Automatic Image Segmentation Using Feature Merging

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Abstract: **In many computer vision applications image segmentation is fundamental task. While performing any enhancement technique, it must be performed on whole image. Before enhancement the objects must be identified by photo applications to cover the entire image. A new unsupervised color image segmentation algorithm is used which gives the information in LCH – luminous, color, hue value is obtained by detecting edges in color images. To obtain group of non-overlapping segmentation of the image with segment tagged, image is to be broken into equal segments and find perceptual objects. Thus to output a non-overlapping segmentation of the image with segment tagged as a perceptual object, multi resolution merging is used which gives feature and information of color along with a region grown map.**

Keywords:- Color Gradient, Entropy, Foliage Detection, Image Segmentation,Skin Detection, Sky Detection.

I. INTRODUCTION

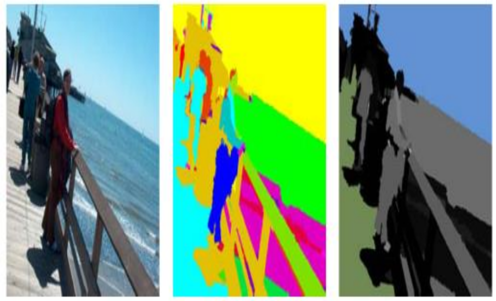
To design Automatic Image Segmentation, an Image is divided into objects then enhancement is performed on particular object. Automatic detection of image content is important for many algorithms, such as image enhancement, image classification and image retrieval algorithms. Comprehensive approach for the object and segment detection in the image is proposed. Detection is done by identifying the main characteristics – color, gradient. Also distribution of those characteristics in a data set of image segments corresponding to the object of interest. Two significant stages are done off-line, and are the core of our object detection algorithms. The tagging approach combines the knowledge gained in the off-line stage, with a segmentation of the image. Its start by locating a region or segment for which have high confidence that this region indeed describes the object of interest. This significant segment is used to learn the way in which the object's characteristics are expressed in the specific image. Approximate this information by a Gaussian probability model. Then apply this model to the entire image to find other segments containing the object of interest. Some color based algorithms clusters pixels only by considering color similarities, irrespective of their spatial location and correlation of pixels. Existing algorithms for skin, sky and foliage detection are based on color model and global threshold. M Jones and James M. Rehg[6], used histogram based color model for skin detection. Author used large dataset, which improves performance of detector. This algorithm totally depends upon color characteristics of image.

II. RELATED WORK

The work we present is related to many different image analysis problems. Our work is most related to specific object detection algorithms. We have briefly described some work on segmentation and object detection.

III. EXISTING METHODOLOGY

Photo applications that exist today, contains mature algorithms for image denoising, image sharpening, contrast enhancement, color correction[7] etc which depends on local features. Some applications depend on some level of content understanding. For e.g. Red eye removal. Algorithms that are listed here treat specific objects in the image, so that each object appears most pleasing, for example, blue sky, greener grass, sharper foliage, skin with a healthy glow. In our algorithm, a segmented image is tagged to identify specific object categories. To identify any object and tagging those objects require segmented image. Here present are some segmentation techniques and object detection approaches for detecting sky, skin and foliage. Tagging algorithms such as Sky tagging, Skin tagging & Face tagging are used in existing system. Sky tagging algorithms is used with an image of main characteristic consisting of blue sky. Sky detection uses a color model that describes a range of blue and gray colors with high luminance, and evaluates additional characteristics we expect in sky regions, such as size, smoothness, gradients and overall luminance, to ascertain a final probability that the region depicts sky. These algorithms compute the response of each pixel to a color model, and a global threshold is used to separate the object from the background. Skin detection algorithms are used consisting main characteristics as detection of face. The appearance of skin in many color spaces have been studied including RGB, normalized RGB, HSV, YCbCr and LCH. In addition, a variety of color models have been investigated, including metric methods, such as a single Gaussian model and a Gaussian mixture density model , as well as non-parametric color histograms. Foliage detection algorithm is used on an image. This algorithm computes likelihood maps using three color models as a general foliage model, a forest (or shaded foliage) color model, and a ground color model. The algorithm accepts segments that have very high likelihood foliage color which means the likelihood is higher than a definite foliage threshold.



