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Assistive Cloth Pattern Recognition for Visually Impaired People

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A B S T R A C T

In this paper, we aim at a practical system, magic closet, for automatic occasion-orientedclothing recommendation. Given a user-input occasion, e.g., wedding, shopping or dating, magic closet intelligently suggests the most suitable clothing from the user's own clothing photo album, or automatically pairs the user-specified reference clothing (upper-body or lower-body)with the most suitable one from online shops. Choosing clothes with complex patterns and colors is a challenging task for visually impaired people. Automatic clothing pattern recognitionis also a challenging research problem due to rotation, scaling, illumination, and especially large intra class pattern variations. We have developed a camera-based prototype system that recognizes clothing patterns in four categories (plaid, striped, pattern less, and irregular) and identifies 11 clothing colors. The system 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 verbally. This system can be controlled by speech input through microphone. To recognize clothing patterns, we propose a novel Radon Signature descriptor and schemata extract statistical properties from wavelet sub bands to capture global features of clothing patterns. More specifically, the clothing attributes are treated as latent variables in ourproposed latent Support Vector Machine (SVM) based recommendation model. The wearing properly criterion is described in the model through a feature-occasion potential and an attribute-occasion potential, while the wearing aesthetically criterion is expressed by an attribute-attribute potential. The prototype was also used by ten visually impaired participants. Most thought such a system would support more independence in their daily life but they also made suggestions for improvements.

Keywords: Clothing pattern recognition, assistive system, texture analysis, global and local image features, visually impaired people

Introduction

Image processing is any form of signal processing for which the input is an image, such as a photograph or video frame. The output of image processing may be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniquesto it. Image processing usually refers to digital image processing, but optical and analog image processing also are possible. Image processing is closely related to computer graphics and computer vision. Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually, Image Processingsystem includes treating images as two-dimensional signals while applying already set signal processing methods to them.

As aforementioned, we aim at an occasion-oriented clothing recommendation system, magic closet. It takes photos of user's own clothing and a specified occasion as the inputs and automatically suggests the most suitable clothing for the occasion from the provided photos or retrieves the clothing from online shops which pair with a reference clothing well. In particular, magic closet is based on a latent SVM model, which is learned from the visual features of the givenclothing photos with full annotations on occasions and attributes. The model describes the matching rules among visual features, clothing attributes (treated as latent variables) and occasions. Based on this model, we can obtain occasion-oriented rank of the clothing photos and aesthetic scores of the candidate clothing pairs. In this way, magic closet provides suitable clothingrecommendations. In this section, we first formally describe the clothing recommendation model constructed based on latent SVM. Then we introduce the model learning and inference process for clothing recommendation. We use the same latent SVM as the work, but here we would like to emphasize that each potential function in the adopted latent SVM is defined specifically for the clothing recommendation task.

Literature survery

The aim at a practical system, magic closet, for automatic occasion-oriented clothing recommendation. Given a user-input occasion, e.g., wedding, shopping or dating, magic closet intelligently suggests the most suitable clothing from the user's own clothing photo album, orautomatically pairs the user-specified reference clothing (upper body or lower- body) with the most suitable one from online shops .Two key criteria are explicitly considered for the magic closet system. One criterion is to wear properly, e.g., compared to suit pants, it is more decent to wear a cocktail dress for a banquet occasion. The other criterion is to wear aesthetically, e.g., a red T-shirt matches better white pantsthan green pants. To narrow the semantic gap between the low-level features of clothing and the high-level occasion categories, we adopt middle-level clothing attributes (e.g., clothing category, color, pattern) as a bridge. More specifically, the clothing attributes are treated as latent variables in our proposed latent Support Vector Machine (SVM) based recommendation model.Studies on clothing are receiving increasing interest these days mainly due to the huge market related with clothing. In China, the potential market is expected to break 20 billion US dollars1. Such huge market prospect greatly motivates clothing relevant research. However, related researchliterature is still quite limited and most of them only focus on clothing segmentation andrecognition. We developed a practical occasion-oriented clothing recommendation and pairing system, named magic closet. Given a user specified occasion, the magic closet system is able to automatically recommend the most suitable clothing by considering the wearing properly and wearing aesthetically principles. We adopted a latent SVM based recommendation model to incorporate the matching rules among visual feature, attribute and occasion within a unified framework. To learn and evaluate the model, we collected large clothing dataset with full attribute and occasion annotations. This paper presents a method for extracting distinctive invariant features from imagesthat can be used to perform reliable matching between different views of an object or scene. The features are invariant to image scale and rotation, and are shown to provide robust matching across aa substantial range of affine distortion, change in 3D viewpoint, addition of noise, and change inillumination. The features are highly distinctive, in the sense that a single feature can be correctlymatched with high probability against a large database of features from many images. This paper also describes an approach to using these features for object recognition. The recognition proceeds bymatching individual features to a database of features from known objects using a fast nearest-neighbor algorithm, followed bya Hough transform to identify clusters belonging to a single object, and finally performing verification through least-squares solution for consistent poseparameters.

