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SPECIAL ISSUE ON RECENT RESEARCH CHALLENGES IN BIO-MEDICAL APPLICATIONS

Geometric Based Bank Cheque Segmentation- A Heuristic Approch

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Bank cheque process in banking industry requires lot of human time and delay in the process. An automated bank cheque processing using machine vision approach and image processing algorithms will overcome the above drawbacks. So in this work automating the bank cheque process system is proposed.This automation system involvesegmentation,feature extraction and object recognition. Among them the segmentation is the fist process that segments require parts from the cheque image in order to extract the require features for the further process. There are many segmentation algorithms are presented in the literatethat has good quality of segmentation with the high computation cost. In this work a heuristic based geometric based segmentation technique that will segment the required parts of the check for the feature extraction is presented. This methods offer very good accuracy with less computational complexity comparing other methods.

Key words: Automation, Image segmentation, Machine vision.

Machine vision (MV) is the technology and methods used to provide imaging-based automatic inspection and analysis for the applications such as process control, automatic inspection and robot guidance in industry. Among that application automated process for quality control and industrial process has recent focus in the area of machinevision. They are few image processing based quality access machine vision techniques in the literature. Aflatoxin detection in chili pepper by machine vision is reported in[1],in this work based on hyper spectral imaging and machine learning a compact machine vision system is proposed.An egg grading system based on combined fuzzy logic and machine vision techniques for grading of egg using parameters such as defects such as internal blood spots, cracks and breakages of eggshell and size of eggs are proposed[2]. The Correct Classification rate (CCR) was reported as 95% for size detection, 94.5% for crack detection and 98% for breakage detection. As the machine vision is used in many industries as agriculture, robotics,manufacturing process, etc. Banking industry is the one where many innovation taking place to avoid the delay in getting services. In that case we need to replace human operatorbased services by machine services or digital services which will avoid delay in giving service and reduces human resource cost and speed up the banking process. Currency counting machines, Automatic teller machine and Internet banking are such an innovation that are taken place lost few decade in this direction. But there are only very few attempt make in the banking services automation using machine vision and image processing. A2iA Cheque Reader[4] have been reported that processing cheques in France, America, Canada and many other countries. Courtesy amount can be recognized automatically with high reliability in these systems. A prototype system of courtesy amount recognition (CAR) for Chinese bank cheques is proposed in[3].

Bank cheque is a complex document with many information fields such as cheque amount in number, cheque amount in words,account number,

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date of the cheque, payee person name, cheque number and signature. There is lot of challenges in processing the bank cheque image by image processing algorithm. Usually cheque amount is indicated twice as a numeral expressed in digits (courtesy amount), and as a phrase expressed in words (legal amount). Cheque processing system should be able to correctly read the numerical value representing the sum to be paid to the owner of the cheque; it has to validate the signature of the person, and has to verify the date of the cheque. All the task are related to pattern recognition tasks that require lot of computational power but the accuracy of such task depends on the accurate segmentation of the components from the cheque image. In[6] aline segmentation algorithm based on the computation of an information content level/ energy, for each pixel of the image and seam carving procedure is proposed.Segmenting text and graphics part of document images based on textural cues is presented using Wavelet Scale–Space Features in[7]. Which involve computational task such as wavelet transform. A multi-scale segmentation scheme for mixed raster content (MRC) document encoding is proposed[8] which use two stage segmentation mechanisms. In first stage a blockbased cost optimized segmentation (COS) algorithm is formulated in a global cost optimization framework is done and in the second stage connected componentclassification (CCC) is used to filter the early segmentation by classifying feature vectors of connected components using an Markov random field (MRF) model. All the above discussed approach require some high level of computation and computational time which will introduces some amount of delay in the process of bank check system. So a low complex,accurate segmentation of all the components in the check image is proposed in this paper.

System model

A general machine vision system consists of sub systems like image capture hardware system, segmentation section, feature extraction system and pattern recognition system. This general system model for the machine vision is illustrated in the fig.1. Image capture system should be designed with carefully with incorporating the mechanisms need for the target application. This involves electromechanical system design. Image segmentation is the process of segmenting the required object from the mixture of object in the given image. It will facilitate only to extract the required region of interested portion of the image. Feature extraction is the process of extracting the required feature from the segmented portion of image in order to find out some pattern of interest is presented or not. Pattern recognition is the process of matching the extracted feature with the stored template features in order to find the required feature is available in the given input image or not.

