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Efficient Clothing Pattern Recognition for Blind People Using SVM Classifier

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Abstract: ***Choosing cloths with complex patterns and colors is a challenging task for visually impaired people. For that we aimed at a practical system magic closet, for automatic occasion oriented clothing recommendation. Given a user input occasion, e.g., wedding, shopping or dating, magic store room brilliantly proposes the most suitable clothing from the user's own apparel photograph collection. Automatic clothing pattern recognition is also a challenging exploration issue due to rotation, scaling, illumination, and particularly vast intraclass pattern variations. Here we developed a camera based prototype system that perceives dress patterns in four classifications (plaid, striped, irregular and patternless) and identifies 11 attire colors. The system integrates a camera, a microphone, a computer, and a Bluetooth earpiece for sound depiction of clothing patterns and colors. A cam mounted upon a pair of sunglasses is used to catch dress pictures. The clothing patterns and colors are described to visually impaired people verbally. This system can be controlled by speech input through microphone. To perceive apparel patterns, proposed a novelRadon signature descriptor and a schema to separate measurable properties from wavelet subbands to capture global features of clothing patterns. More specifically the clothing attributes are dealt with as idle in our proposed inert support vector machine (SVM) based recommendation model. The wearing appropriately measure is described in the model through a highlight event potential and a quality event potential, while the wearing aesthetically foundation is communicated by a characteristic attribute potential. The prototype was additionally utilized by ten outwardly impatient members. Most thought such a system would support more autonomy in their day by day life but they likewise made proposals for upgrades.***

Keywords: magic closet, clothing design recognition, SIFT, texture analysis, Radon signature, DWT, Support vector machines

1. Introduction

Based on the statistics from World Health Organization (WHO) there are approximately 162 million visually impaired people around world and 38 millions of them are blind. Picking garments with suitable colors and designs is a testing errand for visually impaired or outwardly weakened individuals. They deal this undertaking with the assistance from relatives, utilizing plastic Braille marks then again distinctive sorts of sewing pattern tags on the garments, or by wearing garments with a uniform color or without any patterns. Naturally perceiving dress patterns and colors may move forward their life quality. Automatic camera-based apparel design acknowledgment is a testing assignment because of numerous dress patterns and shading outlines and comparing expansive intraclass varieties. Existing surface examination routines mostly center on surfaces with huge changes in viewpoint, orientation, and scaling, however with less intraclass pattern and intensity varieties. We have watched that conventional surface investigation strategies can't accomplish the same level of exactness in the setting of apparel pattern recognition. Here, we present a camera-based framework to help outwardly impeded individuals to perceive dress designs and colors. The framework contains three noteworthy segments: 1) sensors counting a camera for catching apparel pictures, a receiver for discourse charge data and speakers (or Bluetooth, headphone) for sound yield; 2) information catch and examination to perform summon control, dress example acknowledgment, and color ID by utilizing a PC which can be a desktop in a client's room or a wearable PC (e.g., a smaller than expected PC on the other hand a cell phone); and 3) sound yields to give acknowledgment consequences of apparel designs and designs, and in addition framework status. In an augmentation to our framework can deal with garments with complex patterns and perceive attire designs into four classifications (plaid, striped, patternless, and irregular) to meet the essential prerequisites in light of our review with ten visually impaired members. Our framework has the capacity distinguish 11 colors: red, orange, yellow, green, cyan, blue, purple, pink, black, gray, and white. For garments with different hues, the initial a few prevailing hues are addressed clients. So as to handle the expansive intraclass variations, we propose a novel descriptor, Radon Signature, to catch the worldwide directionality of clothing patterns. The mix of global and local picture features fundamentally beats the cutting edge surface investigation systems for dress example acknowledgment. We likewise demonstrate that our strategy accomplishes similar results to the best in class approaches on the traditional texture classification problems.

