www.ijecs.in
International Journal Of Engineering And Computer Science ISSN: 2319-7242
Volume 5 Issue 4 April 2016, Page No. 16317-16324

Clothing Color and Pattern Recognition for Impaired people

Mrs. Anuradha.S.G, Thogaricheti Ashwini

Assistant Professor for M.Tech
Dept. Of CSE, RYMEC, Bellary
Affiliated to VTU University, Belgaum
anuradha_gadagin@rediffmail.com
M.Tech 2nd year,
Dept. Of CSE, RYMEC, Bellary
Affiliated to VTU University, Belgaum
ashwinit.rymec@gmail.com

ABSTRACT: - In the study of Human-computer-interaction (HCI) the design and use of technology using digitalized computer systems mainly focusing on the particular interfaces between people and computers. There is an ongoing research that taking place till today using Human-computer-interactions especially on visually impaired people. This system mainly introduces the thematic study on "Blind and visually impaired people Human computer and access to Graphics" represents a current research study towards solution for impaired people and brings together a new researchers and practitioners. Here, we are approaching one of the methods which can be useful for the visually impaired people in the form of recognising the clothing patterns. Choosing clothing pattern is one of the challenging tasks for visually impaired people. We matured a camera-based model to notice the clothing patterns. The clothing patterns are categories as five types like (plaid, striped, pattern less, horizontal-vertical, irregular etc) and it identifies 11 clothing colors. The system mainly integrates with the microphone, camera, Bluetooth, earpiece for audio signal. The output of our system is given by audio signal. To recognize clothing patterns, we propose a Hough line Transformation for the detection of pattern and canny detection for detection of edges in the clothing pattern. we proposed the CCNY Clothing Pattern dataset and other different pattern datasets to our method. Using various other performances our method is under the study. In this project we are using OpenCV library for capture the images. Thought such a system would support more independence in blind person's daily life.

Keywords: - Human computer interaction, cloth patterns, visually impaired people, color

1. INTRODUCTION

Human computer interaction they observe the ways in which humans interact with computers and design technologies that let humans with computers in novel ways. As a field of research, Human Computer Interaction is situated at the intersection of computer science, behavioural sciences, design, media studies, and several other fields of study[1]. Humans interact with computers in many ways; and the interface between humans and the computers they use is crucial to facilitating this interaction. Desktop applications, internet browsers, handheld computers, and computer kiosks make use of the prevalent graphical user interfaces (GUI) of today. Most impaired people don't have access to extra special teaching aids they need to learn. Based on data from the World Health Organization (WHO)[1][2][4], there are more than 37 million people across the globe who are blind, over 15 million are in India .Our system mainly says about how the human computer interaction can be done with the help of sensor and like other devices helps the visually impaired people. Our system focus on these kind of fields where such as pattern recognition in the form of clothes how a impaired person can come to know about the pattern and color of that clothes. Our system can handle clothes with complex designs and notice clothing patterns into four categories (plaid, striped, pattern less, horizontal, vertical and irregular etc.). Our system is able to identify 11 colors[5][1][6][4][13]: red, orange, yellow, green, cyan, blue, purple, pink, black, grey, and white. For the large intra class variations. etc.

Although many methods have been developed for texture matching and colour detection in the computer vision and image processing research, currently there is no device that can effectively supply matching choices for blind people. In this paper, we develop a computer vision-based prototype to match a pair of images of clothes for both pattern and colour. The image pair is captured by a camera which is connected to a computer. To configure and control the system, users can simply speak out the commands to switch on/off the system, execute corresponding functions, and adjust the volume of audio outputs. Our algorithm can detect: 1) Colours of the clothes; 2) whether the clothes have pattern or have homogeneous colour3) whether the colours match for a pair of images.

