Information Engineering (IE) Volume 4, 2015
doi: 10.14355/ie.2015.03.004

The Best Jumper Points Design of the Sewing Machine

Shih-Yen Huang [1], Chin-Chiang Huang[2], Wen-Yuan Chen[*3], Chiu-Keng Lai[4] and Yi-Ying Chang[5]

[2,3] Department of Electronic Engineering, National Chin-Yi Institute of Technology

[1,5] Department of Computer Science and Information Engineening, National Chin-Yi Institute of Technology

[4] Department of Electrical Engineening, National Chin-Yi Institute of Technology

[1]syhuang@ncut.edu.tw, [2]gtmpandayo@gmail.com, [3]cwy@ncut.edu.tw, chiukl@ncut.edu.tw, tony@ncut.edu.tw

Abstract

This article uses the principle of Wavelet transformation and Quad-tree structure to find the best jumper points of embroidery machine. Embroidery want the image to be cut into four equal parts. Furthermore, to judge each part if there exist two object for connection jumper point selection. For special case, the four parts divided will be extended until the best jumper point were found. According to the simulation results, our method is evidently an effective and high quality method for sewing machine for embroidering purpose.

Keywords

Sewing Machine; Quad-tree; Jumper Points; Image Processing

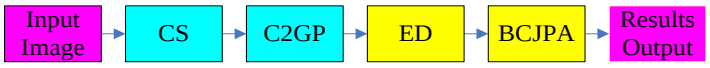
Introduction

The performance of the textile industry has increased steadily in recently years. For example, the total revenue are 14.158 billions, 15.123 billions, 15.866 billions and 17.91 billions in 2012, 2013, 2014 and 2015, respectively. The sales amount is positive growth, it is expressed as an increase in garment manufacturing time. If we can reduce the working time, the company's production capacity can improve. It can also increase the company's profit.

Path planning will be used in the sewing machine for embroidering. This technique can improve the efficiency of sewing machines. Chen et. al. [1] published an article *Image-Based Obstacle Avoidance and Path-Planning System* and Rigasova [2] proposed the Path planning algorithm based on search algorithm, edge detector and GPS data/Satellite image for outdoor mobile systems are offer the information about the path planning studies. Other related path algorithm can refer to [3-4]. According to the [5-8], it can be found these sewing techniques, but they did not discuss about the best connection points. In order to improve sewing techniques, we proposed the Quad-tree technique to accelerate the search time for searching the best connection jumper point of the sewing machine.

The Best Jump Point Algorithm

In this paper, we focus on the best connection jump point design for sewing machines. It is a part of the picture of sewing techniques. Figure 1 shows the flow chart of the best jump point design. At beginning, the color picture is entering to the system. And then the color segmentation was used to separate the picture into several parts which are the same color. In practical, the same color parts will be processed at the same time. Due to the fact that greyscale is suitable for the image processing. Therefore, we use the color to greyscale mapping to transfer the color picture into greyscale picture. Next, edge detection was used to obtain the edge of the picture. Once we get the edge and each color parts, we use the quad-tree technique to get the best jump point information. The sewing machine can achieve best efficient and best quality on the picture embroidering.



CS : Color Segmentation ED : Edge Detection
BCJPA : Best Connection Jamp Point Algorithm
C2GP : Color to Grayscale Maping

FIG.1 THE BEST JUMP POINT ALGORITHM

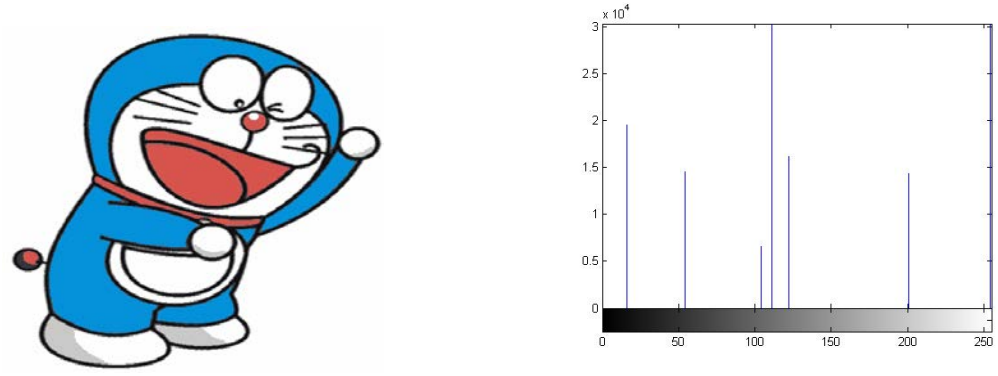
Color Segmentation

Color segmentation was used to divide several same color parts from a picture. Figure 2 shows a test example. Figure 2(a) shows the test picture and figure 2(b) is the histogram which is corresponding to figure 2(a) in greyscale.