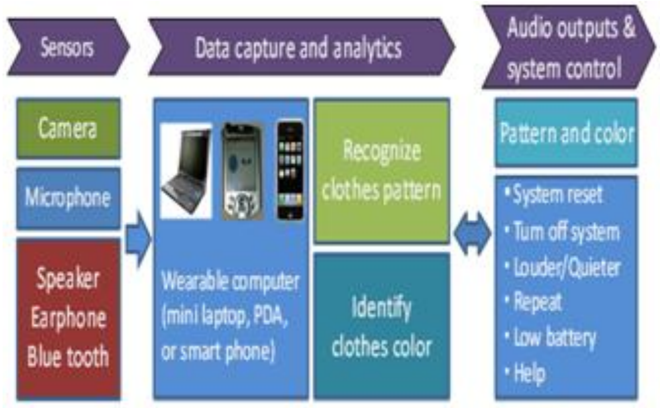

Figure 1: Overview and architecture design of camera based system

This paper is organized as follows. In section II, we summarize the computations of global and local features for clothing pattern recognition. The system interface and design is described in section III and in section IV presents our experimental results on a challenging clothing pattern dataset and a traditional texture dataset. Section V describes the preliminary evaluations by blind users. Section VI concludes the paper.

2. Feature Extraction for Clothing Pattern Recognition

Some clothing patterns present as visual designs described by the redundancy of a couple of essential primitives (e.g., plaids or stripes). As needs be, nearby elements are compelling to concentrate the auxiliary data of dreary primitives. On the other hand, because of vast intraclass fluctuation, neighborhood primitives of the same garments design classification can shift altogether. Global components including directionality and measurable properties of apparel patterns are more stable within the same class. In this way, they find themselves able to give integral data to local basic elements. Next, we exhibit extractions of global and local elements for garments design acknowledgment, i.e., Radon Signature, factual descriptor (STA), and scale invariant feature change (SIFT).

A. Radon Signature

Dress pictures display extensive intraclass varieties, which result in the real test for clothing pattern recognition. On the other hand, in a global point of view, the directionality of attire patterns is more predictable crosswise over distinctive classes and can be utilized as a vital property to recognize distinctive attire designs. As demonstrated in Figure, the clothing patterns of plaid furthermore, striped are both anisotropic. Conversely, the attire designs in the classifications of patternless and unpredictable are isotropic. To have utilization of this effect of directionality, we propose a novel descriptor, i.e., the Radon Signature, to portray the directionality highlight of attire examples. Radon Signature (RadonSig) is based on the Radon transform which is commonly used to detect the principle orientation of an image. The image is then rotated according to this dominant direction to achieve rotation invariance. The Radon transform of a 2-D function $f(x, y)$ is defined as

$$R(r,\theta)=\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f(x,y)\,\delta(r - x\cos\theta - y\sin\theta)\,dxdy$$

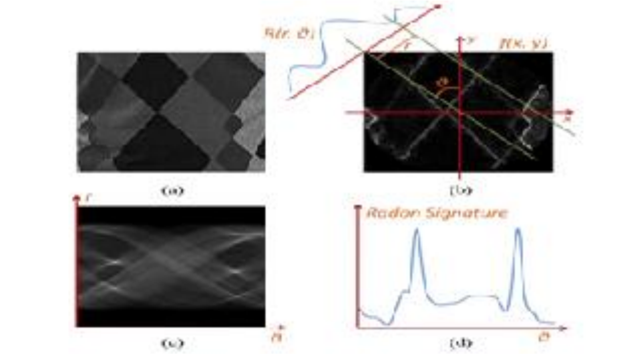

Figure 2: computation of Radon sig.(a)An intensity image of clothing pattern, (b)Radon transform performed on a maximum disk area within the gradient map of (a), (c)Result of radon transform, (d)feature vector of radon transform

Where r is the perpendicular distance of a projection line to the origin and θ is the angle of the projection line. To retain the consistency of Radon transform for different projection orientations, we compute the Radon transform based on the maximum disk area instead of the entire image. The large intraclass variations of clothing patterns also reflect as images in the same category present large changes of colour or intensity.

Figure 3: Clothing patterns samples and associated RadonSig descriptors

Fig. 3 illustrates RadonSig descriptors of four sample images from different clothing pattern categories. The plaid patterns have two principle orientations; the striped ones have one principle orientation; as for the patternless and the irregular images, they have no obvious dominant direction, but the directionality of the irregular image presents much larger variations than that of the patternless image. Accordingly, there are two dominant peak values corresponding to two principle orientations in the RadonSig of the plaid image. The RadonSig of the striped image has one peak value associated with the one principle orientation. There is no dominant peak value in the irregular and the patternless cases. But the RadonSig of the patternless image is much smoother than that of the irregular image.