We introduce a camera-based [1][2][24][26]system to help visually impaired people to recognize clothing patterns and

DOI: 10.18535/Ijecs/v5i4.51

colors. The system contains three major components : 1) sensors including a camera for capturing clothing images, a microphone for speech command input and speakers (or Bluetooth, earphone) for audio output; 2) data capture and analysis to perform command control, clothing pattern recognition, and color identification by using a computer which can be a desktop in a user's bedroom or a wearable computer (e.g., a mini-computer or a smartphone); and 3) audio outputs to provide recognition results of clothing patterns and colors.

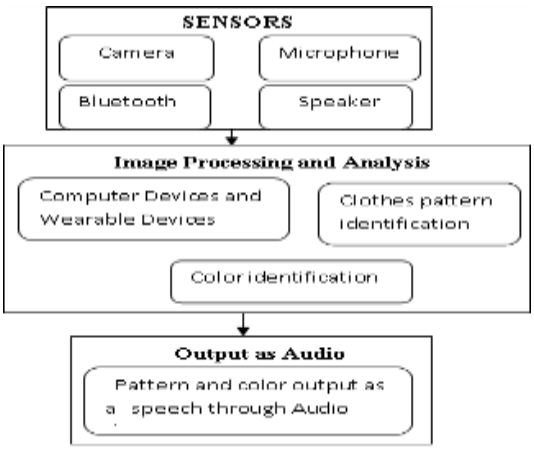


Figure 1 :- overview of major components for our system

2. METHODLOGY OF THE SYSTEM

In this document, "clothing design and color recognize" implies that the automatic system is capable of noticingthe clothing patterns and colors. The camera captures the image of clothes which as different patterns and colors. The color of 255x255x255 like red, blue, green ect all the 11 colors are stored in friendly ARM board.

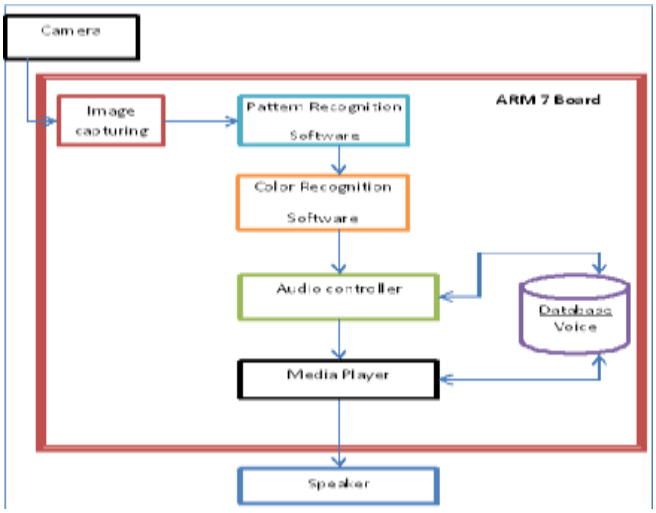


Figure 2 :- System Block Diagram

The Raspberry Pi board or a ARM board will be loaded with voice recognition library, Hence when user says a word the library is programmed to recognize the a word from user's voice. Based on the pronounced word appropriate action is taken. For example when user says "capture", the word will be recognized and software will activate the camera and it will capture the picture. Or when user says word "reboot", the word will be recognized and system will reboot.

The captured image will be processed with image processing technique. The image will be analyzed for various patterns like lines and shapes. The shapes include circle, square, triangle and few other shapes. The software will be programmed to recognize these shapes. Also the various colors will be identified for example the captured picture has red color then red color will be detected and voice will tell that captured image has red color. Same way if captured image has many colors like blue, green and yellow then all three colors will be announced through voice. Some 10 to 12 colors can be detected approximately. Since the color and pattern detection depends on camera resolution and lighting conditions.

In the next levels of the section the paper is organized as :section ii) Related Literature work and other different techniques used for visually impaired people. In section iii) understanding levels for visually impaired people. In section iv) The details of clothes pattern recognition. Section v) feature extraction and recognition of cloth. Section vi) system design. Section vii) experimental results. Section viii) conclusion.

