**Project Description**

**ESTIMATION OF IMPROVEMENT IN ROSACEA USING IMAGE PROCESSING**

**Abstract:**
The project addresses a need by dermatologists of being able to assess quantitatively the change in severity of the skin disease Rosacea. Traditionally, the efficacy of a treatment could only be assessed subjectively, such as by a dermatologist at weekly intervals giving a patient under treatment a score related to the degree of severity of the Rosacea, with say a score of 5 meaning “severe” and a score of 1 “mild”. The method used in this project offers an objective measure of the change in severity of Rosacea; the basic idea is to use image processing techniques to find, assess and compare the sizes and degrees of redness of skin in photographs of a patient’s face taken over a period of time. Challenges include the need to take into account the different lighting conditions and orientations of the photographs.

**Method:**
The basic objective can be stated as, “devising an image processing algorithm which takes as input two photographs of a patient’s face and automatically determines if the patient’s skin is improving or getting worse”. Rosacea is a skin disease, characterized in the project by presence of acnes, reddish papule, and scars on skin and/or reddening of skin. On the other hand, reduction in severity of disease is characterized by decrease in intensity of redness of affected areas and decrease in area affected by redness/acnes.

Prior to any analysis it is essential to identify the skin regions in the given photograph. Surveying the existing techniques in literature for skin segmentation and noting the fact that the major criterion for distinguishing normal skin from affected skin is a colour cue (that the affected skin appears redder), parametric modelling of skin using colour information was identified as the appropriate technique for identifying skin regions owing to its demonstrated capability of achieving acceptable results, relevance in context, and ease of implementation.

Thus a training set consisting of human faces from different ethnicities (to account for skin colour variations in different races) was constructed and skin and non skin pixels were manually extracted from these images. The pixel values were statistically analysed under various dimensions of different colour models (such as RGB, HSV, LCH , HSL, YCbCr ) and finally features providing acceptable segmentation results were chosen for constructing a parametric model of skin. Using this, skin regions are identified. To take into account differences due to varying illumination conditions the pixel values (of each pixel in RGB colour model) are normalized.

Further, the pixels labelled as skin pixels were again statistically analysed and along with the help of heuristics, a parameter identifying Rosacea were obtained. This parameter was named as ‘Disease identifying parameter (DIP)’, and the severity of disease was found out to be directly related to the value of this parameter. The 2 images are taken as input and value of DIP is calculated for each pixel of each image. Depending on the distribution of DIP, the skin regions of images are divided into 3 regions namely “severely affected, moderately affected and least affected (or normal)”. Now taking into account area of skin under each region (2 images of patients were taken in almost identical positions to eliminate the difference in areas of corresponding skin patches arising out of different orientations of faces), and from the mean and variation of DIP under each region an estimate of severity of disease can be made and it is possible to quantify the improvement in disease.

The project was done under the mentorship of Prof. Jonathan Manton, University of Melbourne. The images of patients used were obtained from Dr. Weng-Hung Chung, Dep. of Dermatology, Chang Gung Memorial Hospital, and Taipei. He also commented on the results of the works and provided useful feedback in the course of developing the above mentioned technique.

The project was done using MATLAB tools and a GUI interface was developed for the same.