B. Statistics of wavelet subband

The discrete wavelet transform (DWT) decomposes an image I into low-frequency channel Dj (I) under a coarser scale and multiple high-frequency channels under multiple scales Wk,j (I) ; $k = 1, 2, 3$; $j = 1, 2, . . . , J$, where J is the number of scaling levels. Therefore, in each scaling level j, we have four wavelet subbands including one low-frequency channel Dj (I) and three high-frequency channels Wk,j (I)..

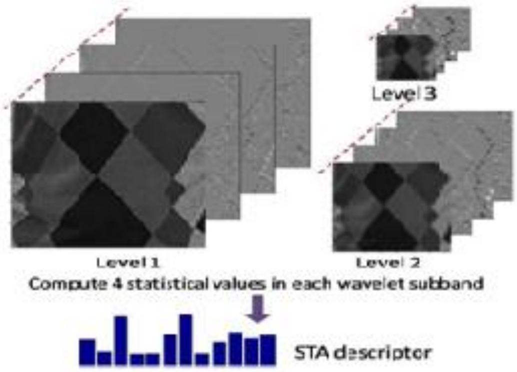

Figure 4: The computation of STA on wavelet subbands.

The high frequency channels Wk,j (I) ; $k = 1, 2, 3$ encode the discontinuities of an image along horizontal, vertical, and diagonal directions, respectively. In this paper, we apply J = 3 scaling levels of DWT to decompose each clothing image, as shown in Fig. 4. Statistical features are well adapted to analyze textures which lack background clutter and have uniform statistical properties. DWT provides a generalization of a multi resolution spectral analysis tool. Therefore, we extract the statistical features from wavelet subbands to capture global statistical information of images at different scales. It is customary to compute the single energy value on each subband.

C. Scale invariant feature transform

The local image features are well adapted to a number of applications, such as image retrieval, and recognition of object, texture, and scene categories, as they are robust to partial occlusion, cluttered background, and viewpoint variations. This has motivated the development of several local image feature detectors and descriptors. Generally, detectors are used to detect paper, the uniform grids are used as the interest points sampling strategy, as more sophisticated detectors tend to saturate and fail to provide enough interest points, especially for the texture less images. The evenly sampled interest points are then represented by SIFT descriptors.

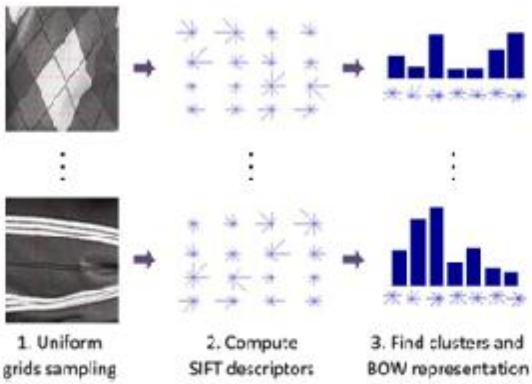

Figure 5: Process of local image feature extraction

We choose the SIFT descriptor as the representation of interest points based on the following reasons: 1) the descriptor with 128 dimensions is compact and fairly distinctive; 2) the representation with careful design is robust to variations in illumination and viewpoints; 3) an extensive comparison against other local image descriptors observed that the SIFT descriptor performed well in the context of image matching. The bag of- words (BOW) method is further applied to aggregate extracted SIFT descriptors by labelling each SIFT descriptor as a visual word and counting frequencies of each visual world.

3. System Design and Interface

The camera-based clothing recognition aid prototype for blind people integrates a camera, a microphone, a computer, and a Bluetooth earpiece for audio description of clothing patterns and colors. A camera mounted upon a pair of sunglasses is used to capture clothing images. The clothing patterns and colors are described to blind users by a verbal display with minimal distraction to hearing. The system can be controlled by speech input through a microphone. The high priority commands can be used at any time. A user can speak *help*, and the minimize background sounds. The battery level will also be checked and an audio warning is provided if the battery level is low.

