



# Feature Space Scaling Of 2D Segmented Psoriasis Skin Images

Anuradha Balasubramaniam<sup>1</sup>, Anbu Selvi<sup>2</sup>

Student, Computer Science & Engineering, Meenakshi College of Engineering, India<sup>1</sup>  
Asst. Professor, Computer Science & Engineering, Meenakshi College of Engineering, India<sup>2</sup>  
radha.anu.b30@gmail.com, g.anbuselvi.be@gmail.com

**ABSTRACT**—Psoriasis is a chronic inflammatory, immune mediated skin disease. Assorted techniques are used to assess psoriasis severity and to monitor therapeutic response. The PASI system of scoring employs a visual analogue scale to score the thickness, redness (erythema), and scaling of psoriasis lesions. PASI scores are subjective and suffer from indigent inter and intra-observer concurrence. A Pixel Labelling Algorithm incorporating color, contrast and image texture conjointly provide a treatment solution. This includes feature extraction and classification. The process involved is scaling segmentation of the image. The Markov random field (MRF) is used to smooth a classification from a support vector machine (SVM) that utilizes a feature space derived from image color and scaling texture. So initially the image is contrasted to find the affected area. The concentration is on the lighting and the skin type. The scaling contrast map provides an effective way to contrast image. It focuses on colour and intensity of the image. Gabor filter is used to extract the texture from the image. The final image obtained is the ground truth. The proposed system focuses on segmentation and scaling of 2D digital images of Psoriasis to detect vague scaling. An edge mapped luminance algorithm is used. Using this algorithm, the detected vague scale gives the exact amount of affected area.

**Keywords**—Feature Extraction, Image Segmentation, Markov random field (MRF), Support Vector Machine (SVM), Psoriasis, Erythema.

## 1. INTRODUCTION

Psoriasis is a chronic, inflammatory, non-contagious skin disorder which is characterized by red plaques covered by silvery-white scales. It is caused by genetic fault where immune system is somehow mistakenly triggered which produce skin cells faster and thicker than normal. It affects about 3% of world population. A number of ways to segment the psoriasis lesion from healthy skin has been reported in the literature. The drawback in most method is that the exact affected area is not properly classified. Subtracting the green band from blue band in RGB color space can effectively discriminate lesion from healthy skin. However, this method may not work well for dark skin cases. Also the PASI system of scoring is widely used for evaluating psoriasis severity. It has a visual analogue scale to score the thickness, redness (erythema), and scaling of psoriasis lesions. However, PASI scores are also



Suffering from poor inter and intra-observer concordance. A pixel labelling algorithm had been utilized to segment psoriasis lesion.

The determination of vague scaling is done based on the boundary detection by using an edge mapped luminance algorithm. The ground truth tells the majority amount of affected area.

## **2. FINDING THE VAGUE SCALE**

The detection of vague scale is done so that we can identify the exact amount of affected area. Apart from that we predict the probability that the disease is going to spread or heal. This is done by comparing the edge of the affected area with the normal skin and the majority of the affected area. If it is darker than normal skin and affected area, it is healing. If it is reddish and light in colour, it is going to spread. This helps in finding the severity of the disease.

## **3. SYSTEM ANALYSIS**

### **3.1 Existing System**

In existing system the early psoriasis diagnosis is difficult and may be confusing, so it may affect treatments to the patients. The psoriasis skin pattern has scanty border definition which is not accessible to analyze and figure out. A scaling contrast mapping is carried out to heighten the contrast of scaling from erythema. A Gabor filter is used to discern the normal skin from the affected skin. K-means from a Support Vector machine (SVM) is used to achieve pattern matching. A k-means algorithm is adopted for this intention. A Markov Random Field (MRF) is applied to smoothen the image. The existing system comprises two stages,

1. Feature Extraction Stage
2. Scaling Segmentation Stage

The algorithm first analyzes skin color and skin texture using scaling contrast mapping and Gabor filter for image feature extraction. Next is the classification process using MRF and SVM for segmentation.