FIG. 3 displays the classified results. Figure 3(a) shows the class that the pixel value is 17 and figure 3(b) shows the pixel value is 55. Similarly the pixel value is 105, 112, 123 and 202 are the values correspond to figure 3(c), 3(d), 3(e) and 3(f) respectively.

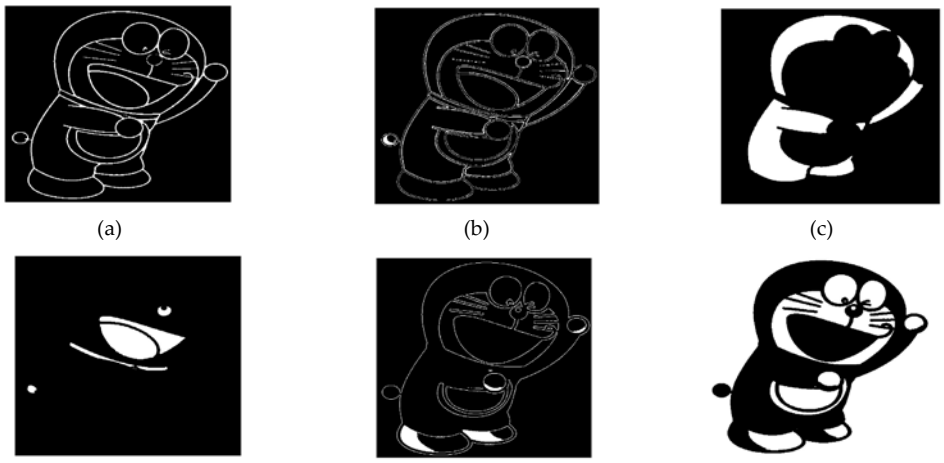
In the paper, we use the concept of the wavelet techniques and Quad-tree structure to design a best connection jump point design.

According to the [9-10], the sewing step and sewing jumper points are on the edge, so to find the side track is important. In edge detection, we put the original picture and erosion operation to produce a good performance edge image. From the simulation result, it is superior to the Sobel operation or Canny edge detection.



(a) (b)

FIG.2 COLOUR SEGMENTATION; (A) THE TEST IMAGE (B) THE HISTOGRAM OF CLUSTERING



(a) (b) (c)

(d) (e) (f)

FIG. 3 THE CLASSIFIED RESULTS; (A) THE PIXEL VALUE IS 17, (B) THE PIXEL VALUE IS 55, (C) THE PIXEL VALUE IS 105, (D) THE PIXEL VALUE IS 112, (E)A THE PIXEL VALUE IS 123, (F) THE PIXEL VALUE IS 202

The Best Jump Point Search Method

A picture can be divided into several independent objects. When the sewing machine do embroider action, jumping to the other object is necessary. Thus search the best jump point is important. Figure 5 shows the best jump point situation for a picture. In the figure, the green points are the best jump points.

The wavelet concept divides the picture into four parts first. And then check each part if it includes two objects. If the answer is yes, then search the best jump points. If the part only has one object then the part can be discarded because there is no jump exists. FIG. 5 shows the process of dividing the picture into several parts for searching the

best jump points. Figure 5(a) is the original test picture. Figure 5(b) and figure 5(c) are the parts include two objects. Similarly, Figure 5(d) and figure 5(e) are the parts only have one object, it means no jump point needed.