In this work the first stage of the machine vision system that is the segmentation is focused. The system model fist converts the RGB scale image into gray scale image then it finds the size of the image i.e.the geometric area if the image based on the size of the image.Based on human heuristic the geometric position of the individual components of the cheque image like account number, payee name, date of the cheque, amount to be paid, cheque no and signature of the persons are segmented. The following equations will give the various co-ordinate of the bank check image

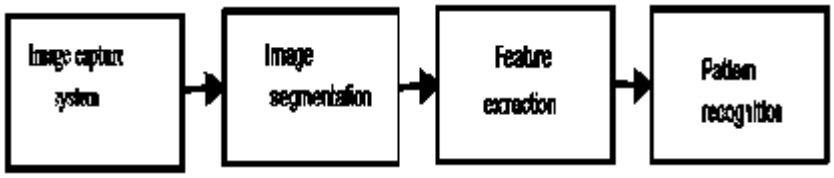

Fig. 1. General machine vision system block diagram

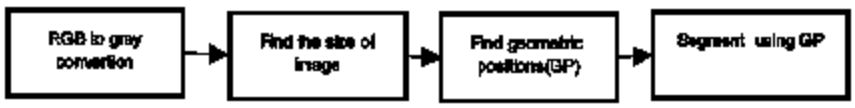

Fig. 2. Geometric based cheque image segmentation system block diagram

$$C_{PER} = (x_{per}, y_{per}) = (round\left(\frac{R}{5.7}\right), round\left(\frac{C}{7.4}\right)) \quad ...(1)$$

Where R is the no of rows in the given input image is the no of columns in the given input image;

C_{PER} is the co-ordinate of the top corner of the rectangle which has the name of the person towhom the cheque is written.

Similarly the coordinate of other interested portion of the cheque image is given below

$$C_{sig} = (x_{sig}, y_{sig}) = (round(\frac{R}{1.96}), round(\frac{C}{1.43})) \quad ...(2)$$

$$C_{amt} = (x_{amt}, y_{amt}) = (round(\frac{R}{2.83}), round(\frac{C}{1.41})) \quad ... (3)$$

$$C_{dat} = (x_{dat}, y_{dat}) = (round(\frac{R}{17.23}), round(\frac{C}{1.21})) \quad ...(4)$$

$$C_{ac} = (x_{ac}, y_{ac}) = (round(\frac{R}{1.81}), round(\frac{C}{41.66})) \quad ...(5)$$

$$C_{cn} = (x_{cn}, y_{cn}) = (round\left(\frac{R}{1.16}\right), round\left(\frac{C}{4.16}\right)) \quad ...(6)$$

$$C_{amtw} = (x_{amtw}, y_{amtw}) = (round(\frac{R}{345}), round(\frac{C}{33.33})) \quad ...(7)$$

The dimension of the rectangles for each and every portion of the image in cheque image is another feature using which the interested portions are segmented. The size of the rectangleiewidth and height of rectangles are fixed one which will not vary for the given size of the image and focal length. Assuming the image capturing unit always has a fixed focal length and the resolution of the image capturing device also fixed one, we can approximate the dimensioniewidth and height of the rectangles of the interested portion. The following set of equations defines the dimension of the interested portion of the check image.

$$D_{PER} = (W_{per}, H_{per}) = (round\left(\frac{C}{1.42}\right), round\left(\frac{R}{7.22}\right)) \quad ...(8)$$

Where D_{PER} is the dimension of the rectangle ie width and height for the name of the person;

Fig. 3. Input check image

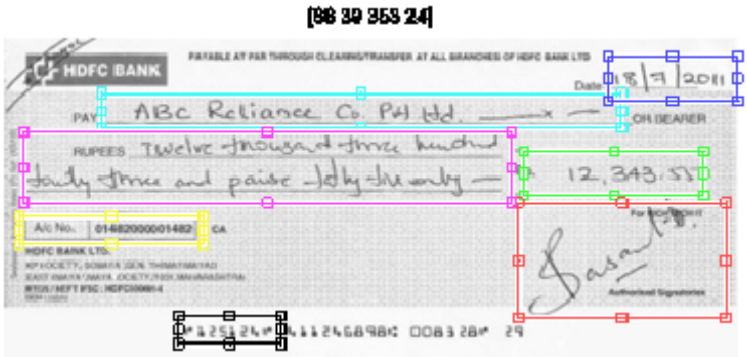

Fig. 4. All check portion geometric position with rectangular mark

W_{per} is the width of the rectangle portion of name of the person to whom the check is written, like wise H_{per} is the height of the rectangular for the name of the person. Likewise other sections dimensions also defined by the following set of equations

$$D_{sig} = (W_{sig}, H_{sig}) = (round\left(\frac{C}{3.55}\right), round\left(\frac{R}{2.8}\right)) \quad ...(9)$$

$$D_{amt} = (W_{amt}, H_{amt}) = (round\left(\frac{C}{4.1}\right), round\left(\frac{R}{7.22}\right)) \quad ...(10)$$