3. RELATED WORK

Xu*et al.* Texture representations based on this method benefit from the invariance of fractal dimensions to geometric transformations[1]. For example, multi-fractal spectrum (MFS) proposed combined fractal dimensions of pixel sets grouped by density functions and orientation templates.

Lazebnik*et al.* proposed a texture representation method based on affine-invariant detectors (Harris and Laplacian) and descriptors (RIFT and SPIN). Zhang *et al.* also combined scale invariant feature transform (SIFT) and SPIN for texture classification. [3] **Liu *et al.*** built a clothing recommendation system for specific occasions (e.g., wedding or dating). [4] **Hidayati*et al.*** proposed a method for genre classification of upper-wear clothes. The two systems are both designed without considering key factors for blind users . [5] **Yuan *et al.*** developed a system to assist blind people to match clothes from a pair of clothing images.

Irati Rasines, Pedro Iriondo, and IbaiDíez :- This article focuses on developing a real time display detector and digital

character recognition application using techniques based on the connected components approach.

Sameer Antania, RangacharKasturia, Ramesh Jainb:- The need for content-based access to image and video information from media archives has captured the attention of researchers in recent years. Research e0orts have led to the development of methods that provide access to image and video data. These methods have their roots in pattern recognition. The methods are used to determine the similarity in the visual information content extracted from low level features.

Faiz M. Hasanuzzaman, Xiaodong Yang, and YingLiTian:- we have proposed a component-based framework for banknote recognition using SURF. Patches with fixed sizes of reference images for each class of banknotes are selected as reference regions for matching with query images. SURF mainly demonstrates effectiveness in handling background images, image rotation, scaling and illumination.

[9][10]In This Survey advocates new strategies for the extraction techniques and models to live image textural properties mistreatment applied mathematics and structural approaches which has Spatial Gray Tone Dependence: Co-occurrence Matrix And also deals with extracting Texture Features based on which different Image Textures can be classified by comparing with the original image and the segmented image. Segmentation of texture is completed exploitation combinatorial methodology and Segmentation while not exploitation native most condition methodology. Supervised and unsupervised Texture classification is additionally projected for classifying the mosaic textures in a very graphical method.

[10] [11] This article introduces a texture representation suitable for recognizing images of textured surfaces under a wide range of transformations, including viewpoint changes and non-rigid deformations. At the feature extraction stage, a sparse set of affine *Harris* and *Laplacian* regions is found in the image.

4. UNDERSTANDING LEVELS OF VISUALLY IMPARIED PEOPLE

Globally, an estimated 40 to 45 million people are totally blind, 135 million have low vision and 314 million have some kind of visual impairment. The incidence and demographics of blindness vary greatly in different parts of the world. In most industrialized countries, approximately 0.4% of the population is blind while in developing countries it rises to 1%. It is estimated by the World Health Organization (WHO) that 87% of the world's blind live in developing countries.

Of all sensations perceived through our senses, those received through sight have by far the greatest influence on perception. Sight combined with the other senses, mainly hearing, allow us to have a world global perception and to perform actions upon it. For the blind, the lack of sight is a major barrier in daily living: information access, mobility, way finding, interaction with the environment and with other people, among others, are challenging issues.

Assistive devices designed to aid visually impaired people need to deal with two different issues: at first they need to capture contextual information (distance of an obstacle, position of the[18] sensors, environment around the user), second they need to communicate to the user with those observed information . A basic building block of assistance system to measure the distance of the obstacle from the user is shown in the Fig. 4 . The elements involved are Sensors, Arduino Board, Arduino Software, Flash Memory and Audio output .

