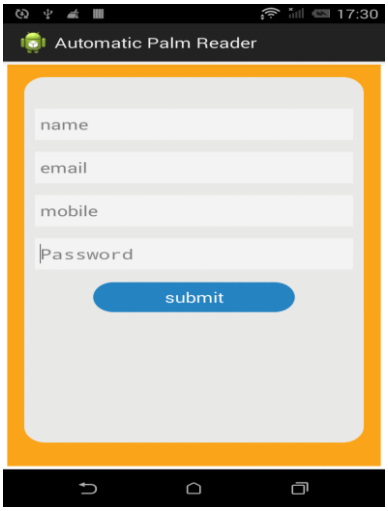


Fig.4.1: Registration

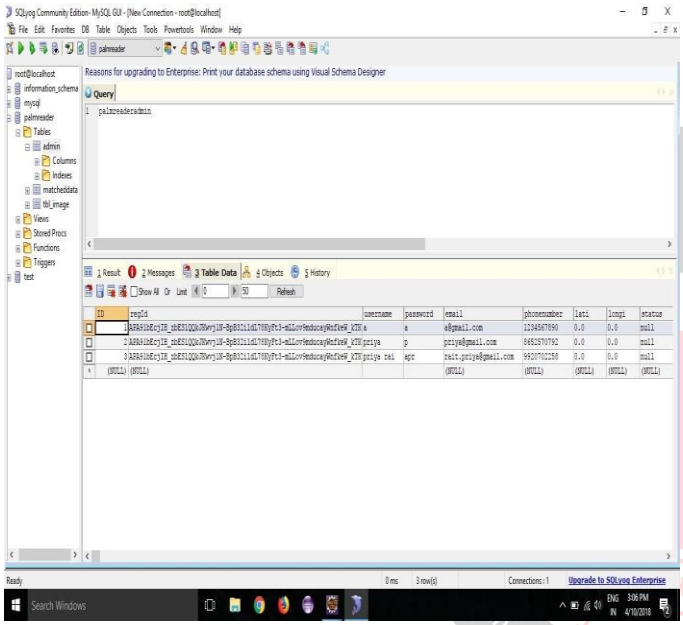

Fig.4.2: Database uploading

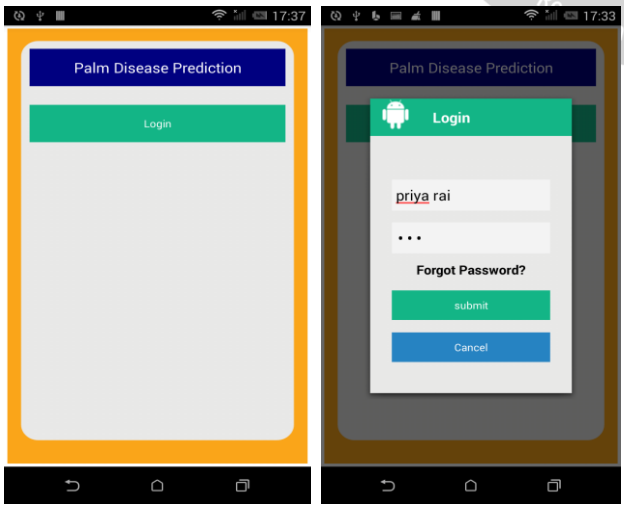


Fig.4.3: Login


Fig.4.4: Home page of Automatic Palm reader

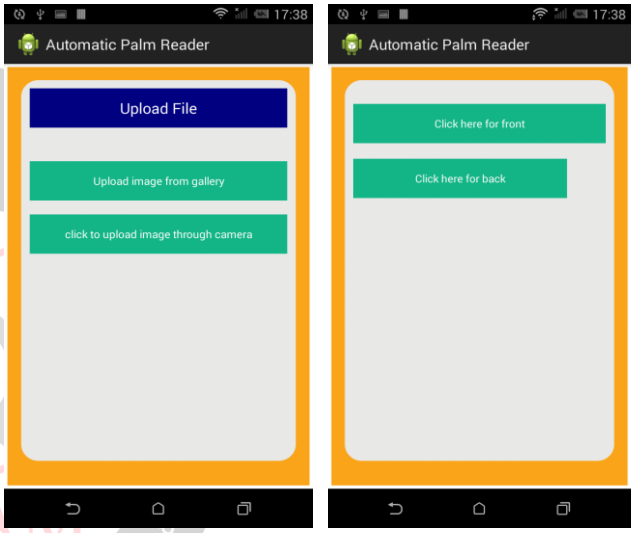


Fig.4.5: Taking input image

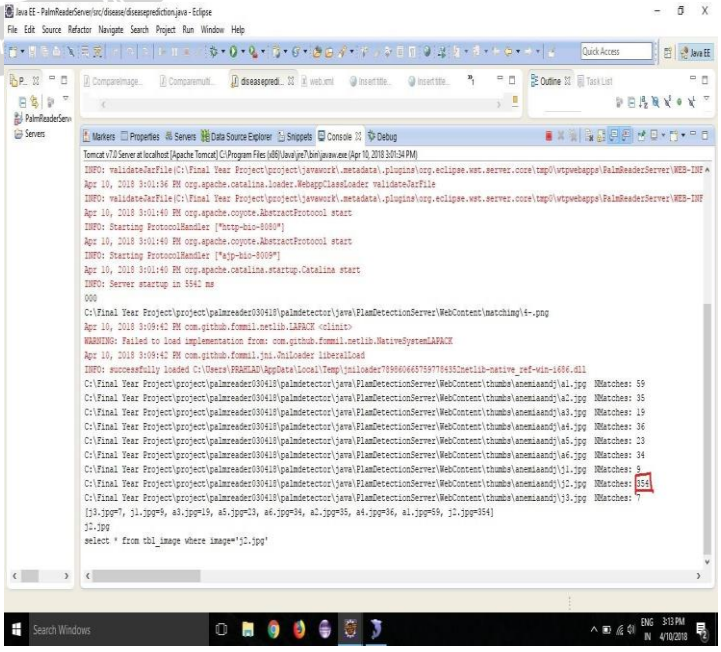

Fig.4.6: SIFT Matching

 DOI : 10.35291/2454-9150.2020.0243 

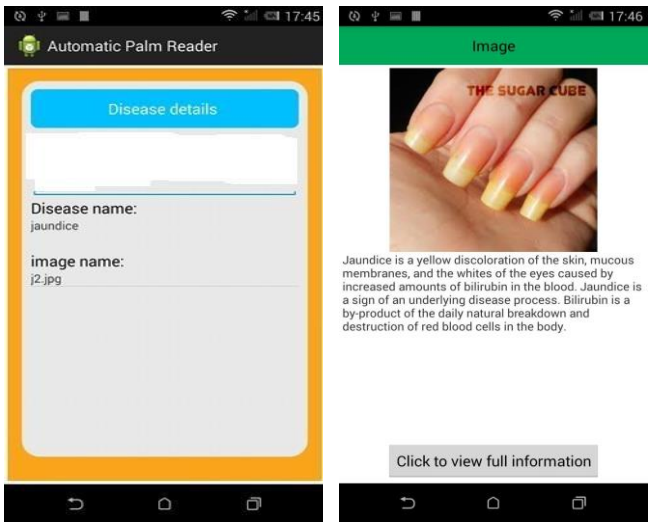


**Fig.4.7: Disease detection and displays the result**

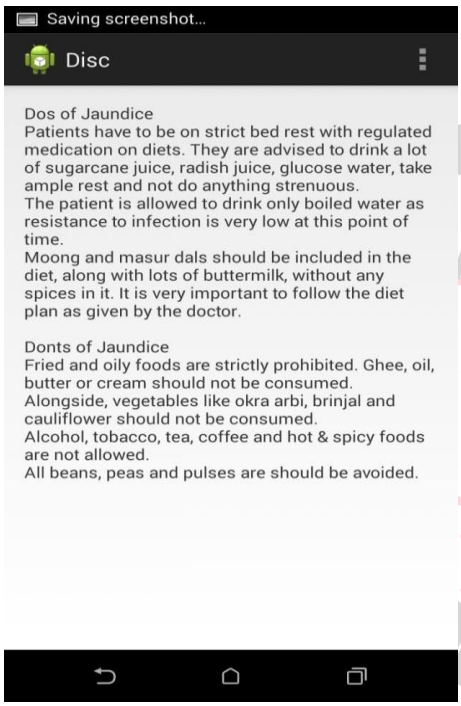


**Fig.4.8: Disease pesticide precautions**

## V. CONCLUSION

This study is among the first to develop a palm-reading algorithm that could segment the palm from the background, compute the length of fingers, and extract the three principle lines of the palm automatically. The proposed algorithm was integrated into an Android application with a user-friendly Graphical User Interface (GUI). Experimental results showed that the proposed algorithm produces accurate detection results while the computational requirement is not demanding. First, although there are many image-processing operations in our proposed algorithm, the computational speed under the mobile application development platform is acceptable. The errors of detecting palm lines are greatly reduced. Second, this project has the potential to trace the changes of the palm lines over time for further research. By SIFT Matching algorithm, we predict about the health status of the person like the anemia and jaundice.

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