$$D_{dat} = (W_{dat}, H_{dat}) = (round\left(\frac{C}{5.68}\right), round\left(\frac{R}{7.23}\right)) \quad ...(11)$$

$$D_{ac} = (W_{ac}, H_{ac}) = (round\left(\frac{C}{4}\right), round\left(\frac{R}{11.2}\right)) \quad ...(12)$$

$$D_{cn} = (W_{cn}, H_{cn}) = (round\left(\frac{C}{7.14}\right), round\left(\frac{R}{11.2}\right)) \quad ...(13)$$

$$D_{amtw} = (W_{amtw}, H_{amtw}) = (round\left(\frac{C}{1.51}\right), round\left(\frac{R}{4.48}\right)) \quad ... (14)$$

Table 1. Check features geometric positions and dimensions

S. No	Check Feature	Corner co-ordinate (col,row)	Width (in pixel)	Height (in pixels)
1	Name of the person	(68 ,39)	353	31
2	signature	(351,115)	141	80
3	Date	(412,13)	88	31
4	Account number	(12, 124)	125	20
5	Amount in number	(355, 79)	122	31
6	Amount in word	(15 ,65)	331	50
7	Check number	(120,193)	70	20

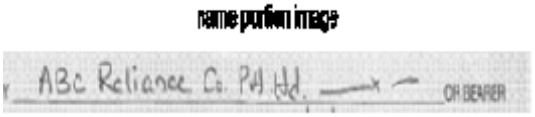

Fig. 5. Name of the person segmented

Using the above set of equations the required portion geometric location, their rectangular is defined and they are segmented from the input image with simple calculation of divisions comparing other complex segmenting techniques.

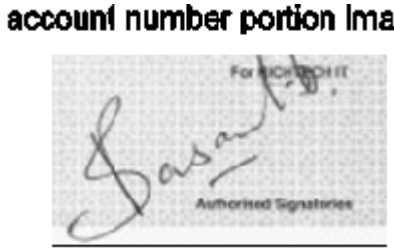

Fig. 6. Signature portion segmented

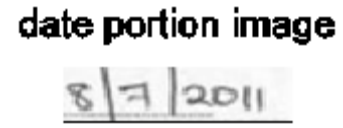

Fig.7. Date portion segmented

Fig. 8. Account number segmented

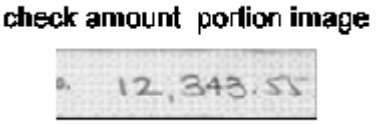

Fig.9. Check amount segmented

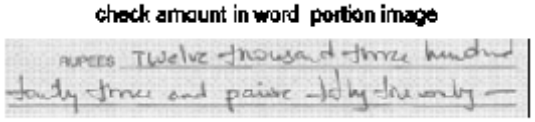

Fig.10. Check amount in words portion segmented

Fig.11. Check number segmented

RESULTS AND DISCUSSION

The entire system for segment the portion of the bank check is simulated in MATLAB.A sample HDFC bank chequeis taken to test the system. Figure 3 gives input image after conversation of RGB to gray image.

Based on the size of the input image the geometric location of the rectangle geometric shape for the various interested portion of the cheque image is obtained by using the equations defined in the system model section. In this work image size of 224x500 is used as input image. After finding the coordinates and dimensions of the rectangles the findings are marked as rectangle as shown in the figure 4. From the figure it is observed that the proposed method finding the exact coordinates and rectangular dimensions for all the interested portion of the bank chequeimage

The exact coordinates, rectangular dimensions ofall the interested portion of the bank cheque image is given in the table I for the given input image of size 224x500. All the values are given in the unit of no of pixel ie 353 width means the width is 353 no of pixel in x direction(x coordinate);31 height means 31 pixel height in y direction(y coordinate).Likewise the coordinate point (68,39) meant for the top left corner of the rectangular is at 68 th column and 39 throw in the given image.

After locating the top left corner of the rectangle and dimensions of the rectangular of every interested portion it is very easy to segment them from the input image. The interested portions that are segmented by the proposed approach is given in the figures from figure 5 to figure 11. From the figures it is evident that this geometric based approach segments the entire interested portion successfully

CONCLUSION

In this work heuristic based low computational complex geometric position based image segmentation for bank cheque feature segmentation is presented. Theresults show that the proposed method will segment the entire cheque feature accurately.As this system is low computation complex it can be implemented in practical automated cheque processing system using image processing algorithms. Since under machine vision system the size of the image and the focus length is fixed under the system consideration the proposed algorithm will work out in all practical system. Because of the location of the all the components like cheque number, account number, payee person name, and date and cheque amount are fixed and will be appear on the same location this geomantic location based segmentation will be functioning very well.

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