High priority commands: A blind user can set the system configuration by several high priority speech commands such as *system restart*, *turn-off system*, *stop function* (i.e., abort current task), speaker volume and speed control (e.g., *louder*, *quieter*, *slower*, control.

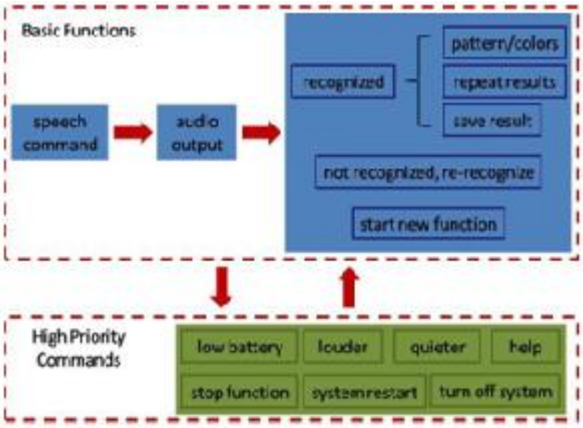

Figure 6: System interface with the camera mounted clothing pattern recognition system

Basic functions: A blind user can verbally request the function he/she wants the clothing recognition aid to perform. The recognition results will be presented to the blind user as audio outputs including *recognized*, *not recognized*, and *start a new function*. As for the *recognized* function, the next level functions include *pattern/colors* to announce the recognized clothing pattern and dominant colours; *repeat results* to repeat the recognized result; and *save result* to save the clothing image with associated pattern and colour information in the computer.
Audio output: As for audio display, we use an operating system speech facility that is standard in modern portable computer systems and smart phones. We currently use Microsoft Speech Software Development Kit which supports scripts. A number of configuration options are also available according to user preference, such as speech rate, volume, and voice gender.

4. Results

Modules of the Project

1. Input Image
2.Preprocess
3.Feature Extraction
4.Classification
5.Analysis

Input Image*:* Get a RGB picture as data methodology. It stores in any picture form. Material example is utilized as a part of the info picture or dim picture. Doing preprocess and sifting are the primary activity perform into the picture.

Preprocess: Change over the RGB picture in dim scale picture. At that point use Gaussian channel to uproot the commotions. In gadgets and sign handling, a Gaussian channel is a channel whose motivation reaction is a Gaussian capacity (or a rough guess to it). Gaussian channels have the properties of having no overshoot to a step capacity data while minimizing the ascent and fall time. Sifting includes convolution. The channel capacity is said to be the piece of a basic change. The Gaussian part is persistent. Most normally, the discrete identical is the inspected Gaussian piece that is created by inspecting focuses from the consistent Gaussian. Another system is to utilize the discrete Gaussian bit which has prevalent qualities for a few reasons.

Feature Extraction: Three sorts of calculation is utilized to concentrate the highlight RADON Feature, Discrete Wavelet Transformer (DWT), SIFT Feature.

We propose a methodology taking into account SIFT highlights for face acknowledgment. The SIFT highlights are separated from all the appearances in the database. At that point, given another face picture, the highlights extricated from that face are analyzed against the highlights from every face in the database. The face in the database with the biggest number of coordinating focuses is viewed as the closest face, and is utilized for the grouping of the new face. A highlight is viewed as coordinated with another highlight when the separation to that highlight is not as much as a particular division of the separation to the following closest highlight. This ensures that we diminish the quantity of false matches. This is on the grounds that if there should be an occurrence of a false match, there will be various other close highlights with close separations, because of the high dimensionality of the highlights. Then again, if there should arise an occurrence of a right match, it is unrealistic to discover another highlight that is excessively close because of the exceedingly unmistakable nature of SIFT highlights.

Discrete wavelet change, a numerical technique in numerical examination and useful examination, a discrete wavelet change (DWT) is any wavelet change for which the wavelets are discretely inspected. Also as with other wavelet changes, a key playing point it has more than Fourier progressions is common determination: it gets both repeat and territory information (area in time).