FIG. 4 THE SCHEMATIC OF THE BEST CONNECTION JUMP POINTS

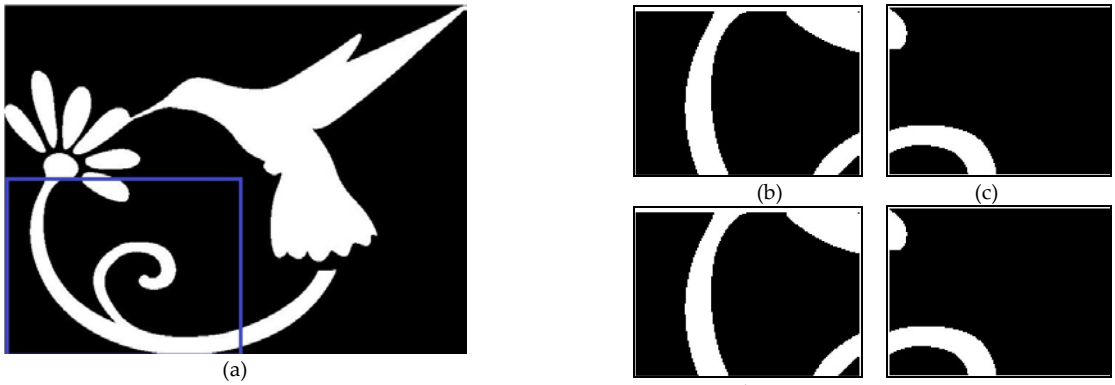


FIG. 5 THE PROCESS OF DIVIDING THE PICTURE INTO SEVERAL PARTS FOR SEARCHING THE BEST JUMP POINTS; (A) THE ORIGINAL PICTURE, (B) THE PART INCLUDE TWO OBJECTS, (C) THE PART INCLUDE TWO OBJECTS, (D) THE PART ONLY HAS ONE OBJECT, (E) THE PART ONLY HAS ONE OBJECT

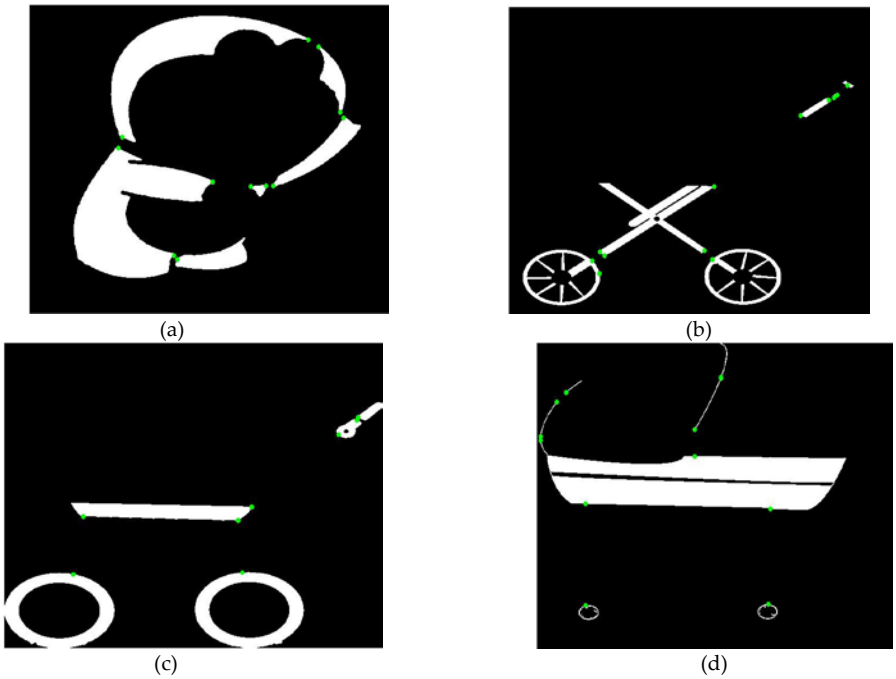


FIG.6 THE SUCCESSFUL TEST RESULTS; (A)CASE-1, (B) CASE-2, (C)CASE-3, (D)CASE-4

Experimental Results

In order to demonstrate that our method is effective and of high quality, several image are used to simulation.

From the simulation results it is evident that the wavelet based quad-tree structure is suitable for the sewing machine to find the best jump point search.

Figure 6 shows the successful test results of the best jump point design for the picture. Figure 6(a) is the best jump point design of the case-1 picture. Figure 6(b) shows another best jump design of the case two picture. Simultaneously, Figure 6(c) and figure 6(d) are the successful jump point design case of different pictures.

Conclusion

In this paper we use the shortest distance technique, the wavelet concept and Quad-tree structure to search the best jump points for sewing machine.

