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DEVELOPMENT OF IMAGE PROCESSING AND ITS APPLICATIONS ON CRYPTOGRAPHY

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ABSTRACT

The importance of embedded applications on image and video processing, communication and cryptography domain has been taking a larger space in current research era. Improvement of pictorial information for betterment of human perception like deblurring, de-noising in several fields such as satellite imaging, medical imaging etc are renewed research thrust. Specifically we would like to elaborate our experience on the significance of computer vision as one of the domains where hardware implemented algorithms perform far better than those implemented through software. So far embedded design engineers have successfully implemented their designs by means of Application Specific Integrated Circuits (ASICs) and/or Digital Signal Processors (DSP), however with the advancement of VLSI technology a very powerful hardware device namely the Field Programmable Gate Array (FPGA) combining the key advantages of ASICs and DSPs was developed which have the possibility of reprogramming making them a very attractive device for rapid prototyping. Communication of image and video data in multiple FPGA is no longer far away from the thrust of secured transmission among them, and then the relevance of cryptography is indeed unavoidable.

KEYWORDS: This paper shows how the Xilinx hardware development platform as well Mathwork's Matlab can be used to develop hardware based computer vision algorithms and its corresponding crypto transmission channel between multiple FPGA platform from a system level approach, making it favourable for developing a hardware-software co-design environment.

INTRODUCTION

Vision processing incorporates human perception and intelligence which makes the field most interesting to the research community as it can mimic human behavior in the computer system by means of video surveillance system, integrating more intelligence to machines such as robots, as well as in ecology, biometrics and medical applications. Interestingly, recent NASA's mission "Curiosity" on Mars, sending valuable images and information of Mars environment in a secure communication channel, transmitted images also need to processed exhaustively to find out any vital information about Mars.

Hardware designs for image and video processing is used for faster performance rather than software, to meet the requirements of the end users, keeping its market relevancy and at the same time security is another concern, so the necessity to communicate these media data securely among multiple platforms after processing to enhance human perception and satisfaction in which our focus lies. The basic 4 steps in image processing domain are pre-processing, segmentation, feature extraction and recognition and those has been keeping their strong importance in research mostly in the case of software implementation and very few implemented on hardware.

IMAGE THRESHOLDING: SEGMENTATION STEPS

The first stage that we can think of in all stage of image processing and analysis is image binarization (i.e. to make binary image, the image should contain any two pixel values either 0 or 1 in contrast with gray images which can contains 255 pixel values for 8 bit image) which poses as one of the serious problem in applications like machine

vision, pattern recognition, target tracking and image segmentation where the gray level information is required to reduce to bi-level information.

In order to extract the useful information from an image it needs to be divided into distinct components like foreground (where pixel value is '1') and background (where pixel value is '0') objects for further analysis where most often the gray level pixels of foreground components are quite different from that of background and in this context a very crucial and significant technique available in literature known as thresholding is applied which is the process of partitioning pixels in the images into object and background classes based upon the relationship between the gray level value of a pixel and the significant parameter threshold to separate the object from the background, finding the correct value of which to separate an image into desirable foreground and background remains a very crucial step in image processing domain . Because of its efficient performance and simplicity in theory, thresholding techniques have been studied extensively and a large number of thresholding methods have been published so far.

A dedicated custom hardware on FPGA can process image in real time with fairly lower processing cost and power compare to software. Field Programmable Gate Arrays (FPGAs), can be used to speed up image processing applications. An application implemented on an FPGA can be one to two orders of magnitude faster than the same application implemented in software where parallel computation of hardware should be one of the important merit of hardware platform.

ALGORITHM FLOW

1) Divide the colour image into its constituent Red, Green and blue component matrices. For each separate channel i.e Red, Green and Blue perform the following
2) Calculate the histogram of individual matrices.
3) Repeat for 1 to n // where n is the total no of different pixel intensity present// Multiply and accumulate a type of pixel intensity with its number of occurance. End
4) Repeat step 3 for red, green and blue matrices.
5) Divide step 3 with the total no of pixels present in a particular matrix to calculate the threshold for it.
6) Construct the binary image for each R,G,B.
7) Add the similar pixel positions for each RGB.$\sum$ (Rij+Gij+Bij) i=1 to m and j= 1 to n, where m and n are the total no of rows and columns…
8) If summation is less than 1 set
   Output pixel <= '0';
   Else
   Output pixel <= '1';

RESULTS AND OBSERVATION

The signals may be formatted in a logic or analog format and may be viewed in binary, hex, or decimal radices. It was obtained from execution of the code. It consists of two parts viz: the left portion showing the parameter list and the right one having the results corresponding to each of the parameters on the left-hand-side. All these values are in decimal. The RGB value is represented in decimal terms.

CONCLUSION

Here throughout this paper we briefly discussed the work that has been carried out on image processing domain particularly by emphasizing its implementation on hardware device and also transmission of image data through a secured way. This paper will encourage the further initiatives to be taken for implementation of work in such domain. In the paper the time complexity of the whole thresholding method and limitation of image data to be stored in the FPGA board are few limitation that has to be taken care, we stared working on basic filtering mechanism, digital image water marking and some other issues related to image security and in near future we could propose some innovative idea related to this.

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