International Journal of Engineering Research and Modern Education (IJERME)
Impact Factor: 7.018, ISSN (Online): 2455 - 4200
(www.rdmodernresearch.com) Volume 3, Issue 1, 2018

IMAGE BASED LABLE DETECTION WITH VOICE OUTPUT FOR VISUALLY CHALLENGED PERSONS USING CLASSIFIERS

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Cite This Article: J. Nasreen Banu, S. Thilaga, G. Vinothini & S. Abirami, "Image Based Lable Detection with Voice Output for Visually Challenged Persons Using Classifiers", International Journal of Engineering Research and Modern Education, Volume 3, Issue 1, Page Number 25-29, 2018.

Abstract:

Common individuals check the expiration date easily before using the product. But it is very difficult for visually impaired people. Nowadays many barcode readers are available for identifying products. But such readers are inaccessible to blind folded persons. A computer vision algorithm enabling a blind person to locate read and detect barcode which helps to identify goods data such as product's item number. Product expiry date represents important information for products consumptions. The proposed stages include numeral string preprocessing, string segmentations, features extractions and numeral recognition. Texture and segmented region can be analyzed by Gabor filters and SVM classifiers respectively using CNN. The computer vision output will provide spoken feedback that the product is expired or not.

Key Words: Barcode, Expiry Date, OCR, SVM & CNN

1. Introduction:

In the entire world, nearly 4.66% human population was visually affected people which are approximately equal to the 295 million people. Due to baby boomer generation ages this number is rapidly increasing. So far many assistive devices were designed for better understanding the environment. The combination of computer vision technology (neural networks) with other existing system such optical character recognition (OCR) system to assist these individuals by developing camera-based products. Many Computers vision program, digital cameras, portable computers and mobile application are still in development to reduce the work load of visually impaired person. Few products like food and medicine could not stay fresh for a long time. The condition of food or any other product is predicted by validity date usually printed on product during final stage of packaging. This date hauls information whether to use that product or not. Sighted people can easily access that information but not so for visually impaired people who always seeks a help of others. But the availability of such human assistance is not always available for identifying the product and validity date. In day to day work of visually impaired people they may consumes expired food or take some expired medicine cause threatening to life.

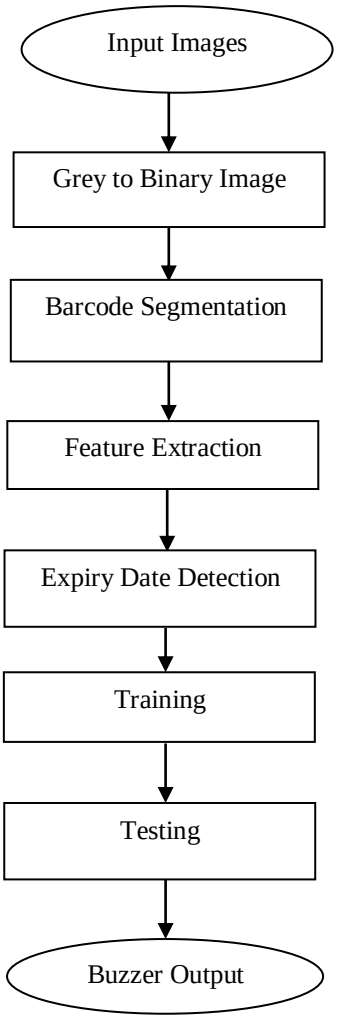
At present, there were already in existences of some portable systems but they cannot handle product barcode and validity date. In short, the technique like barcode scanner hauls information about product which compared with an extensive database and shows the expected result. Reading barcodes will help blind and visually impaired to distinguish one product from other. For example, box of potato and box of crackers would resemble the same. But this technique requires proper positioning the barcode in front of scanner is very hard for blind users to hold the product before the scanner. In this paper we proposed the computer vision system for obtaining the expiry date enabling the visually impaired to work independently which is done by MATLAB with buzzer output. The remainder of this paper is as follow: Section 2 explains EAN-13 barcode; Section 3 explains image processing; Section 4 describes the barcode localization and segmentation; Section 5 provides the expiry date detection; Section 6 shows the experimental results; Section 7 concludes this paper.