We use the wavelet concept to obtain a suitable jump point search. Besides, we use the Quad-tree structure to obtain a computation complicate. From the simulation results, it is demonstrated that our method obtain 29.9% ~ 55.6% computation reduce time

ACKNOWLEDGMENT

This work was partly supported by the National Science Council, Taiwan (R.O.C.) under contract NSC 101 - 2221 – E - 167 – 034-MY2. References

REFERENCES

[1] Chen.Y. H , Chen. M. C, Li. I, Wang. W. Y, and Su. S. F ,"Image-Based Obstacle Avoidance and Path-Planning System", IEEE International Conference on System Science and Engineering, 2013, pp. 205 – 209

[2] Zidek, K, Rigasova, E"Path planning algorithm based on search algorithm, edge detector and GPS data/Satellite image for outdoor mobile systems", Applied Machine Intelligence and Informatics (SAMI), 2012, pp.349 – 354

[3] Lin. Z. D." Covering the whole field of home cleaning robot's path planning and implementation".[D], Taiwan,National Cheng Kung University Department of Engineering Science, 2005

[4] Zhang. J. "A * algorithm to improve the planning of a better guide paths"[D], Taiwan, Tatung University Information Engineering Institute,2009

[5] Li. J. Y. "Development of an Automatic Sewing Machine by Embedded Controller"[D], Taiwan, Konkuk University of Science and Technology, Institute of Electrical and Automation Engineering-cum-light system, 2008

[6] Lin. C. Y. "Development of Sewing Path Design Software for Broidery"[D], Taiwan, Konkuk University of Science and Technology, Electrical Engineering, 2005

[7] Tsai. T. R." Machine vision based servo control of a robotic sewing system"[D].Taiwan, National Yunlin University of Science and Technology, Mechanical Engineering, 2012:5-8.

[8] Chen. C. N. "Analysis & Design Practice of the industrial design development for the OBM household sewing machine–Case study of RICCAR"[D]. Taiwan, Chaoyang University of Technology, Master of Design in Industrial Technology R&D, 2011.

[9] Yang. Z. Y "A Fast Inter Residual Quad-Tree Construction Construction Method in HEVC" [D].Taiwan, National Cheng Kung University institute of Computer and Communication Engineering

[10] Tan. Y. H, Yeo .C, Tan .H .L, and Li. Z ,"On residual quad-tree codingin hevc "in Multimedia Signal Processing(MMSP),2011 IEEE 13th

[11] Cheng, S.C, Yang ,C.K, "A fast and novel technique for color quantization using reduction of color space dimensionality"[C] Pattern Recognition Letters(Volume 22, Issue 8)2001,pp. 845–856

Chih-Chiang Huang was born in Taichung, Taiwan, in 1992. He received the B.S. degree in Department of Electronic Engineering from National Chin-Yi Institute of Technology in 2010 and 2014. Currently, he is studying for his master degree on Department of Electronic Engineering from National Chin-Yi Institute of Technology. His research interests include image analysis, wind energy, Electromagnetic Compatibility.

Shih-Yen Huang received the PhD Degree in Electrical Engineering in 2005 from National Cheng Kung University, Tainan, Taiwan. Currently, he is an associate professor at the National Chin-Yi University of Technology, Taichung, Taiwan. His research interests include image processing, object recognition, object tracking, and application of micron processor.

Wen-Yuan Chen was born in Taichung, Taiwan, in 1957. He received the B.S. and M. S. degrees in Electronic Engineering from National Taiwan University of Science and Technology in 1982 and 1984, respectively, and the Ph.D. degree in Electrical Engineering from National Cheng Kung University at Tainan Taiwan, in 2003. Since 2007, he has been a Professor in the Department of Electronic Engineering at National Chin-Yi University of Technology. His research interests include digital signal processing, image compression, pattern recognition and watermarking.

Chiu-Keng Lai received the B.S. degree in Electronic Engineering from National Taiwan University of Science and Technology, Taipei, Taiwan in 1989, and the M.S. and Ph.D. degrees in Electrical Engineering from National Central University, Chung-Li, Taiwan in 1991 and 2001 respectively. In 1992, he joined the National Chin-Yi Institute of Technology (NCIT), Taiping City, Taiwan. In 2003, he was an Associate Professor in the Institute of Information and Electrical Energy in NCIT. In 2006, he joined the department of Electrical Engineering in National Chin-Yi University of Technology, and he is now the Director of the department. His teaching and research interests include variable-structure system applications for motor control, PC-based control system design, DSP-based control system and motor drive design, and digital circuit design with FPGAs for motor drives.

Yi-Ying Chang, he received his college graduate in Electronics Engineering (1982), and Master degree in Computer Information Science (1997) in the Department of Computer Information & Science Engineering in Knowledge System Institute, Skokie, Illinois USA. He received the Ph. D degree in Electrical Engineering Department of National Cheng Kung University, Tainan, Taiwan. His research interests include image enhancement, segmentation and application of Internet of Things. He joined the National Chin-Yi University of Technology in 1982 and he is an Associate Professor of Department of Computer Science and Information Engineering of National Chin-Yi university of Technology.