### **3.2 Proposed System**

Psoriasis skin segmentation images are digitally captured under composed environment. In the proposed system the vague scaling which was difficult to detect is detected. An edge mapped luminance algorithm is implemented for this reason. Using this image, the growth rate estimation is done. A bisected factor based clustering algorithm is adopted. The feature extracted image is saved separately so that the original image is not lost. Now an SVM is used to segment and smoothening of the image is done using MRF segmentation.



## 4. IMPLEMENTATION

### 4.1 Feature Extraction

Feature extraction includes implementing scaling contrast map to modify image based on color. The scaling contrast mapping is used to contrast image based on intensity and lightness of the image. This contrasted image is subjected to a Gabor filter. A Gabor filter is used to extract the texture feature in the image. The Gabor filter includes extraction of a texture based on the contrast to detect the affected area of psoriasis skin images. This is implemented using a Pixel labeling algorithm.

The scaling contrast map is defined as,

$$S = J(L^*) + J(\text{inv}(a^*))$$

Where  $S_{x,y}$  is scaling contrast of image. Here  $J$  detects the contrast.  $L^*$  is lightness of image (0-black and 100-diffuse white).

$a^*$  is red-green dimension(positive-red and negative-green)  $b^*$  is blue-green dimension.  $\text{Inv}(a^*_{x,y})$  is given as

$$\text{inv}(a^*) = \max_{i,j} (a^*_{i,j}) - a^*$$

It inverts the image in  $a^*$  dimension.

The multi center surround filter  $J(\cdot)$  is given as

$$J(X) = \sum_{s=1}^3 \left( X - \frac{1}{N} \sum_{\substack{x-w(s) \leq m \leq x+w(s) \\ y-w(s) \leq n \leq y+w(s)}} X_{m,n} \right)$$

Where  $s$  is scale.  $w$  is window size,  $w = d/2^s$ , where  $d$  is large value of image width or height in pixels.  $N$  is number of pixels in window. Here  $s \in \{1, 2, 3\}$ . This scale covers the contrast analysis. The contrast filter  $J(\cdot)$  compares the intensity of the current pixel with its surroundings at the different scales. In normal lighting conditions, if it is scaling, then  $J(L^*)$  is still positive. In the presence of shadows  $J(L^*)$  is still positive with sufficient contrast

### 4.2 SVM And MRF Classification

A support vector machine (SVM) identifies the normal and the affected skin. The SVM is used to cluster the normal skin and the scaling image. The MRF is used to smoothen the changes made so that it is restricted to that particular region. The set of possible scaling part  $L_{\text{scaling}}$ , and skin part  $L_{\text{skin}}$ , are obtained and clustered ( $C_1$  and  $C_2$  respectively) using  $L_{\text{scaling}} \cup L_{\text{skin}}$ .

$F = \{(S, T) | (x) \in \text{dom } L_{\text{scaling}} \cup L_{\text{skin}}\}$  is set of all features.

Centroid is given by,

$$O_i = \frac{\sum_{C_i} W(L, C_i) F}{\sum_{C_i} W(L, C_i)}$$

Where  $O_i$  is centroid,  $C_i$  is class,  $W$  is weight function,  $L$  is location and  $F$  is feature space. The k-means algorithm is used for this purpose. It partitions the feature into those that are closer to scaling and those that are closer to normal skin. The MRF objective function is given as,



$$\omega = \operatorname{argmax} P(A|\omega)P(\omega)$$

Where  $P(A|\omega)$  is likelihood term of MRF obtained from SVM,  $A$  is set of features for all images that are not erythema,  $\omega$  is segmentation of scaling part from skin part through set of image features.

### 4.3 Detection Of Vague Scaling

The main aim here is to detect vague scaling. The ground truth is further analyzed to get the new ground truth where the vague scale is detected. This is done by locating the exact region where the affected area is either beginning to heal or about to spread. It can be done by analyzing the skin color say, if it is dark color, then it is starting to heal. But if it is red, then it is about to spread. This enables us to identify the complete affected area in the skin. It also enables us to classify in detail. An edge mapped luminance algorithm is used.