Methadology

Scale Invariant Feature Transform (SIFT) features are features extracted from images to help in reliable matching between different views of the same object. The extracted features are invariant to scale and orientation, and are highly distinctive of the image. They are extracted in four steps. The first step computes the locations of potential interest points in the image by detecting the maxima and minima of a set of Difference of Gaussian (DoG) filters appliedat different scales all over the image. Then, these location share refined by discarding points of low contrast. An orientation is then assigned to each key point based on local image features. Finally, a local feature descriptor is computed at each key point. This descriptor is based on the local image gradient, transformed according to the orientation of the key point to provideorientation invariance. Every feature is a vector of dimension 128 distinctively identifying the neighborhood around the key point.The discrete wavelet transform (DWT) is a linear transformation that operates on a data vector whose length is an integer power of two, transforming it into a numerically different vector of thesame length. It is a tool that separates data into different frequency components, and then studies each component with resolution matched to its scale. DWT is computed with a cascade of filtering's followed by a factor 2 subsampling the main feature of DWT is multiscale representation of function. By using the wavelets, given function can be analyzed at various levels of resolution. The DWT is also invertible and can be orthogonal. Wavelets seem to be effective for analysis of textures recorded with different resolution. It is very important problem in NMR imaging, because high-resolution images require long time of acquisition. This causes an increaseof artifacts caused by patient movements, which should be avoided. There is an expectation that the proposed approach will provide a tool for fast, low resolution NMR medical diagnostic. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of thegap they fall on.