2. Ean-13 Barcode:

Figure 2.1: EAN - 13 Barcode

EAN-13 is a European Article Number in which 13 represents numeric codes. This barcode is used for recognizing retail goods throughout the world. The first 2 or 3 characters are country code. The next 9 or 10 characters represent manufacturer code and product code (depending on the length of country code). The 13th character describes the checksum. The EAN-13 barcode is appears in the form of line patterns with graphical rendering of a 13 digit code. These line patterns are in the form of dark bars and light spaces with various thickness, were black (1) and white (0) with various widths. Left hand guard pattern and right hand guard pattern in EAN-13 is always mount and bound with a black-white-black pattern (101) referred to be White-black-white-black-white (01010) which code is another pattern called as center guard pattern. On the basis of this guard patterns, all the 13 digits are decoded. To ensure the 13 digits of barcode value, the checksum value is calculated. The mismatch implies that these barcode were not decoded properly.

2. Algorithm Design:



3. Image Processing:

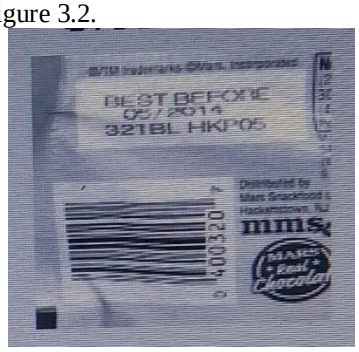
In order to get an enhanced image or to extract some useful information image processing can be used. Nowadays image processing is a growing technologies which are used in many computer science disciplines and engineering too. Image processing basically includes the following three steps:

- ✓ With help of image acquisition tool, image can be imported
- ✓ Analyzing and manipulating the image.
- ✓ Based on image analysis, the output result can be altered.

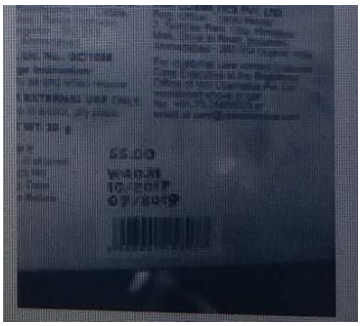
Original Image 3.1 (a): Expired Product

3.1 (b) Non Expired Product

This image were fetched into MATLAB which the source code convert this image into gray level image in figure 3.2.



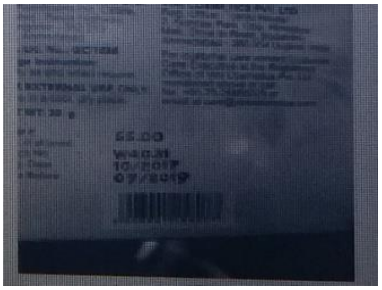
3.2 (a): Gray sacle image of expired product



3.2 (b): Gray scale image of non expired product

Now, everything is ready for binarization of image, thresholding is employed for binarization of the gray level image and thus to separate the object of interest from the background. After the binarization, the morphological algorithm is employed in the thinning module. The result of the binarization and thinning modules of expiration code without duplication is shown in figure 3.3

3.3 (a): Binary images of expired product



3.3 (b): Binary images of non expired product

After image binarization, the segmentation of digits string is carried out. Then, each normalized digit image is convolved with a bank of S-Gabor filter at some orientations and at specified frequency (*filter* 1.... '*o*'; with '*o*' is the number of orientations). According to the number of orientation, many feature maps are determined. For example, if '*o*=3' we have three features map of LE and likewise for FM and CM. In each stage of the filtering algorithm, the norm of the difference between feature maps at subsequent orientation channels is calculated and considered. Each numeral is obtained by a vector system consisting of many features, depending on the numerical of orientation. The feature vector consider as an input of a Neural Network for numeral recognition.

