

Barcode Detection using OpenCV-Python

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Abstract— Almost all the products and items that exist into the market today have a unique code or an ID associated with them. This special ID is what we call as Barcode. Barcode Detection is very common and is a necessity today as it makes our job easy. One can just scan the code and easily get all the details of the product. It's becoming even more popular and prevalent day by day. The algorithm involves mainly 4 steps: calculation of Scharr gradient, making the image blur, kernel application and erosions & dilations. After implementing this algorithm, we made a Barcode Detection Android App.

Keywords— Barcode Detection, Python, OpenCV, Computer Vision, Image Processing, Android App.

I. INTRODUCTION

We are living in 21st Century and the technology has been rapidly developing. In this phase of advancement, Barcode has been quite common. Most of the items and products that are present in one's household currently have their own unique barcodes. One can scan them and easily obtain all the relevant information like price, product details and description. There are even various apps available to let us scan the barcode through our phones itself. This is because of the high-quality pixel cameras that are present in all iPhones, android devices or windows' phones.

In this paper an algorithm that uses Python and Open Computer Vision Library (OpenCV) is being presented. Later, we made an android app for Barcode Detection.

This paper is sorted as: Introduction, Barcodes, Related Work, Open Computer Vision Library, Process & Algorithm, Results, Conclusion and Future Scope.

II. BARCODES

A Barcode or simply bar code is collection of data bits that describes the item which has that particular barcode. The data is being represented in a specific type of structure. This structure is made of parallel lines with different widths and spacings between them. These parallel lines are called bars, and hence the name "Barcode". They are formed by different amalgamation of special characters such as colons or dots and many more. [1]. The Barcode has been constantly developing since its birth trying to cover minimal amount of space and carry maximum possible data. Earlier only one-dimensional bar codes were available. Later two-dimensional ones were developed in which all alphanumeric and other special characters were being used. The original idea came out of the Morse code which gave the birth to the Barcode. But it almost took two decades before this could be of actual use in the market.

The numbers written in the barcode under parallel lines are actually a unique ID to the item. This code is scanned at

marketplaces using a laser-scanner or a mobile phone. The scanned code contains all the relevant product information. Using barcodes is now a Checkout system in all big malls and markets. At checkout, the code is being scanned and the mall employee gets the cost price of the product and the bill is easily generated.

There are basically two types of barcodes:

1. Linear Barcode (1D Barcode)
2. Matrix Barcode (2D Barcode)

Linear barcodes consist of subtypes like Code 11, Codabar, Code 25, EAN-2, EAN-5, EAN-8 etc.

Matrix barcodes consist of subtypes like Aztec Code, Color code, Cyber code, Dot code. Etc.

The Barcode is used by the companies to easily maintain a reliable and fast, isolated database for Sales and Purchases.



Fig. 1. Example of a Barcode on a book.

The concept of Image Processing is used to detect the barcode, extract information out of it and then use it practically. After being scanned a signal is being generated which is processed by a software.

In the figure 1 is an example of twelve numbers in the code. Every single number possess 7 bits of memory. There are three bits for beginning, three bits for ending and in middle are five bits which are used for referencing.

Let's have a look on another type of Barcode. It is known as Aztec.

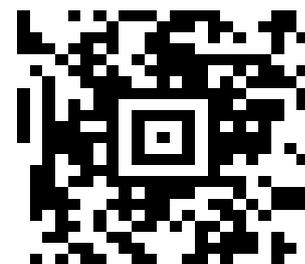


Fig. 2. Sample Aztec (2D).

This figure 2 is an example of 2D barcode.

By the end of this paper, a successful method has had been studied for barcode detection with various steps explained.

III. RELATED WORK

The idea of barcode was originated from a graduate student, Bernard Silver in the year 1948 in the US. Since then, Barcodes have been completely changed and been progressed on a lot.

- 1) The team from University Teknikal Malaysia Melaka and University of Fukui where they are trying to recognize the Barcodes using a web camera. They developed a program on MATLAB for this purpose. [1]
- 2) Another team from University of Szeged used a morphology to have efficient detection on 1D and 2D algorithms. They have improved the detection technique from their previous algos. [2]
- 3) Vidya Pratishtan's College of Engg.,Baramati, Pune university made an android application which easily managed barcode detection from android's camera of different sizes and solving the problem of uneven problem of illumination. [3]

IV. METHODS TO DETECT BARCODES

The types of methods for reading of barcodes are:

1. Reading barcode using mobile camera:

It is used for 2D barcode detection, where a deformed shape of the barcode is captured using the mobile phone camera. This deformed shape is normalized using an algorithm that is inverse perspective transformation [4].