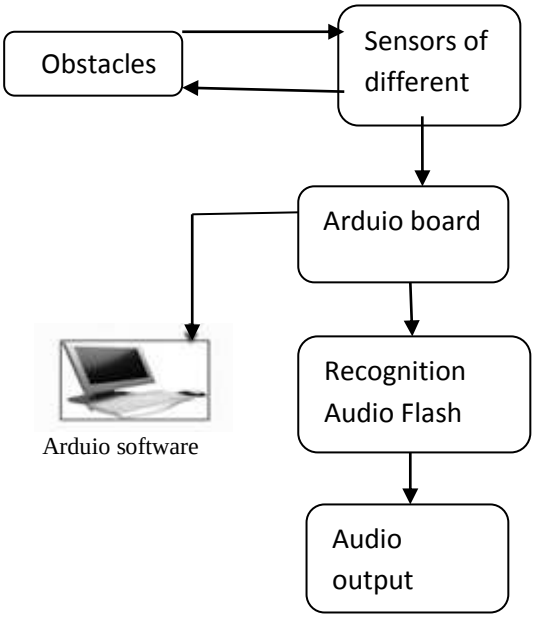


Figure 4: Block diagram for viusally imparied people using obstacles and sensors.

For the visually imparied people how the human computer interaction can be identified using some wearable sensors and wearable devices considered like hearing and touching, assistive devices worn on fingers and hands, Assistive devices worn on the wrist and forearm, Assistive devices worn on the tongue, imagination, etc.

5. CLOTHES PATTERN

There are many kinds of clothing patterns. In our project we mainly used clothing patterns like palid, striped, irregular,patternless,vertical etc. Most of the clothing pattern will have there own structure, identification etc. The below figures indicates different patterns are listed.

Plaid cloth pattern

DOI: 10.18535/Ijecs/v5i4.51

Striped cloth pattern

Irregular cloth patterns

Pattern less cloth pattern

6. RECOGNITION OF PATTERN AND COLORS

6.1 Pattern identification

Cloth Pattern Identification (CPI) is used to retrieve the image based on their features such as color, texture and shape. The primary use of the cloth pattern identification is to retrieve the data from the database by using color and shape features. The main aim of the CPI is to increase the efficiency during image retrieval and image indexing. Therefore, human intervention in the indexing process is reduced. Here, we develop a camera-based system specifically for visually impaired people and also common people to help them recognize clothing patterns and colors. The extracted global and local features are combined to recognize clothing patterns by using a support vector machines (SVMs) classifier. The recognition of clothing color is implemented by quantizing clothing color in the HIS (hue, saturation, and intensity) space. In the end, the recognition results of both clothing patterns and colors mutually provide a more precise and meaningful description of clothes to users.

6.2 Clothing color identification

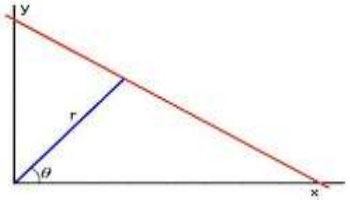
Clothing color identification is based on the normalized color **histogram** of each clothing image in the HSI color space. The key idea is to quantize color space based on the relationships between hue, saturation, and intensity. In particular, for each clothing image, our color identification method quantizes the pixels in the image to the following 11 colors: red, orange, yellow, green, cyan, blue, purple, pink, black, grey, and white.If a clothing image contains multiple colors, the dominant colors (i.e., pixels larger than5%of the whole image) will be output. The clothing patterns and colors mutually provide complementary information, the recognized patterns provide additional information about how different colors are arranged, e.g., striped clothes with blue and white color.

The recognition of clothing color is implemented by quantizing clothing color in the HIS (hue, saturation, and intensity) space. In the end, the recognition results of both clothing patterns and colors mutually provide a more precise and meaningful description of clothes to users. 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. The algorithm here we are considered is “Hough Line Transformation”.