(a) Original image (b) Segmented image (c) Tagged segments

Fig 1. Example of tagging

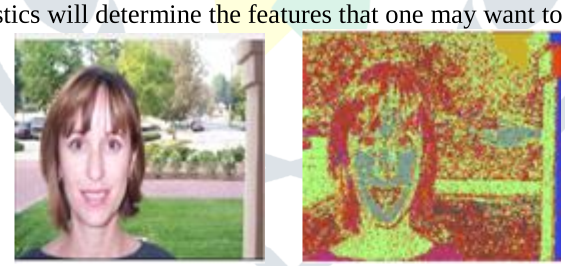
In above fig 1 sky regions are found using an open space method. After applying segmentation on original image as shown in fig (a) segmented image is obtained as shown in fig (b). In segmentation process an image is dividing into non-overlapping regions. The primary objective of any segmentation algorithm is to break an image into small number of contiguous regions of similar which is nothing but segments. Once the image is segmented further analysis of regions determines the features required to tag within an image. The Tagged segments are as shown in fig (c).

IV.PROPOSED SYSTEM

System is designed which will segment input image and tagging algorithms will tag sky, skin and foliage region in image and remaining objects will be tagged as unknown. Tagged image can be used to identify specific object and enhancement will be done on the same object. The proposed algorithm consists of two stages. First, the image is segmented based on location, color and texture characteristics. Next, we tag segments using object detection techniques.

A. Stage 1 - Segmentation

The segmentation algorithm [3], [6], [10] uses a region growing approach based on color and texture features.This region growing approach may combine segments that are not adjacent; see, for example, the mountains in Figure 1(a). This ability means the extracted features will be robust against occlusion; a common problem in natural images.Once the image has been segmented, further analysis of those regions using object specific heuristics will determine the features that one may want to tag within an image.



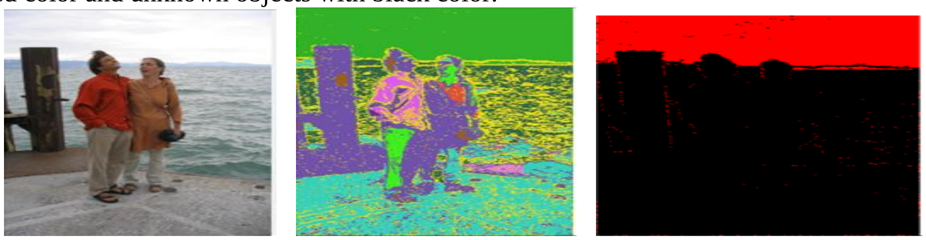
(a) original image(b) segmented image

Fig 2.Segmentation

B. Stage 2 - Object Tagging

In object tagging if a segment is tagged as sky or snow, it will not be checked for skin tagging. Similarly, segments are tested for foliage only if they have not been tagged for either sky or skin. The focus of the presented object tagging work is on the detection of skin, sky and foliage.

