

LINEAR BARCODE SCANNING SYSTEM BASED ON DYNAMIC TEMPLATE MATCHING FOR OOF BLURRED IMAGES

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ABSTRACT

A Novel Linear Barcode scanning system based on a Dynamic template matching scheme. The proposed system works entirely in the Spatial domain and is capable of reading Linear Barcodes from low-resolution Images containing severe OOF blur. This paper treats Linear barcode scanning under the perspective of deformed Binary waveform analysis and classification. A directed graphical model is designed to characterize the relationship between the blurred barcode waveform and its corresponding symbol value at any specific blur level. A Dynamic programming-based inference algorithm is designed to retrieve the optimal state sequence, enabling real-time decoding on Mobile devices of limited processing power.

Key Words: Barcode, Dynamic Template Matching, Blurred Images

INTRODUCTION

Digital Image refers to processing of a 2 Dimensional picture by a Digital Computer. In a broader context, it implies Digital processing of any two dimensional data. A Digital Image is an array of real or complex numbers represented by a finite number of bits. An Image given in the form of a transparency, slide, photograph or an X-ray is first digitized and stored as a matrix of binary digits in computer memory. This digitized image can then be processed and/or displayed on a high-resolution television monitor. An Image Processor does the functions of Image Acquisition, Storage, Pre-processing, Segmentation, Representation, Recognition and Interpretation and finally displays or records the resulting image. Digital Image Processing has a broad spectrum of applications, such as Remote Sensing, Medical Processing, RADAR, SONAR & Acoustic Image Processing, Robotics & Automated inspection of Industrial parts.

This paper mainly addresses the analysis and classification of Binary waveforms under Out of Focus (OOF) Blur in the form of Linear Barcode scanning, the methodology presented can be extended to other blurs such as moving Blur and other related domains, such as Document Analysis and Recognition, where Image Blurs are also challenging issues and Deblurring is normally resorted for Character Segmentation and Word Recognition

BARCODE

Barcode Technology has found its applications in many industries and has been playing an important part in people's daily lives. Multiple generations of barcode scanning systems ranging from earlier LASER Scanners to more recent area Charge Coupled Device (CCD) scanners have been invented and developed. As the location/size information of bars and spaces is of paramount importance for deciphering information embedded in barcodes, modern barcode scanning systems generally request well-focused barcode signals, which help in the retrieval of location/size-related features by confining the edge interaction between the code patterns. Depth-of-field (DOF), the range of distance at which the scanned symbol is sufficiently in focus to be read without error, is an important aspect of any specific barcode scanning system. Area CCD scanners have the advantage of reading both linear and 2D barcodes, but have less DOF than that of laser scanners, because the directional and coherent nature of laser light permits expanded DOF. This DOF constraint has limited the availability of area CCD scanners on various occasions. For example, linear barcode scanning based services are largely not available on mobile devices with fixed-focus lenses because the barcode images captured by these devices contain excess edge interactions triggered by out-of-focus (OOF) blur, which cannot be handled by current techniques.

Unfortunately, images taken by cell phone cameras are often of low quality. Many cell phone cameras on the market are equipped with low-grade lenses, generally lacking focusing capability, which often produce blurred images. Few cell phones have a flash and, therefore, motion blur and noise can be expected with low ambient light. All of these factors, possibly combined with low image resolution, make barcode reading difficult in certain situations. Indeed, all existing image-based barcode readers have limited performance when it comes to images taken in difficult light conditions, or when the camera is not close enough to the barcode. In order to improve accuracy, barcode reading apps usually prompt the user to precisely position the camera to ensure that the barcode covers as much of the frame as possible. This operation can be somewhat bothersome, as it requires a certain amount of interaction with the user, who needs to frame the barcode correctly using the viewfinder.

EXISTING SYSTEM

Existing system requires that the Barcode has been localized with fairly good precision. This operation is facilitated by the fact that a Barcode is bordered to the side by a white area whose size is prescribed by the standard. We propose a simple and fast algorithm for localization that assumes that the bars are approximately

vertical. The localization algorithm has no pretense of optimality but works reasonably well in existing method. The disadvantages of the Existing methods are (i) OOF blur cannot be handled by current techniques, (ii) not feasible for real-time barcode scanning in real-world situations, (iii) Template matching scheme only matches the scan lines which are not affected by maximum noise & (iv) Its capability of real-time processing, which is made quite impossible because sometimes resolution low images may need to find.

PROPOSED SYSTEM

The proposed approach is different in the aspects that it neither exploits Blur invariant features because none of the currently popular features are robust to severe OOF blur, nor tries to reconstruct OOF free barcode signal from the blurred images because Image Reconstruction is usually a mathematically ill-defined problem, computationally difficult to be dealt with. One notable feature of the proposed system is that its Template Matching scheme takes Image Blur and interactions of character templates into consideration by modelling the waveform of Barcode characters and their interactions at any specific Blur level. This gives the proposed system the capability to deal with severe OOF level. The maximum OOF blur level that can be handled by the current implementation of the proposed system is up to seven times of the X-dimension of a Barcode. Another feature of the proposed system is its capability of Real Time processing, which is needed in practical situations. This feature is made possible by designing a directed graphical model, which not only establishes the relationship between the blurred barcode waveform and its corresponding symbol value