The Hough Line Transform is a transform used to detect straight lines. To apply the Transform, first an edge detection pre-processing is desirable.The Canny Edge detector was developed by John F. Canny in 1986. Also known to many as the optimal hl detector. Canny algorithm aims to satisfy three main criteria: Low error rate: Meaning a good detection of only existent edges.Good localization: The distance between edge pixels detected and real edge pixels have to be minimized.Minimal response: Only one detector response per edge.a line in the image space can be expressed with two variables. For example:

In the **Cartesian coordinate system:** Parameters: (m,b)

In the **Polar coordinate system:** Parameters (r, θ)



DOI: 10.18535/Ijecs/v5i4.51

For Hough Transforms, we will express lines in the *Polar system.* Hence, a line equation can be written as:

$$y = \left(-\frac{\cos\theta}{\sin\theta}\right)x + \left(\frac{r}{\sin\theta}\right)$$

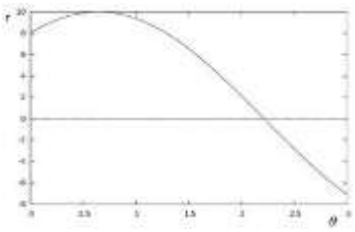
Arranging the terms above equation:

$$r = x\cos\theta + y\sin\theta$$

1.) In general for each point (x_0, y_0) we can define the family of lines that goes through that point as: $r_\theta = x_0 \cdot \cos\theta + y_0 \cdot \sin\theta$

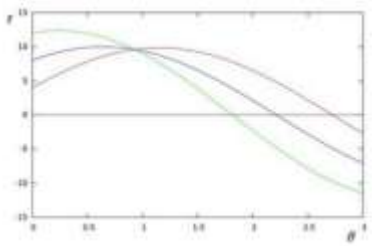
Meaning that each pair (r, θ) represents each line that passes by

2.) If for a given (x_0, y_0) we plot the family of lines that goes through it, we get a sinusoid. For instance, for $x_0 = 8$ and $y_0 = 6$ we get the following plot.



We consider only points such that $r > 0$ and $0 < \theta < 2\pi$

3.) We can do the same operation above for all the points in an image. If the curves of two different points intersect in the plane θ - r, that means that both points belong to a same line. For instance, following with the example above and drawing the plot for two more points: $x_1 = 4,\ y_1 = 9$ and $x_2 = 12,\ y_2 = 3,$ we get :



The three plots intersect in one single point $(0.925, 9.6)$, , these coordinates are the parameters (θ, r) or the line in which $(x_0, y_0), (x_1, y_1)$, and (x_2, y_2) lay.

4.)What does all the stuff above mean? It means that in general, a line can be *detected* by finding the number of intersections between curves. The more curves intersecting means that the line represented by that intersection has more points. In general, we can define a *threshold* of the minimum number of intersections needed to *detect* a line.

5.) This is what the Hough Line Transform does. It keeps track of the intersection between curves of every point in the image. If the number of intersections is above some *threshold*, then it declares it as a line with the parameters (θ, r_θ) of the intersection point.

7. SYSTEM DESGIN

7.1 Raspberry Pi

In the above block diagram for model *A, B, A+, B+*; model *A* and *A+* have the lowest two blocks and the rightmost block missing (note that these three blocks are in a chip that actually contains a three-port USB hub, with a USB Ethernet adapter connected to one of its ports). In model *A* and *A+* the USB port is connected directly to the SoC. On model *B+* the chip contains a five-point hub, with four USB ports fed out, instead of the two on model *B.*

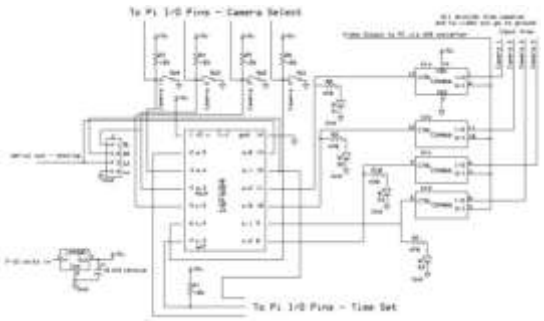


Figure 7.1(a):- Raspberry pi circuit diagram

The Raspberry Pi is a series of credit card-sized single-board computers developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools. The original Raspberry Pi and Raspberry Pi 2 are manufactured in several board configurations through licensed manufacturing agreements with Newark element14 (Premier Farnell), RS Components and Egoman. These

companies sell the Raspberry Pi online. Egoman produces a version for distribution solely in China and Taiwan, which can be distinguished from other Pis by their red coloring and lack of FCC/CE marks. The hardware is the same across all manufacturers.