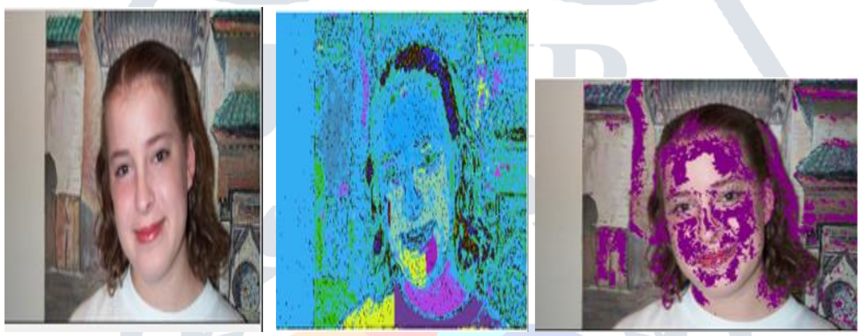
1) Sky tagging: The sky detection algorithm we propose is based on the following intuition and common knowledge we have about sky. Sky detection aims to find all the pixels in an image which satisfies characteristics of sky. Sky in an image should cover a large region at the top of the image. Its color should be blue, or gray and it should have other sky characteristics, e.g., low texture and high luminance. Our algorithm looks for such regions. In addition, after finding a very likely sky region, it extracts a color model for the sky in this image, and applies this color model to other pixels in the image that might be sky as well. In fig2.Original image which is an input image is segmented and tagged.fig 2(a) shows original image, fig 2(b) shows segmented image, fig 2(c) shows tagged image which shows sky with red color and unknown objects with black color.



(a)Original image (b) Segmented image (c) Tagged sky

Fig 3. Sky tagging

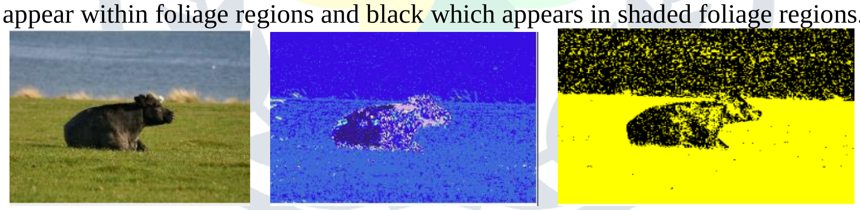
2) Skin tagging: Facial skin detection combines face detection, segmentation, and a global skin color model. Each of these modes of image analysis provides a different perspective and the combination enables the algorithm to accurately locate skin in the image. The algorithm tags face segments and compute a body skin map. To do so it examines each face in order. For each face it refines the skin color model repeatedly.



(a) Original image (b) segmented image (c) tagged skin

Fig 4.Skin tagging

3) Foliage tagging: Color range for foliage detection is broader than sky and skin color. For e.g. bright green of grass, dark green of trees browns which tend to appear within foliage regions and black which appears in shaded foliage regions.



(a) Original image (b) Segmented image (c) Tagged Foliage

Fig 5.Foliage tagging

C.Merging

Initially the segmentation of the input image has been performed with the absence of information about the individual regions. Now the image has been segmented into different groups, information can be gathered from each individual region. Regions that have been separated due to occlusion, or small texture differences, are merged together.

D.Enhancement

Image enhancement enhances each region in each image by exactly the 'right' amount based on the attributes and content of that specific region.

E.Analysis

The algorithm has been tested on a large database of 200 images. Original input image is tested with its ground truth image to show the actual pixel count match i.e. it displays the no. of pixels matched with the original image. The quality of results show that our algorithm is robust to various image scenarios and is superior to the results obtained on the same image when segmented by other methods.