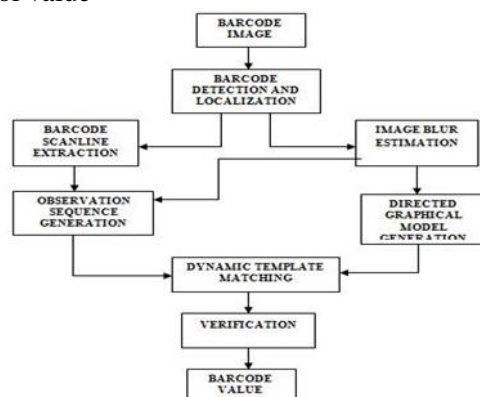


Figure.1. Block diagram of proposed system

DYNAMIC TEMPLATE MATCHING

Dynamic Template Matching (DTM) which can efficiently find the optimal state variable sequence and, therefore, the barcode value. Merits of the Proposed Systems are as .(i) It gives the capability to deal with OOF level. (ii) Its capability of real-time processing, which is made possible by directed graphical model. (iii) Similar to OOF blur any blur can be able to handle by proposed techniques. (iv) Directed graphical model will help to generate closer scan line of original barcodes.

MODULE DESCRIPTION

The work presented in this paper consists of the following major modules such as

- Barcode localization
- Linear barcode scan line segmentation and observation sequence modelling
- Standard reference waveform segments generation
- A directed graphical model
- Dynamic template matching

RESULTS

Figure 2 & 3 shows the Clear & Blurred Input Images .Figure 4 & 5 shows the Gray scale conversion of Clear & Blurred Input Images respectively .Figure 6 & 7 shows the Gradient Images .Figure 8 & 9 shows the Gaussian Motion Filtered Noise. Figure 10 & 11 is the Binarized Barcode. Figure 12 & 13 is Deformed Scanline. Figure 14 & 15 is Observation sequence. Figure 16 & 17 is Standard Deviation Waveform.

FUTURE ENHANCEMENT

This paper mainly addresses the analysis and classification of binary waveforms under OOF blur in the form of linear barcode scanning, the methodology presented can be extended to other Blurs such as moving Blur and other related domains, such as Document Analysis & Recognition, where Image blurs are also challenging issues and Deblurring is normally resorted for Character Segmentation and Word Recognition



Figure 1



Figure 2



Figure3



Figure4

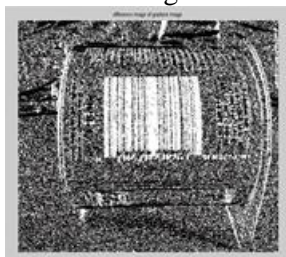


Figure5

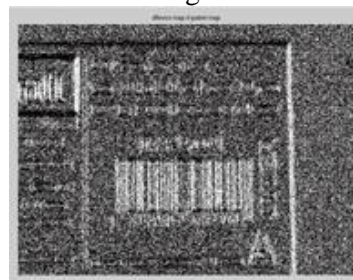


Figure6

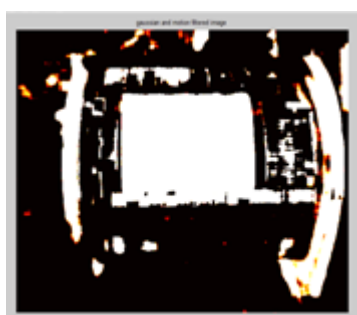


Figure7

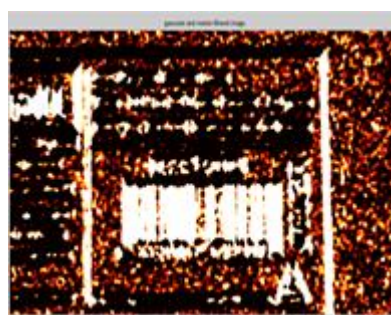


Figure8



Figure9



Figure10

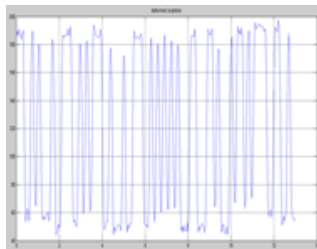


Figure11

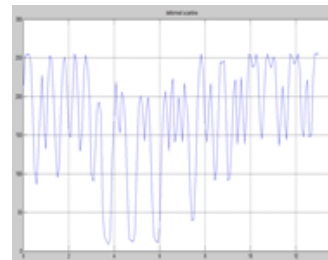


Figure12

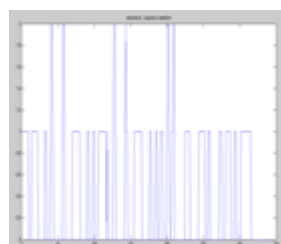


Figure13

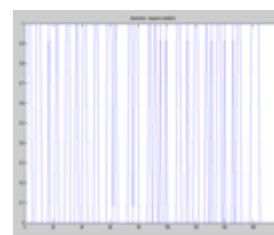


Figure14

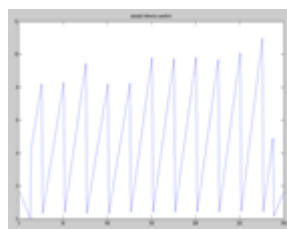


Figure15

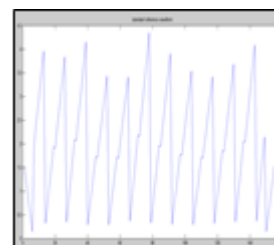


Figure16

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