Classification: Utilizing the SVM classifier for grouping methodology

1) Data setup: our dataset contains three classes, every N tests. The information is 2D plot unique information for visual investigation
2) SVM with direct piece (-t 0). We need to locate the best parameter esteem C utilizing 2-fold cross approval (significance utilize 1/2 information to prepare, the other 1/2 to test).
3) After discovering the best parameter esteem for C, we prepare the whole information again utilizing this parameter esteem
4) Plot bolster vectors
5) Plot choice region

SVM maps data vectors to a higher dimensional vector space where an ideal hyper plane is developed. Among the numerous hyper planes accessible, there is stand out hyper plane that boosts the separation in the middle of itself and the closest information vectors of every classification. This hyper plane which amplifies the edge is known as the ideal dividing hyper plane and the edge is characterized as the whole of separations of the hyper plane to the nearest preparing vectors of every classification.

Analysis: Analysis methodology to locate the classifier precision. At that point discover the examination of Existing and proposed framework execution. We assess the execution of the proposed strategy on two separate datasets:

1) The CCNY Clothing Pattern dataset with substantial intra-class varieties to assess our proposed system and the cutting edge surface characterization systems, and
2) The UIUC Texture dataset to accept the speculation of the proposed methodology.

Our investigations concentrate on the assessment and approval of

1) The correlative connections between the proposed worldwide and nearby highlight channels;
2) The prevalence of our proposed strategy over the best in class surface arrangement approaches in the connection of garments example acknowledgment; and
3) The speculation of our methodology on the customary composition characterization.

5. Practicle Output Figures

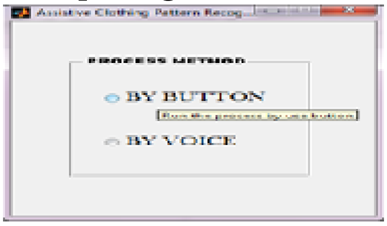

Figure 8: Select anyone processing method

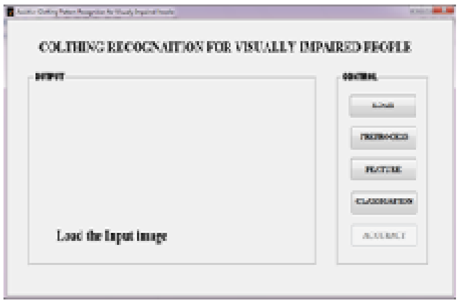

Figure 9: Load the input image to be processed

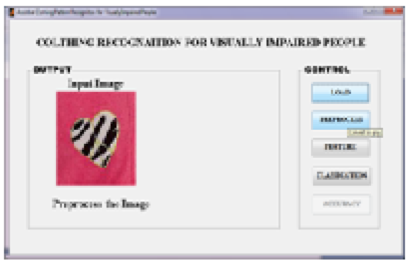

Figure 10:.Preprocess the input image

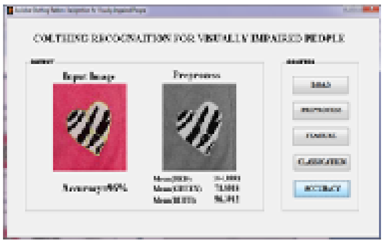

Figure 11: Accuracy of the projected method

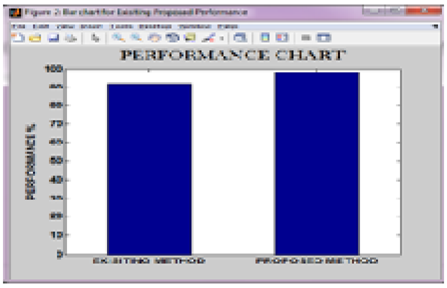

Figure 12: Performance chart between existing and proposed methods

6. Practical Evaluations

In this section, we evaluate the performance of the proposed method on two different datasets: 1) the CCNY Clothing Pattern dataset with large intra-class variations to evaluate our proposed method and the state-of-the-art texture classification methods, and 2) the UIUC Texture dataset to validate the generalization of the proposed approach.

Figure 13: Practical system interface with user or blind people

Our experiments focus on the evaluation and validation of 1) the complementary relationships between the proposed global and local feature channels; 2) the superiority of our proposed method over the state-of-the-art texture classification approaches in the context of clothing pattern recognition; and 3) the generalization of our approach on the traditional texture classification.