F. System Architecture

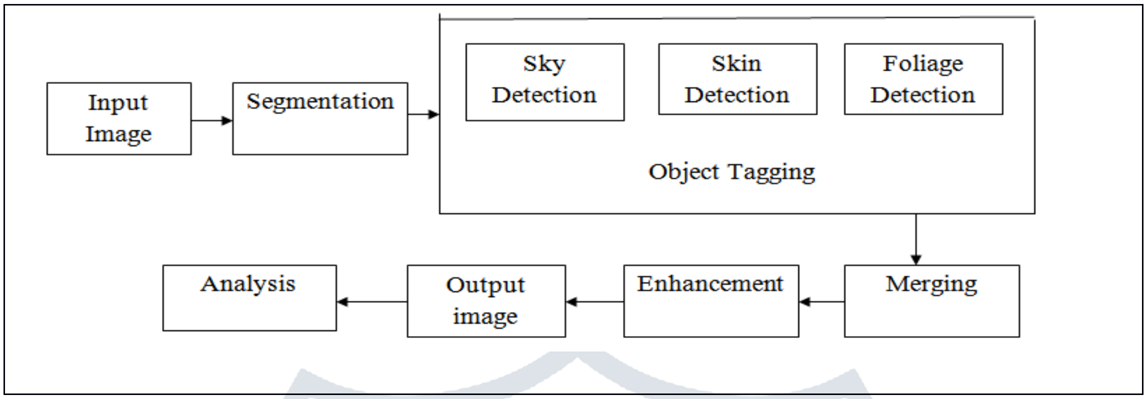


Fig 6. System Architecture

Initially user has to register itself to perform the image enhancement. After registering user has to login with the username and password and perform required operations. After registration an input image will be taken for performing the operation. The input image is then segmented according to the user's requirements, later on with reference to sky, skin and foliage the input image is segmented into parts separately. For this segmentation algorithm such as sky, skin and foliage detection are performed on each segmented object. Then each image is enhanced separately and is merged together into a particular dataset. The Segmented image is tagged to identify specific object categories. Finally analysis is done which shows that the algorithms is robust to various image scenarios and is superior to the results obtained on the same image when segmented by other methods.

V. RESULTS

Figures throughout the paper demonstrate tagged segmentation results where the colored tagged segments indicate skin, sky and foliage, and gray-level segments indicate unknown objects. Figure 2(a,b,c) demonstrate detection of blue sky, gray sky and snow. Skin detection for images is demonstrated in Figure 3(a), Figure 3(b) and 3(c). Foliage detection examples are shown in Figures 4(a), Figure 4(b) and Figure 4(c). Pixel counts are a better measure for the performance of sky and foliage detector, for which it is important segments to detect large segments, and less critical to detect small segments. For skin, all segments are important, so the segment count is the better measure. One distinction of our results is the dataset on which we evaluate
the algorithms. These datasets do not contain sky images and non-sky images, or skin and non-skin images. Rather the dataset is representative of what users might have in their Archives, or of photos that would be printed in an album. All the algorithms have been evaluated on the same set of images, and on all segments of the images. These images are sometimes challenging for people to tag. Nevertheless, the tagging algorithms have satisfactory results. They compare results of our algorithm on this dataset is rather better than on our own test dataset, which is probably due to the fact that our dataset represents more general and realistic photo scenes.

VI. CONCLUSION

This work presents efficient method designed to detect object accurately by identifying multi-features of an image- location, color, texture objects are easily enhanced using segmentation followed by region merging. By detecting a small set of perceptual objects: skin, sky, and foliage, combination of image segmentation is done and feature extraction mostly correlates with human perception of the content of the image. The skin detection algorithm is very reliable, and its primarily limitation stems from the performance of face detection. The main advantage of the foliage detection algorithm is that it detects both grasses and shady forests.Algorithms used are more robust for image segmentation and region merging.

VII.FUTURE SCOPE

We plan to develop detection algorithms for additional objects including hair, water and sand, for which we have some insight already. the segmentation and object detection algorithms should be more tightly coupled, and intend to pursue this approach over the long term.

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REFERENCES

[1]. D. Greig. Hp labs multi-view face detection. In *Proceedings of hPICS'06*, 2006.

[2]. Guru P. Balasubramanian, Eli Saber, Vladimir Misic, Eric Peskin, and Mark Shaw. Unsupervised color image segmentation using a dynamic colsor gradient thresholding algorithm. In Bernice E. Rogowitz and Thrasyvoulos N. Pappas, editors, *Proceedings of SPIE/IS&T: Electronic Imaging Symposium*, volume 6806, January 2008.

[3]. H. Nachlieli, R. Bergman, D. Greig, C. Staelin, B. Oicherman, D. Shaked, and G. Ruckenstein, "Skin-sensitive automatic color correction" HP Laboratories, Tech. Rep. HPL-2009-13, 2009.