Figure 7.1(b):- Raspberry pi or ARM board

The original Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S700 MHz processor, VideoCore IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded (models B and B+) to 512 MB. The system has Secure Digital (SD) (models A and B) or MicroSD (models A+ and B+) sockets for boot media and persistent storage In 2014, the Raspberry Pi Foundation launched the Compute Module, which packages a BCM2835 with 512 MB RAM and aneMMC flash chip into a module for use as a part of embedded systems.

The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC (via the RISC OS image or the Brandy Basic clone for Linux), C, C++, Java, Perl and Ruby. As of 18 February 2015, over five million Raspberry Pis have been sold. While already the fastest selling British personal computer, it has also shipped the second largest number of units behind the Amstrad PCW, the "Personal Computer Word-processor", which sold eight million.

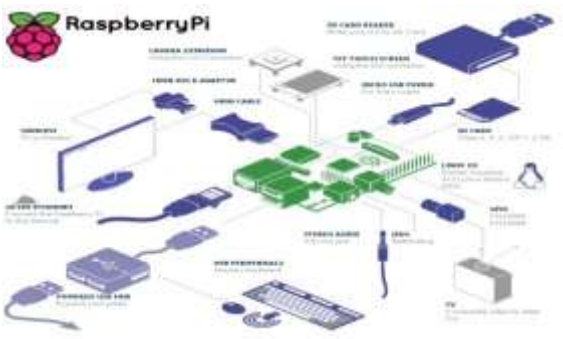


Figure 7.1(c):- Raspberry pi Architecture

8. CLOTH PATTERN DETECTION AND COLOR DETECTION

In this paper, process of classification is performed in to the phases; the first one is the computation of features and second is the classification of with the help of extracted features using suitable classifiers.

8.1 Pattern Detection

Pattern recognition is the assignment of a label to a given input value. We use the concept of supervised learning and train our pattern recognition module from labelled training data acquired in the form of images from datasets.

Figure 8.1 (a):- sample cloth pattern

After analysing the voice command for the system start-up, image is captured using the camera. It is then converted to Grey scale and it forms gray scale values. Once it has been forms in terms of gray scale values then the edge detection takes places The sum of edges for each section is calculated and stored in separate variables. Difference in the number of edges in each section to all the other sections, is computed and stored as matrix. And the detected sample cloth is shown below.

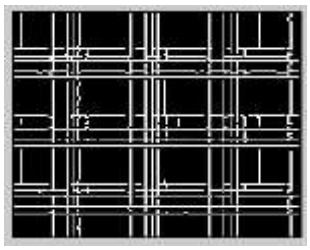


Figure 8.1(b):- Edge detection of sample cloth

8.2 color detection

Color is the most vital visual feature for humans. By representation, we mean the overall of image content when used as a "global" feature. A space is defined as a model representing in terms of intensity values. There are different s models: RGB, Lab, HSV, HSI, YCbCr, etc. Each of these has got specific applications and also has got advantages and drawbacks.

DOI: 10.18535/Ijecs/v5i4.51

Figure 8.2:- RGB additive color model

9. RESULT AND DISCUSSION

we have proposed in our system to recognize clothing patterns and colors to help visually impaired people in their daily life. Our proposed system uses the detection of the colors and patterns it gives some new approach to the impairment person. Here the below table indicates some detected colors as audio controller as a speech or sound output. Here we are using OPENCV techniques and methods for our system. In the future work of our system we include the edge detection and recognition of clothing patterns, colors our system uses the morphological methods and operations.

