MCGILL UNIVERSITY, DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

Final Project

Introduction to Image Processing

Prof. Alexandre Zaghetto

June 14, 2017

1 INSTRUCTIONS

1. The project must be completed in groups of 2 students.
2. The report should have between two (2) and four (4) pages, to be prepared following the IEEE template[1]. The following structure should be respected:
   a) Title
   b) Authors
   c) Abstract
   d) Introduction
   e) Background and Related Work
   f) Proposed Solution
   g) Experimental Results
   h) Conclusion
   i) References
3. Twenty (20) to thirty (30) minutes presentation, demonstration and questions (05 July).
4. You must submit the source code developed during the project, the written report and the presentation using myCourses. Your code must be well-documented and should be written using MATLAB[2] toolbox or OpenCV[3].

[1] http://www.ieee.org/conferences_events/conferences/publishing/templates.html
[2] https://www.mathworks.com/help/pdf_doc/images/
[3] http://opencv.org/

5. Due on July 05 2017, 9:35am.

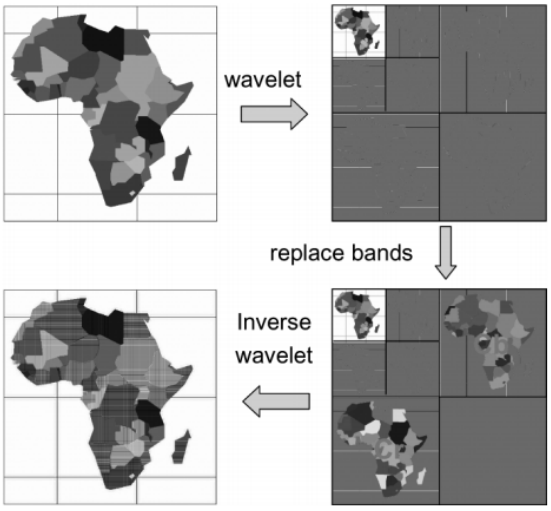
The code must be well-documented.

2 Suggested Topics

2.1 Color to Gray and Back: Color Embedding Into Textured Gray Images

Ricardo L. de Queiroz and Karen M. Braun

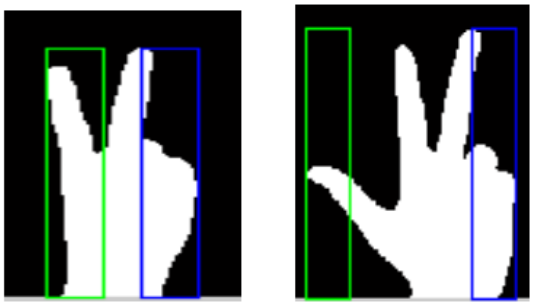
Abstract - We have developed a reversible method to convert color graphics and pictures to gray images. The method is based on mapping colors to low-visibility high-frequency textures that are applied onto the gray image. After receiving a monochrome textured image, the decoder can identify the textures and recover the color information. More specifically, the image is textured by carrying a subband (wavelet) transform and replacing bandpass subbands by the chrominance signals. The low-pass subband is the same as that of the luminance signal. The decoder performs a wavelet transform on the received gray image and recovers the chrominance channels. The intent is to print color images with black and white printers and to be able to recover the color information afterwards. Registration problems are discussed and examples are presented.



2.2 HAND GESTURE RECOGNITION BASED ON SHAPE PARAMETERS

Meenakshi Panwar

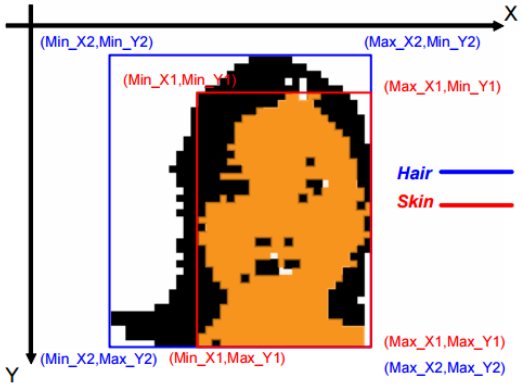
Abstract - Pattern recognition and Gesture recognition are the growing fields of research. Being a significant part in non verbal communication hand gestures are playing vital role in our daily life. Hand Gesture recognition system provides us an innovative, natural, user friendly way of interaction with the computer which is more familiar to the human beings. Gesture Recognition has a wide area of application including human machine interaction, sign language, immersive game technology etc. By keeping in mind the similarities of human hand shape with four fingers and one thumb, this paper aims to present a real time system for hand gesture recognition on the basis of detection of some meaningful shape based features like orientation, centre of mass (centroid), status of fingers, thumb in terms of raised or folded fingers of hand and their respective location in image. The approach introduced in this paper is totally depending on the shape parameters of the hand gesture. It does not consider any other mean of hand gesture recognition like skin color, texture because these image based features are extremely variant to different light conditions and other influences. To implement this approach we have utilized a simple web cam which is working on 20 fps with 7 mega pixel intensity. On having the input sequence of images through web cam it uses some pre-processing steps for removal of background noise and employs K-means clustering for segmenting the hand object from rest of the background, so that only segmented significant cluster or hand object is to be processed in order to calculate shape based features. This simple shape based approach to hand gesture recognition can identify around 45 different gestures on the bases of 5 bit binary string resulted as the output of this algorithm. This proposed implemented algorithm has been tested over 450 images and it gives approximate recognition rate of 94%.