[4]. J.-C. Terrillon, H. O. Fukamachi, S. Akamatsu, and M. N. Shirazi, Comparative performance of different skin chrominance models and hrominance spaces for the automatic detection of human faces in color images, in Proc. 4th IEEE Int. Conf. Autom. Face Gesture Recognit., Washington, DC, 2000, p. 54

[5]. J. Quyang. An image classification algorithm for automatic enhancement of both global contrast and local contrast in hp's real life technologies, 2007.

[6] L Garcia, E. Saber, V.Amuso, M.Shaw, and R.Bhaskar,"Automatic Image Segmentation By Dynamic Region Growth and Multiresolution Merging" in Proc. IEEE Int. Conf. Acoust, Speech Signal Process,pp.961-964,Mar 2008.

[7]. Patil M.J.," Review on Perceptual Object Tagging Techniques" IJCA Proceedings on International conference on Emerging Trends in Computer Science and Information Technology,2012.

[8]. P. Y. Boykov and G. Funka-Lea, Graph cuts and effient n-d image segmentation, Int. J. Comput. Vis., vol. 70, no. 2, pp. 109131, 2006.

[9]. R.Bergman, H.Nachlieli,"Perceptual Segmentation: Combining Image Segmentation With Object Tagging" IEEE Trans. On Image Processing, Vol. 20, No.6, June 2011.

[10]. S. R. Vantaram, E. Saber, V. Amuso, M. Shaw, and R. Bhaskar. "Unsupervised Image Segmentation by Automatic Gradient Thresholding For Dynamic Region Growth in the Cie L*A*B* Color Space. In Bernice E. Rogowitz and Thrasyvoulos N. Pappas, editors, *Proceedings Of SPIE/IS&T: Electronic Imaging Symposium*, volume 6806, January 2009.

[11]. T. Sawangsri, V. Patanavijit, and S. Jitapunkul,"Face segmentation based on hue-crcomponents and morphological technique" in Proc. IEEE Int. Symp. Circuits Syst., May 2005, vol. 6, pp. 54015404.

Algorithms

Sky Detection

1. Initial sky tagging
For each segment Compute probability of sky region based on region characteristics
   a. Color may be blue sky or gray sky or snow.
   b. Location, size, Texture of segment, luminance and
   c.color
gradient's Correlation

2. Find probable segments for sky
Tag each as blue sky or gray sky or snow according to the sky color characteristic
3. Determine color of sky
If
there is a blue probable sky region,
then
set the sky color to blue
Otherwise if
there is a gray probable sky region,
then
set the sky color to gray
4. Reassign probabilities based on luminance values
5. Tagging from per-image map of sky
Compute a color model from the most probable region for sky Apply this color model to the rest of segments of the image For each segment tagged as unknown in previous step: If the mean probability of sky region according to this color model is greater than threshold.

Skin detection

1. Detect faces
2. Tag face skin segments and compute body map
Initialize the body skin map to be 0 everywhere
For each face
Compute Skin probability in face rectangle using the global skin color model
Label skin pixels - the 1=4 most probable skin pixels in a central area of the face rectangle
Label non-skin pixels - the 1=4 least probable skin pixels of the face rectangle
Compute features weights for LCH features based on information gain
Estimate a color model from the skin pixels and weights
Apply the color model to the face rectangle to get a face skin map
For each segment that matches the face skin map, tag it as face
Estimate a color model from the face pixels and weights
Apply the color model to the image
Set the body skin map at each pixel to the maximum of the current body skin map and the map just computed
3. Tag body skin segments
For each segment that matches the face skin map, tag it as skin

Foliage Detection

1.Compute likelihood maps for color, texture and local gradient direction

2.Compute segments representative statistics and natural statistics

3. Reject likely ground segment

4. Accept likely grass segment

5. Accept likely foliage segment

6. Accept likely forest segment