Clothes	Detected lines of cloth	Output as speech(pattern /color)
		Pattern less / red color
		Vertical pattern/ white and black
		Irregular pattern / red, blue and white

Figure 9(a) : patterns with color which are detected

Image of cloth				
Pattern	Pattern less	Vertical	Irregular	striped
Color	Red(98%)	White(90%) Black(7	Red(20%) White(50%)	White(95%) Pink(60
		5%)	Blue(40%)	%)

Figure 9(b) :- different pattern and color values

9.1 DATASETS

This dataset includes 627 images of four different typical clothing pattern designs: plaid, striped, pattern less, and irregular with 156, 157, 156, and 158 images in each category. Every one of the photographed electronic device's displays has its own illumination, the selection of the devices was base on the types of displays commonly found in daily life. The experiments for display localization were performed using color images of size 640x480 pixels.

10. CONCLUSION

There exist numerous patterned clothes nowadays. Choosing clothes with different patterns are challenging issues for visually impaired people. In our paper we propose a system that helps impaired people choose clothes easily. The system can identify successfully 11ccolors and 5patterns using canny edge detection and Hough transformation. In the future work our results and evolution of performance can be made by different methods. we can apply morphological operations also extend system to identify patterns and colors of different types for blind people.

11. REFERENCES

1. " Assistive Clothing Pattern Recognition or Visually Impaired People", Xiaodong Yang, Shuai Yuan, and yingli Tian, ieee transactions on human-machine systems, vol. 44, no. 2, april 2014, digital object identifier 10.1109/thms.2014.2302814.
2. "Hi, magic closet, tell me what to wear," , S. Liu, J. Feng, Z. Song, T. Zhang, H. Lu, C. Xu, and S. Yuan, in Proc. ACM Multimedia, 2012
3. "Clothes matching for visually impaired persons," S. Yuan, Y. Tian, and A. Arditi, J. Technol. Disability, vol. 23, no. 2, pp. 75–85, 2011.
4. "Local features and kernels for classification of texture and object categories:Acomprehensive study," J. Zhang, M. Marszalek, S. Lazebnik, and C. Schmid, Int. J. Comput. Vis., vol. 73, no. 2, pp. 213–238, 2007.
5. Real-Time Display Recognition System for Visually Impaired Irati Rasines1, Pedro Iriondo2, and Ibai Díez, K. Miesenberger et al. (Eds.): ICCHP 2012, Part II, LNCS 7383, pp. 623–629, 2012. © Springer-Verlag Berlin Heidelberg 2012.
6. A survey on the use of pattern recognition methods for abstraction, indexing and retrieval of images and video Sameer Antania, Rangachar Kasturia; ∗, Ramesh Jain Pattern Recognition 35 (2002) 945–965,

7. Robust and Effective Component-based Banknote Recognition by SURF Features", Faiz M. Hasanuzzaman, Xiaodong Yang, and Ying Li Tian,

8. A Sparse Texture Representation Using Local Affine Region", S. Lazebnik, C. Schmid, and J. Ponce , IEEE Trans. Pattern Anal. Mach. Intell., vol. 27, no. 8, pp. 1265–1277, Aug. 2005.

9. A performance evaluation of local descriptors", K. Mikolajczyk and C. Schmid, IEEE Trans. Pattern Anal. Mach. Intell., vol. 27, no. 10, pp. 1615–1630, Oct. 2005.

10. "Texture classification using logical operation," , V. Manian,R.Vasquez, and P.Katiyar IEEE Trans. Image Process., vol. 9, no. 10, pp. 1693–1703, Oct. 2000.

11. Texture Classification using Curvelet Transform

12. Real-Time Detection and Reading of LED/LCD Displays for Visually Impaired Persons", E. Tekin, J. Coughlan, and H. Shen, in Proc. IEEE Workshop Appl. Comput. Vision, 2011, pp. 491–496.

13. Cloth Pattern Recognition With Four Features (RSSM)", N Durga Rao*, Dr. G Sudhavani#, P Balakrishna*, Dr. K Gouthami, 978-1-4673-6708-0/15/$31.00 ©2015 IEEE.