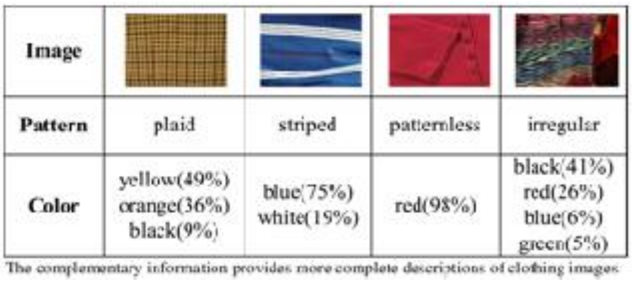

Figure 14: clothing patterns and dominant colors

The recognition results of different features as a function of training set size. For individual feature channels, SIFT and STA achieve comparable recognition accuracies. While the results based on a single channel of the RadonSig are worse than that of SIFT or STA, the performance of SIFT+RadonSig is better than that of SIFT+STA. Both of them outperform any individual feature channel.

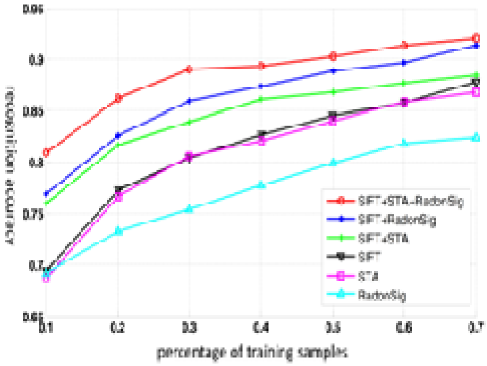

Figure 15: Recognition accuracies of different feature channels

Therefore, for clothing patterns recognition, the global and local feature combination of SIFT and RadonSig is more effective than that of SIFT and STA. Furthermore, the combination of all three feature channels further improves the recognition results and dominates in all of different training set sizes. To validate the effectiveness of the proposed features, we first evaluate the complementary relationships between different feature channels including global features of the RadonSig and statistics of wavelet subbands (STA), and local features (SIFT). SIFT represents the local structural features; STA is the global statistical characteristics; and RadonSig captures the property of global directionality.

Table 1: Comparison of accuracies for different feature channels

Feature channel	10%	30%	50%	70%
SIFT	69.42	80.45	84.50	87.78
STA	69.45	80.65	84.28	86.94
RadonSig	69.24	75.41	79.93	82.54
SIFT+STA	75.80	84.03	87.09	88.68
SIFT+RadonSig	76.94	85.91	88.89	91.34
SIFT+STA+RadonSig	81.06	88.09	90.59	95.98

The comparisons of different feature channels and their combinations validate our intuition that the effectiveness and complementarities of our proposed feature channels. The detailed recognition accuracies of Fig. 10 are listed in Table II. The percentages of training images per class are 10%, 30%, 50%, and 70%, respectively. As shown in Table II and Fig. 10, the recognition accuracy of SIFT+STA+RadonSig using 30% of the images as the training set is comparable or even better than that of other feature channels using 70% of the images as the training set. This observation demonstrates another merit of our proposed approach that it is able to achieve a desirable result by using much less training data.

7. Conclusion

Here, we have proposed a framework to perceive dress examples what's more, hues to help outwardly impeded individuals in their day by day life. We utilize RadonSig to catch the worldwide directionality highlights; STA to concentrate the worldwide measurable elements on wavelet subbands; and SIFT to speak to the neighborhood basic components. The blend of various component channels gives corresponding data to enhance acknowledgment precision. Based on an overview and a proof-of-idea assessment with visually impaired clients, we have gathered a dataset on attire design acknowledgment counting four-example classifications of plaid, striped, patternless, furthermore, sporadic. Test results exhibit that our proposed technique fundamentally beats the best in class techniques in dress example acknowledgment. Besides, the execution assessment on customary composition datasets accepts the speculation of our system to conventional composition examination and grouping assignments. This exploration improves the investigation of surface investigation, and prompts enhancements over existing strategies in taking care of complex dressing examples with vast intraclass varieties. The system additionally gives new capacities to enhance the life quality for visually impaired and outwardly hindered individuals.

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