LNCS 3101

Masood Masoodian
Steve Jones
Bill Rogers (Eds.)

Computer Human Interaction

6th Asia Pacific Conference, APCHI 2004
Rotorua, New Zealand, June/July 2004
Proceedings

Springer

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Library of Congress Control Number: 2004108030

CR Subject Classification (1998): H.5.2, H.5.3, C.2.4, H.4, H.3, I.2, I.3.6, K.4.3, K.8

ISSN 0302-9743
ISBN 3-540-22312-6 Springer-Verlag Berlin Heidelberg New York

Springer-Verlag is a part of Springer Science+Business Media

springeronline.com

Printed in Germany

Typesetting: Camera-ready by author, data conversion by Boller Mediendesign
Printed on acid-free paper SPIN: 11014447 06/3142 5 4 3 2 1 0

Lecture Notes in Computer Science 3101

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

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Preface

APCHI 2004 was the sixth Asia-Pacific Conference on Computer-Human Interaction, and was the first APCHI to be held in New Zealand. This conference series provides opportunities for HCI researchers and practitioners in the Asia-Pacific and beyond to gather to explore ideas, exchange and share experiences, and further build the HCI network in this region. APCHI 2004 was a truly international event, with presenters representing 17 countries. This year APCHI also incorporated the fifth SIGCHI New Zealand Symposium on Computer-Human Interaction.

A total of 69 papers were accepted for inclusion in the proceedings – 56 long papers and 13 short papers. Submissions were subject to a strict, double-blind peer-review process. The research topics cover the spectrum of HCI, including human factors and ergonomics, user interface tools and technologies, mobile and ubiquitous computing, visualization, augmented reality, collaborative systems, internationalization and cultural issues, and more. APCHI also included a doctoral consortium, allowing 10 doctoral students from across the globe to meet and discuss their work in an interdisciplinary workshop with leading researchers and fellow students. Additionally, five tutorials were offered in association with the conference.

The conference was also privileged to have two distinguished keynote speakers: Don Norman (www.jnd.com) and Susan Dray (www.dray.com). Don Norman's invited talk focussed on 'emotional design': the application of recent research on human affect and emotion to the design of products that are easier to use because they are also interesting and beautiful. Susan Dray's research combines expertise in interface evaluation and usability with a cross-cultural and organizational perspective.

The quality of this year's APCHI was the joint achievement of many people. We would like to thank all those who worked so hard to make APCHI a success: the referees for their time and effort generously donated to the reviewing process; the program committee for organizing the reviewing process, the presentations, and of course this volume of proceedings; the steering committee for their support of the APCHI series; and the local organizing committee for their excellent work in bringing the conference to fruition. Finally, we thank the authors and presenters as well as the APCHI 2004 attendees, whose contribution and participation were the crucial ingredients of an exciting and productive conference.

April 2004 Sally Jo Cunningham, Matt Jones

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Doctoral Consortium

A Simple and Novel Method for Skin Detection and Face Locating and Tracking

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Abstract. In many computer vision applications such as human-computer interaction (HCI) and human-motion tracking (HMT), face detection is considered the main step which is also the first step. To detect faces, skin color is considered the most appropriate feature to use. A simple arithmetic on RGB color space components is used in this paper to extract the skin. Elliptical shape fitting is used to locate the face. Then template matching is used to locate the eyes. A very good result is achieved using our simple algorithm. Up to our knowledge, we believe that our skin detection method is one of the most efficient methods being used today.

1 Introduction

Using skin color for face detection has taken the attraction of many researchers and become the subject of their researches [1-12]. Authors in [13] tabulated the major methods of face detection. A survey of human faces detection and recognition is given in [14]. Some image pixels values will be in skin and none-skin regions at the same time. This fact makes it very difficult to perfectly make the right decision for these pixels. Some researchers used the color histogram for skin detection [6,15]. Prior knowledge of skin color clustering and shape information are used to perform pixel level classification [1,2,5,10-12,16,17]. Different researchers used different color spaces [18]. In addition to skin color, geometric properties of faces were used to construct a method for face detection [1,2,9]. Generic algorithm and eigenfaces also used for faces detection [19]. Skin color classification using two discriminates namely: linear discriminate and Mahalanchin distance were presented in [7]. Fischer linear discriminate was used also with color-based segmentation [3]. Building skin color model by subtracting two adjacent image frames as a first step is presented in [6]. The rest of this paper is organized as follows: the main method for skin detection is presented in section 2 whereas steps of face detection and eye locating are discussed in section 3. Section 4 contains the results of applying our algorithm on three faces database [20-22]. A summary is given in section 5.

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2 Skin Detection

Large number of image sources produces the needed images in RGB format. In many researches, the authors claim that other color spaces such as CIF-x, HSV are more appropriate than the RGB space [2,7,13,16,18]. It was shown that this is not true [11,23]. This implies that the transformation form RGB color to another color space is an extra processing step. Brand, J. stated that R/G > 1 and the red color is the predominant color in the human skin color [11]. This property in addition to other equations has been used to classify the skin color pixels. Our main observation is that when G component is subtracted from R component of the RGB color representation the pixels values for none-skin become relatively small whereas for skin pixels values are high. It is supposed that the image quality and resolution is sufficient enough. The next step is to automatically separate the two regions representing skin and none-skin regions. We need to find the best two values where the R-G values for the skin pixels reside. We observed that all R-G values are relatively small except for the skin pixels. We used tanh() function to saturates all R-G values. We recognized that R-G values start increasing sharply at the skin boundary pixels to give tanh() value of 1 which means that R-G is about 20. So we picked a lower threshold value of skin R-G values to be 20. By practice, we found the upper limit to be 80. We used Matlab 6.1 running on 1.7 GHZ CPU with 256 MB of RAM. The following summarizes the skin detection process:

- acquire an image in RGB
- calculate R-G
- if $20 < R\text{-}G < 80$ then R-G pixel is a skin otherwise non-skin

According to [13,15] most of the face databases designed for face recognition, usually contain grayscale images. Whereas collected images from WWW have properties that make them suitable for experiments [15]. So, we have chosen our test images to be from WWW and from different face databases to provide us with more generality [20-22]. Figure 1 (a-d) show the image of a human face before and after skin detection. This method can be used also with complex background as shown in figure 2 and figure 3.

3 Face and Eyes Locating and Tracking

After locating the skin region the largest object which is supposed to be the face is located. Its centroid , majoraxis and minoraxis lengths are determined. The best fitting ellipse is calculated. Objects with semi-skin color may be classified as skin objects which will produce some errors in the skin color classification process. In addition, the neck is not covered most of the time. To reduce the effect of these problems, some image properties can be used. First, the face is an elliptical. Second, the face will be most probably in the upper part of the human in a given image.