International Journal of Innovative
Computing, Information and Control
Volume **5**, Number **9**, September **2009**

ICIC International ©2009 ISSN 1349-4198
pp. **2593–2602**

AN IMPROVED LIVE WIRE ALGORITHM FOR BAREFOOT HEEL IMPRESSION EXTRACTION

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Received March 2008; revised September 2008

Abstract. *The distribution of barefoot impression reflects the behavioral and physiological feature of human body, and has extensive application in criminal investigations. Appropriate characteristics suitable for study can be retrieved from heel impression by scanning the bare footprint in human footprint recognition system. In this work, an improved live wire processing method has been proposed to extract the barefoot heel impression exactly. According to the characteristics of footprint image, a new cost function has been defined in the live wire method. In order to improve the efficiency and accuracy of the extraction, ant colony optimization (ACO) algorithm has been employed to replace the Dijkstra method to find the shortest path, and to obtain the effective edge. The least square method was used then for ellipse fitting to obtain the parameters. The experimental result shows that the improved live wire method is effective in extracting barefoot heel impression.*

Keywords: Live wire, Shortest path, ACO algorithm, Dijkstra

1. **Introduction.** Human beings spend most of the time standing when they are awake, thus some information of them can be reflected by the distribution and magnitude of footprint impression. The shape of heel impression not only reflects the behavioral and the physiological feature of human beings, but also serves as foundation of footprint identification. In the study of automatic footprint recognition system, the extraction of heel impression edge is critical [1,2] to analyze the feature of the human body. Nowadays the barefoot impression recognition still remains in the stage of expert identification, and it can not be performed automatically.

The main difficulty in footprint recognition is caused by the variability of footprint features. Though barefoot impression is mainly decided by human beings' foot bone distribution, one leaves different barefoot impression when he is in different walking gestures. Some simple edge detection algorithms can be only used to get the barefoot's contour [3,4], while is unable to retrieve the edge of hell impression. The structure of the barefoot image shows as Figure 1. In Kennedy's [5,6] study, CAD software was used to get geometric measurements for manual traced footprint graphics, and part of shape landmarks still needs to be located in an alternate way. Kazuki *et al.* [7] developed an automatic footprint-based personal identification system. Under low image resolution, only features of direction and position for whole footprints were extracted.

In order to identify the characteristics of human beings, the extraction of heel barefoot impression has been studied. An interactive segmentation algorithm, based on computational geometry, has been employed to precisely extract the shape of barefoot impression. Several recent works have demonstrated that it is unable to fully solve the problem of weak edge characteristics, exhibited by the heel barefoot impression in the footprint images. This work proposes an improved heel barefoot impression extraction method, based