### 4.4 Growth Rate Estimation and Classification

Classification is done based on the level of severity and based on the type of psoriasis. The growth rate is estimated. A bisected factor based clustering algorithm is used. The growth rate estimation is done with the detected vague scale image and the new ground truth. Also a grade based classification is done to know the exact level of severity. This method is extremely helpful for the assessment of affected patients.

## 5. EXPERIMENTAL RESULTS AND SCREENSHOTS

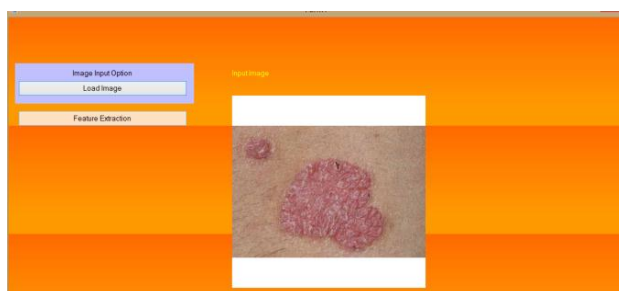


Fig A.1 Image Selected Screen

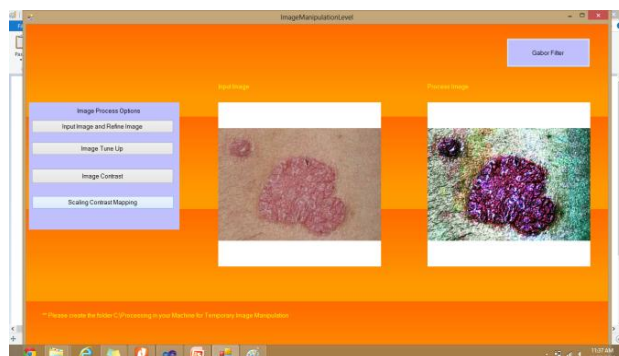


Fig A.2 Scaling Contrast Mapped Image

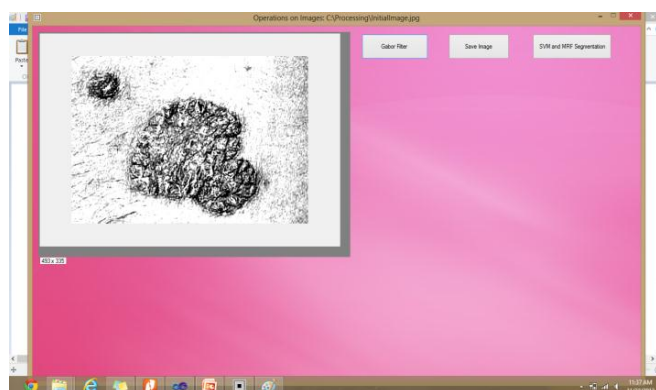


Fig A.3 Gabor Filtered Image

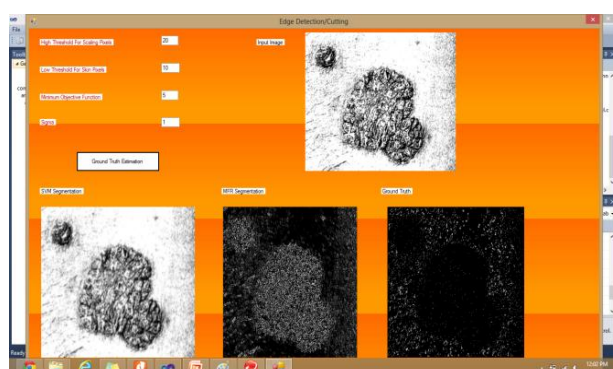


Fig A.4 Ground Truth



## 5. CONCLUSION AND FUTURE WORK

Further methods can be introduced to refine the classification method. Incorporating ubiquitous computing for the entire process can escalate the availability and its usage.

## 6. REFERENCES

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