2. Recognition of highly distorted and resolution images:

The algorithm used in this approach gives fast and accurate results even when the quality of image is poor. It is most suitable for small portable devices [5].

3. Barcode recognition system:

With the help of image processing, firms can make their own barcode recognition system which is capable of reading the barcode of all the variety of products available at the company itself. Retailers often use handy bar code reader which is suitable for the limited number of products they have, but firms with large diversity in products use their own barcode recognition system made using image processing [6].

4. Barcode reader health applications on android mobiles:

Barcode is scanned using the barcode scanner available in modern mobiles and the image is communicated to the server, which in turn communicates back the details of the product whose barcode was scanned.

V. SCHARR GRADIENT

One of the major step in Barcode Detection is detecting edges. They are being detected using a magnitude representation factor called Scharr Gradient. Scharr Gradient or Sobel Operator is prevalent in Computer Vision and Image Processing. This operator has its uses in those images which focuses on Edge Detection [7]. The image intensities are being calculated through functions for an approximate value via this operator. We calculate Scharr Gradient in both x and y direction. We do so using a parameter what we call as "size".

We initialize it to negative of one for building the gradient factor for both Vertical and Horizontal Directions in Image.

VI. BLURRING OF IMAGE

Once the barcode region of the image has been detected, we apply blurring effect to it so that noise is reduced, and it can focus on the bar code [8]. To do so, a 9*9 kernel is applied which provides an average blur, reducing the high frequency disturbances present in the image. Then, a threshold is applied to the blurred image, and pixels greater than 225 are set to 255 that is white color, and pixels less than 225 are set to 0 that is black. The barcode image thus obtained has gaps between its vertical bars. To close these gaps and make it easier for our algorithm to detect the barcode, the following steps can be implemented.

VII. TRANSFORMATION OF IMAGE MORPHOLOGICALLY

This method is dependent on the shape of the input image which has a barcode to be detected. This can be done only on those images which are binary in nature. We need to have to two inputs: the given input image and the kernel to structure the method on the image [9].

There are two fundamental operators for the process of image morphologically namely:

Erosion: Similar to like the concept of soil erosion, this operator basically banishes the boundaries from the object. It affects all the pixels present along the boundary are removed to reduce the noise [10]. This also reduces the thickness of the image which in turn abates the size of the image.

```
import cv2
import numpy as np
img = cv2.imread('barcode.png',0)
kernel = np.ones((6,3),np.uint14)
erosion = cv2.erode(img,kernel,iterations = 1)
```

Fig. 3. Erosion Code Snippet.

The second factor is *Dilation*. This factor has function completely different from Erosion. This factor increases the "white region" in the image. To compensate with the reduced noise from the process of Erosion, Dilation increase the object area and thus the size [11].

```
dilation = cv2.dilate(img,kernel,iterations = 2)
```

Fig. 4. Dilation Code Snippet.

Opening: We generally stick to the procedure of erosion process followed by dilation process. This is coined in the term "Opening".

Closing: It's exact opposite of opening. It's used for shutting down the small holes present in any object that can cause noise or any other kind of hinderance for Barcode Detection [10].

VIII. CONCLUSION

Here we have learnt about barcodes, what the different types of barcodes being used are and where they find their application. We have also analyzed the process used to decode

the barcode and mathematics required to do it. By the time we finished writing this paper, we had an in-depth knowledge about bar codes, how data is stored in them, the algorithms used and how to use them efficiently.

IX. RESULTS

The barcode program with OpenCV-Python took around 0.3 seconds while our android app took 0.4 seconds to detect the barcode. With this detected Barcode, we could copy it and directly search it over internet.



Fig. 3. Barcode detected by our app

X. FUTURE SCOPE

With the advent of technology, many applications will come up requiring the use of RFID tags and barcodes. RFID and barcode can be used to track down equipments and hold basic information including the history, thus helping track down the quality and quantity of products. Some important sectors where it finds it use is personalized patient care, chemical libraries and many more places where it can help identify the object and help locate it easily. As the size of devices is reducing continuously, barcode will be used

excessively as they can hold important information in a very small area.

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