4. Barcode Localization:

A 1D barcode is formed by a rectangular array of parallel lines. In particular, the EAN-13 barcode focused in this paper contains a sequence of 30 black bars with 29 white bars in between. Thus, it has a total of 60 edges in both directions.

Our goal is to detect and locate such patterns in an image. Though one straight forward way to detect such a pattern is to extract lines from an original image and find the region with the highest likelihood, it is very likely to fail were the captured images hauls barcode along with other factors too. Therefore, low level binary image features must be utilized. We first calculate the image gradient of each pixel in the image and preserve those whose gradient magnitude is above a threshold.

The gradient orientation is calculated for those preserved pixels. From the gradient orientation map, one may use the algorithm provided in to locate the barcode: find a number of lines with similar beginnings and endings where each of them passes a number of edge pixels with two opposite polarities. However, a detection algorithm which is much less ad-hoc is developed based on a state-of-art object recognition technique due to its proven efficiency.

We quantize the gradient orientation into four bins for the preserved pixels: horizontal, vertical, both diagonals. Thus, the input image can be turned into a five-label edge map: 0 - non edge pixel; 1 - horizontal edge pixel; 2 - vertical edge pixel; 3 - top left to bottom right edge pixel; 4 - top right to bottom left edge pixel. From this edge map, we need to find the most obvious image sub-region that contains the edge pixels with similar orientation and the non-edge pixels as that is most likely to be the 1D barcode. To do this, a weight map is generated for each desirable orientation *i*, by denoting *I* as the input image and pixel $p \in I$:

$$Weight\ i(p) = \begin{cases} +4 \text{ if } edge(p) = i \\ -1 \text{ if } edge(p) = 0 \\ -4 \text{ otherwise} \end{cases}$$

To evaluate how likely an image sub-region contains a barcode, a quality function of an image sub-region $R \in I$ under the *ith* orientation is defined as:

$$fi(R) = \sum_{p \in R} weight\ i(p)$$

Segmentation:

Comparing the images captured by the camera, it is more difficult to select a proper segmentation point because the characters are get disturbed severely due to the blurred character boundaries. Hence, the binary images are usually enhanced to reduce the external effects before character segmentation. In this section, a character segmentation mechanism with the touched character filter is proposed.

Feature Extraction:

Feature plays a very important role in the area of image processing. Object-of-interest detection to carefully extract the image of the object held by the blind user from the cluttered background or other nautral objects in the camera aspect. If the feature extraction is utilized, then the classification and recognition of images can be concluded easily. Since it designate the role of an image, it is efficient in categorizing and time consumption. The feature extraction contains the following methods which constitute:

GLCM:

The gray level co-occurrence matrix (GLCM) considers the spatial relationships of pixels by statistical methods. The GLCM functions characterize the texture of an image by scheming the pairs of pixels with specific values and then extract statistical measures from the matrix.

Kurtosis:

Kurtosis is a statistical measure that is used to describe the distribution of observed invariant to affine luminance changes in images.

$$Kurtosis = E\left(\frac{X-X}{\sigma}\right)4$$

Homogeneity:

Homogeneity implies consistency in back of variations between items being compared over a long period and across a wide range.

$$homo = \sum_i^n \sum_j^n \frac{cij}{1+mod(i,j)}$$

Skewness:

In a statistical distribution skewness is asymmetrical, where the curve distorted**.** It can be quantified to define the extent to which a distribution differs from a normal distribution.

$$skew = E(\frac{X-X}{\sigma})3$$

Maximum Probability:

Maximum probability is used to estimating the parameters of a statistical model. When applied to a data set and given a statistical model, it provides estimates for the models parameters.

$$max\ prob = \frac{\max(c_{ij})}{N}$$

Inverse Difference Moment:

It is a compute the local homogeneity in an image. IDM ranges from 0.0 for an image that is highly textured to 1.0 for an image that is untextured.

$$idm2 = \sum_i \sum_j \frac{cij}{(i-j)2}$$
$$idm3 = \sum_i \sum_j \frac{cij}{(i-j)3}$$

Entropy:

To characterize the texture of the input image **e**ntropy measures the randomness statistically. It is the information sense to measure the uncertainity associated with random variable.

$$E = -\sum_i \sum_j c\ i\ ;\log c\ ij$$

Expiry Date:

It is defined as the date up to which the food or product preserve its microbiological and physical stability. Validity dates are especially important in the case of medications as it provides the only indication about the product. Expired products can be rendered less effective or made more risky due to a variation in chemical composition. The FDA (Food and Drug Administration) may extend the validity date of a product if there is any curtailment of it. The extended validity date is based on stability data for the usage that has been reviewed by FDA.

Artificial Neural Network:

An Artificial Neural Network is a computational model based on the structure and functions of biological neural networks. It is stationed on a collection of connected units or nodes called artificial neurons. Each connection between artificial neurons can convey a signal from one node to another. The artificial neuron that receives the signal can process it and then signal artificial neurons connected to it. The authentic intention of the ANN was to deal problems in the same way that a human brain would.

Back Propagation Network:

BPN is an algorithm for supervised learning of artificial neural networks using gradient descent. It is *workhouse* of learning algorithm. It is not just a fast learning algorithm but it actually provides the detailed insights. The main function of the algorithm looks for the minimum value of the error function in weight space. Activation function used for a back propagation neural network can either be bipolar sigmoid or a binary sigmoid. The form of plays an important role in choosing the type of activation function.

Results and Discussion:

In our work, we desire to help the visually impaired people to get better knowledge about the product's information using GLCM feature extracted from the collected image with back propagation network. The results reported in this paper show that the current set of features can achieve high performance for barcode recognition using NN and SVM classifiers.

References:

1. En Peng, Patrick Peursum, Ling Li, "Product Barcode and Expiry Date Detection for the Visually Impaired using a Smartphone" in 2012.
2. E. Tekin and J. M. Coughlan, "A mobile phone application enabling visually impaired users to find and read product barcodes," in Proceedings of the 12th international conference on Computers helping people with special needs, ser. ICCHP'10. Berlin, Heidelberg: Springer-Verlag, 2010, pp. 290–295. [Online]. Available: http://portal.acm.org/citation.cfm?id=1880751.1880800.
3. C. Yi and Y. Tian, "Text string detection from natural scenes by structure based partition and grouping," Image Processing, IEEE Transactions on, vol. PP, no. 99, p. 1, 2011.
4. E. Tekin and J. Coughlan, "An algorithm enabling blind users to find and read barcodes," 2009, pp. 1–8.
5. S. An, P. Peursum, W. Liu, and S. Venkatesh, "Efficient algorithms for subwindow search in object detection and localization," in Computer Vision and Pattern Recognition, IEEE Computer Society Conference on, vol. 0. Los Alamitos, CA, USA: IEEE Computer Society, 2009, pp.
6. 264–271.
7. D. G. Lowe, "Distinctive image features from scale-invariant keypoints," Int. J. Comput. Vision, vol. 60, pp. 91–110, November 2004. [Online]. Available: http://portal.acm.org/citation.cfm?id=993451.996342
8. H. Bay, A. Ess, T. Tuytelaars, and L. Van Gool, "Speeded up robust features (surf)," Comput. Vis. Image Underst., vol. 110, pp. 346–359, June 2008. [Online]. Available:
9. http://portal.acm.org/citation.cfm?id=1370312.1370556.
10. G. Takacs, V. Chandrasekhar, S. Tsai, D. Chen, R. Grzeszczuk, and B. Girod, "Unified real-time tracking and recognition with rotation invariant fast features," in Computer Vision and Pattern Recognition (CVPR), 2010 IEEE Conference on, 2010, pp. 934 –941.
11. M. A. Fischler and R. C. Bolles, "Random sample consensus: a paradigm for model fitting with applications to image analysis and automated cartography," Commun. ACM, vol. 24, no. 6, pp. 381–395, Jun. 1981. [Online]. Available: http://doi.acm.org/10.1145/358669.3586922