SYSTEM DESIGNS

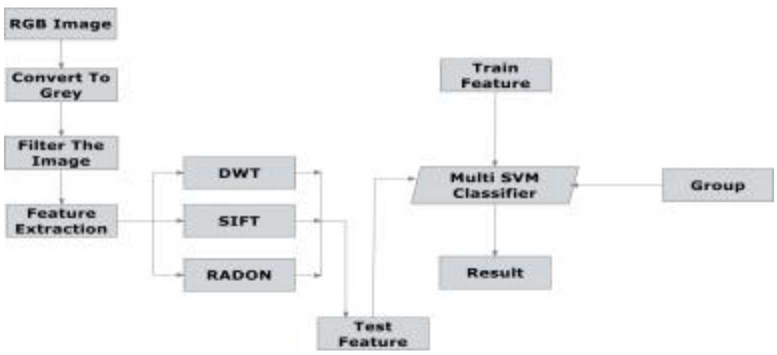

Figure 1: System Architecture

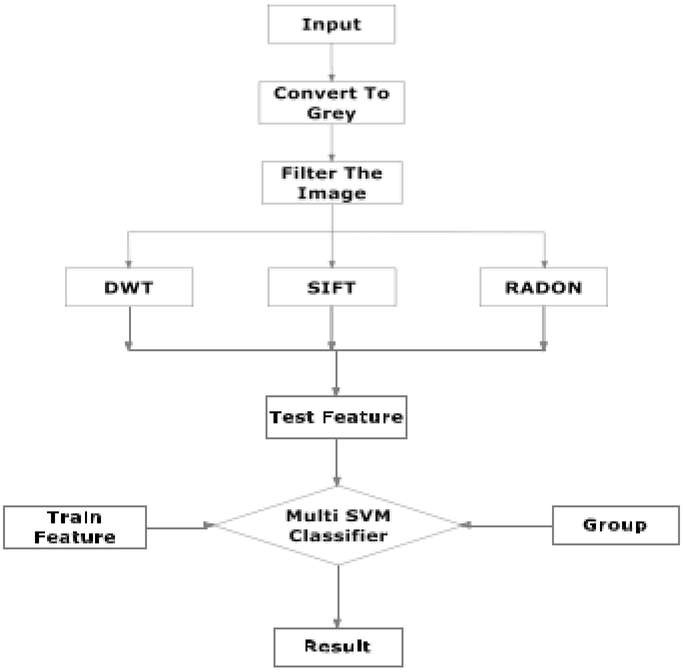

Figure 2: Flow diagram

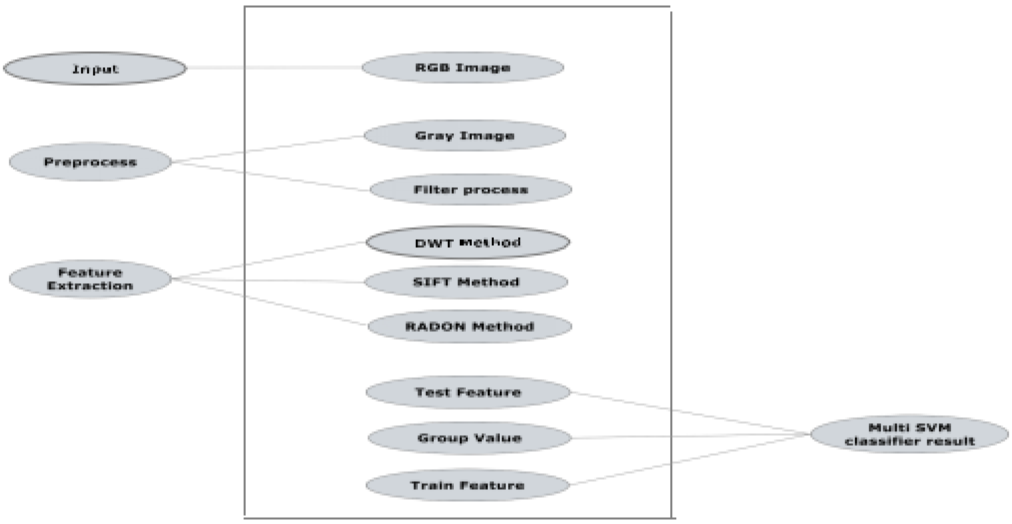

Figure 3: UML Diagram

System Testing

The purpose of testing is to discover errors. Testing is the process of trying to discoverevery conceivable fault or weakness in a work product. It provides a way to check the functionalityof components, sub-assemblies, assemblies and/or a finished product. It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each testtype addresses a specific testing requirement.

Illustrations

MODULES

- Image Input
- *Preprocess*
- Feature Extraction
- *Classification*

Image				
Pattern	plaid	striped	patternless	irregular
Color	yellow(49%) orange(36%) black(9%)	blue(75%) white(19%)	red(98%)	black(41%) red(26%) blue(6%) green(5%)

Figure 4: Cloth Patterns and Color Percentag

Analysis process to find the classifier accuracy. Then find the comparison of Existing andproposed system performance. 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. Our experiments focus on the evaluation and validation of 1) the complementary relationships between the proposedglobal 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.

Equations

The Radon Signature is formed by the variances of r under all sampling projection directions:

$$[Var(r,\theta_0), Var(r,\theta_1), \dots, Var(r,\theta_{T-1})]$$

Acknowledgements

We adopted a latent SVM based Recommendation model to incorporate the matching rules among visual feature, attribute and occasion within a unified framework. To learn and evaluate the model, we collected a large clothing dataset with full attribute and occasion annotations. Extensive experiments were conducted on the collected dataset for the occasion- oriented clothing recommendation and clothing pairing tasks, and showed the effectiveness of the proposed model in capturing the underlying rules and recommending suitable clothing. Here, we have proposed a system to recognize clothing patterns and colors to help visually impaired people in their daily life. We employ Radon Sig to capture the global directionality features; STA to extract the global statistical features on wavelet sub bands; and SIFT to represent the local structural features. The combination of multiple feature channels provides complementary information to improve recognition accuracy. Based on a survey and a proof-of-concept evaluation with blind users, we have collected a dataset on clothing pattern recognition including four-patterncategories of plaid, striped, pattern less, and irregular. Experimental results demonstrate that our proposed method significantly outperforms the state-of-the-art methods in clothing pattern recognition. Furthermore, the performance evaluation on traditional texture datasets validates the generalization of our method to traditional texture analysis and classification tasks. Note that the performance of the proposed model heavily depends on the human detection accuracy. Limited by the current performance of human detector in handling pose variance, some clothing in the user's clothing photo album may be misdetected. This issue can be further alleviated along with the development of state-of-the-art detection methods. In this work, we mainly focus on mining general rules and therefore we collect clothing from various. This research enriches the study of texture analysis, and leads to improvements over existing methods in handling complex clothing patterns with large intra class variations. The method also provides new functions to improve the life quality for blind and visually impaired people.

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