2.3 Simple Face-detection Algorithm Based on Minimum Facial Features

Yao-Jiunn Chen and Yen-Chun Lin

Abstract - This article presents a algorithm for rapid and accurate face-detection. The algorithm detects human faces by the geometric correlations between locations of faces and hairs. Ranges of skin color are used to figure out possible face regions so as to initially localize the faces; furthermore, probable hair blocks in an image are determined by means of hair color spectrums. Grouped skin and hair blocks decide candidate face areas in light of the geometric relation. The accuracy of the single-face detection is higher than 9210 fps, if tested with a simple background and sufficient light source. The algorithm can be transferred from a PC to embedded devices, such as a DSP platform. This system-level implementing ability brings great potential to customized and reusable applications as well as miniature systems.



2.4 Face and Photograph Augmentation Based on a Custom Theme

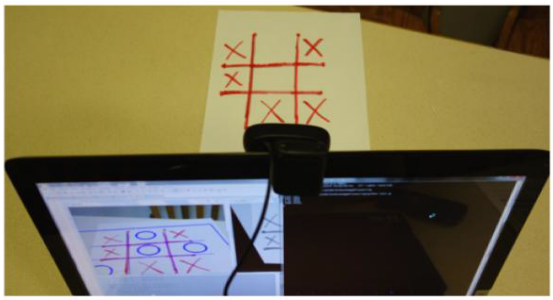
Orly Liba

Abstract - This report describes a technique to automatically augment photographs by adding masks and hats (or ears) to people's faces and to additionally complement the scene by adding Instagram-like effects such as vignetting, gradient blurring and color filtering. Unlike commercially available applications, this approach can be used to make any photographed or animated face into a mask. The augmentation of the target photograph is fully automatic and takes 1-3 seconds, depending on the size of the mage. As next steps, this algorithm could be implemented on a mobile device in real time for video-chat applications.

2.5 Augmented Reality Tic-Tac-Toe

Joe Maguire & David Saltzman

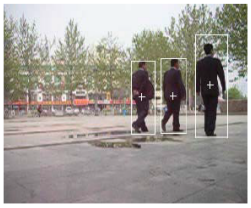
Abstract - This project implements an augmented reality version of Tic-Tac-Toe. In this game, the user draws an X on a paper board. Using a webcam and digital image processing techniques, the computer then determines the board state. Using this information, the computer chooses a move and displays the move in the appropriate place on the screen. Our finalized algorithm successfully completes these steps with high repeatability.



2.6 A METHOD FOR DETECTING PEDESTRIANS IN VIDEO SURVEILLANCE SCENES

Xin Zhang, Yuehua Gao, Xiaotao Wang, Jianing Li, Bing Wang

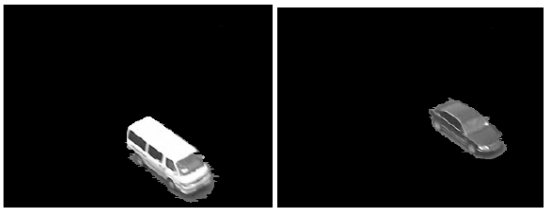
Abstract - Detecting pedestrian accurately from natural scenes makes the important impact on intelligent video surveillance. In this paper, we combine motion information, human skin color information, human shape information and variation of ambient lighting to detect pedestrians for the application of automated video surveillance. The moving objects in the video sequence images are extracted using the multi-frame differencing method with adaptive ambient illumination changes. The adaptive ambient illumination human skin feature extraction algorithm extracts human skin color in different lighting changes in order to tackle the problem that skin color is susceptible to illumination. Improve Hough transform is used to automatically determine the size of human head in different scenes. The experimental results show that the method presented in this paper is feasible and is suitable for online applications in moving human detection in natural scenes.



2.7 Self-adaptive Detection of Moving Vehicles in Traffic Video

Zhai Hai-tao, Wu Jian, Xia Jie, Cui Zhi-ming

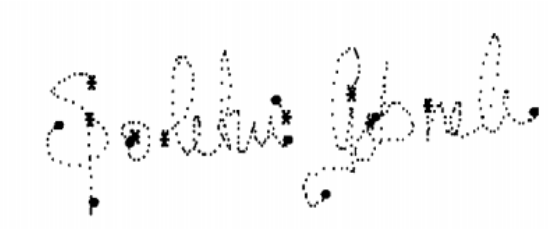
Abstract - Aiming at the difficulty of obtaining the initial background, the inaccuracy of real-time background update and the difficulty of controlling the update speed in moving vehicle detection of traffic video, this paper proposes an accurate and effective moving vehicle detection method which can be used in complex traffic environment. This method first constructs initial background image according to the real-time situation of traffic environment, then segmentalizes the current frame into foreground region and background region accurately using the combined method of inter-frame difference and background subtractions, then do the real-time update on background with a adaptive background update speed which is selected according to the background disturbance and illumination changes of road, lastly obtain the moving object and remove the shadow of moving object with the background subtraction method. Experimental results show that this method can detect moving vehicles fast and accurately in complex traffic situation.