14. Real-time clothing recognition in surveillance videos", ming yang, kai yu, 2011 18th ieee International Conference on Image Processing, 978-1-4577-1303-3/11/$26.00 ©2011 IEEE.

15. Sampling Strategies for Bag-of-Features Image Classification", E. Nowak, F. Jurie, and B. Triggs, in Proc. Eur. Conf. Comput. Vis., 2006, pp. 490–503.
16. "(Computer) vision without sight," R. Manduchi and J. Coughlan, Commun. ACM, vol. 55, no. 1, pp. 96–104, 2012.

17. Pattern Recognition Techniques: A Review ", Seema Asht and 2Rajeshwar Dass, International Journal of Computer Science and Telecommunications [Volume 3, Issue 8, August 2012]

18. Wearable Obstacle Avoidance Electronic Travel Aids for Blind: A Survey D. Dakopoulos and N. G. Bourbakis, IEEE Trans. Syst.,Man, Cybern. C, vol. 40, no. 1, pp. 25–35, Jan. 2010.

19. "Morphological change detection system for real time traffic analysis", anuradha.s.g [1], dr.k.karibasappa [2], dr.b.eswar reddy, International Conference on Emerging Research in Computing, Information, Communication and Applications.

20. "Edge Detection Techniques in Processing Digital Images: Investigation of Canny Algorithm and Gabor Method." , Nosrati, Masoud, Ronak Karimi, Mehdi Hariri, and Kamran Malekia World Applied Programming 3.3 (2013): 116-121.

21. "User interface preferences in the design of a camera based navigation and wayfinding aid," A.Arditi andy.Tian, J. Visual Impairment Blindness, vol. 107, no. 2, pp. 18–129, 2013.

22. "Design and Development of Color and Texture Detection System for the Visually Impaired People", Sushma. B, Pushpa Mala. S, Latha. B, K Ezhilarasan, International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 IJERTV4IS050611, Vol. 4 Issue 05, May-2015.

23. Efficient Costume Analysis and Recognition Acceptance for Optically Challenged Humanity", N.J Divya, X.Anitha Sarafin, International Journal of Innovative Research in Computer and Communication Engineering An ISO 3297: 2007 Certified Organization Vol.3, Special Issue 8, October 2015.

24. "Improved Fabric Defect Detection and Pattern Classification using Radon Transform ", Rakhil K S , Asha S, International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Issue 7, July 2015, DOI:10.15680/IJIRSET.2015.0407087.

25. "Portable Camera Based Assistive Pattern Recognition for Visually Challenged Persons", R. Savitha, R. Ramya, International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 1030 – 1034 ,Volume: 3 Issue: 3 .

26. "The Survey Paper on Clothing Pattern and Color Recognition for Visually Impaired People ", Honey Mishra , IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 09, 2015 | ISSN (online): 2321-0613

27. "Auditory Guidance for Blind People to Recognize the Clothing Patterns", Bharath B. S. R, Mr. Shreekanth T, International Advanced Research Journal in Science, Engineering and Technology Vol. 2, Issue 5, May 2015.

28. "Clothing Color and Pattern Recognition for Visually Impaired People", Shruti Bharadwaj, Sharath H.K., Praveena M.B., Ajay Shetty, Shivarudraiah B. International Journal of Engineering, Management & Sciences (IJEMS) ISSN-2348 –3733, Volume-2, Issue-5, May 2015.

29. "Recognizing Clothes Patterns for Blind People by Confidence Margin based Feature Combination", Xiaodong Yang, Shuai Yuan, and yingli Tian, Proc ACM Int Conf Multimed. 2011; 2011: 1097–1100. Doi: 10.1145/2072298.2071947

30. "Efficient Clothing Pattern Recognition for Blind People Using SVM Classifier", V. Subbarayudu, Dr. D. Vishnu Vardhan, International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064, Volume 4 Issue 7, July 2015.