2.8 AUTOMATIC SIGNATURE VERIFICATION: THE STATE OF THE ART

Donato Impedovo and Giuseppe Pirlo

Abstract - In recent years, along with the extraordinary diffusion of the Internet and a growing need for personal verification in many daily applications, automatic signature verification is being considered with renewed interest. This paper presents the state of the art in automatic signature verification. It addresses the most valuable results obtained so far and highlights the most profitable directions of research to date. It includes a comprehensive bibliography ofmore than 300 selected references as an aid for researchers working in the field.



2.9 FACE SWAPPING

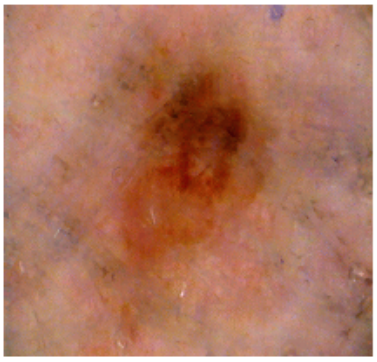
Yifei Feng, Wenxun Huang and Tony Wu

Abstract - Online privacy is a growing concern in today's world. To alleviate privacy concerns, we present an automatic face swapping algorithm that searches and selects faces within an image and replaces them with another face with realistic results. Our algorithm identifies and uses the most suitable faces using a selection process, face extraction using optimal seam search, and blending using linear RGB channel scaling and Poisson Editing.

2.10 DullRazor: A software approach to hair removal from images

Tim Lee, Vincent Ng, Richard Gallagher, Andrew Coldman, David Mclean,

Abstract - Recently, there has been a growing number of studies applying image processing techniques to analyze melanocytic lesions for atypia and possible malignancy and for total-body mole mapping. However, such lesions can be partially obscured by body hairs. None of these studies has fully addressed the problem of human hairs occluding the imaged lesions. In our previous study we designed an automatic segmentation program to differentiate skin lesions from the normal healthy skin, and learned that the program performed well with most of the images, the exception being those with hairs, especially dark thick hairs, covering part of the lesions. These thick dark hairs confused the program, resulting in unsatisfactory segmentation results. In this paper, we present a method to remove hairs from an image using a pre-processing program we have called DullRazor. This pre-processing step enables the segmentation program to achieve satisfactory results.



2.11 TOONIFY: CARTOON PHOTO EFFECT APPLICATION

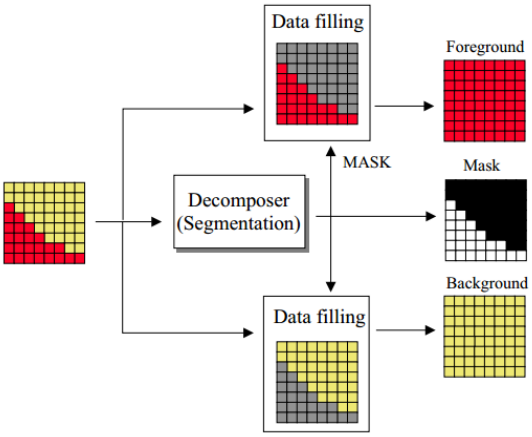
Kevin Dade

Abstract - Toonify seeks to emulate the types of cel-shading effects offered by graphics engines in a lighthearted and userfriendly way.

2.12 Optimizing Block-Thresholding Segmentation for Multilayer Compression of Compound Images

Ricardo L. de Queiroz

Abstract - Compound document images contain graphic or textual content along with pictures. They are a very common form of documents, found in magazines, brochures, web sites, etc. We focus our attention on the mixed raster content (MRC) multilayer approach for compound image compression. We study block thresholding as a mean to segment an image for MRC. An attempt is made to optimize the block threshold in a rate-distortion sense. Also, a fast algorithm is presented to approximate the optimized method. Extensive results are presented including rate-distortion curves, segmentation masks and reconstructed images, showing the performance of the proposed algorithm.



2.13 DEPIXELIZING PIXEL ART

Johannes Kopf and Dani Lischinski

Abstract - We describe a novel algorithm for extracting a resolution independent vector representation from pixel art images, which enables magnifying the results by an arbitrary amount without image degradation. Our algorithm resolves pixel-scale features in the input and converts them into regions with smoothly varying shading that are crisply separated by piecewise-smooth contour curves. In the original image, pixels are represented on a square pixel lattice, where diagonal neighbors are only connected through a single point. This causes thin features to become visually disconnected under magnification by conventional means, and creates ambiguities in the connectedness and separation of diagonal neighbors. The key to our algorithm is in resolving these ambiguities. This enables us to reshape the pixel cells so that neighboring pixels belonging to the same feature are connected through edges, thereby preserving the feature connectivity under magnification. We reduce pixel aliasing artifacts and improve smoothness by fitting spline curves to contours in the image and optimizing their control points.