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Title Fast Contour-Tracing Algorithm based on Pixel-Following Method for Image Sensors

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Abstract Contour pixels distinguish objects from background. To trace and extract contour pixels is widely used for smart/wearable image sensor devices, because it is simple and useful to detect objects. In this paper, we present a novel contour-tracing algorithm for fast and accurate contour following. The proposed algorithm distinguishes between different types of contour such as a local pattern-type based on its relative location among several contour pixels, and it then traces the next contour pixel using the previous one. Therefore, it can classify the type of contour pixels as a straight line, inner corner, outer corner, and inner-outer corner, and it can extract pixels of a specific contour type. Moreover, it can trace contour pixels rapidly because it can determine the local minimal path using the contour case. In addition, the proposed algorithm is capable of compressing data of contour pixels using the representative points and inner-outer corner points, and it can accurately restore the contour image from the data. To compare the performance of the proposed algorithm with that of conventional techniques, we measure their processing time and accuracy. In the experimental results, the proposed algorithm shows better performance compared to the others, and it can provide compressed data of contour pixels and restore them accurately, including the inner-outer corner, which cannot be restored using conventional algorithms.

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**Comments and Suggestions
for Authors**

Dear Authors, i enjoyed reading your manuscript describing your novel method of contour tracing.

I suggest three minor points of improvement:

1) In the experimental results section (5.2), the performance of the proposed algorithm is compared to several other established algorithms. The measurement is repeated 10 times per image, but only the mean results are given in the corresponding table.
 Either the algorithms are deterministic and always require the same processing time, or there is a random component (selection of starting points for contour tracing?) that might cause fluctuations. I suggest that you provide the variance / standard deviation in the tables or - if those are zero or neglectable - discuss in the text why it is not necessary to provide the variance.

2) in general, the figure captions should be more self-explaining. Some of your figure captions are very short and hence can not be easily understood without first reading the text.

3) in the conclusion section, you should discuss that the proposed algorithm is (much?) more complex than older methods, but that this higher complexity is justified by improved quality , speed and compression as shown in your experimental results.

What follows is a list of suggested changes to the text and figures.

abstract

L4: "The proposed algorithm distinguishes between different types of contour such as a local pattern-type based on its relative location among several contour pixels, and it then traces the next contour pixel using the previous one." <-- this is hard to understand please simplify / split it into two sentences.

L13: "In the experimental results, ..." <-- please split into two or more sentences.

Keywords: the fact that your proposed algorithm can compress contour data is missing. please find a keyword that makes this clear - maybe "contour pixel compression" ?

L30: change to "smart watches and smart glasses,"

L34: change to "they require simple and fast"

L43: change to "cannot restore the contour"

L50 to 56: "The paper is organized as follows. In the next section.. " alternatively, you could enumerate the sections: In section 2, ... In section 3, we describe.. and so on.

the sentence "Subsequently, we.." is very long with lots of commas. please split it up into two or more sentences to make it easier to read.

L61: please delete "are used to"

L78: please change to "These methods require a frame-size memory to trace the contour, and generate erroneous images when the contour image is enlarged [17] because they maintain only the pixel coordinates." (if that is true for all the cited pixel following methods)

L101: change to "The method uses only one or two line buffers, and therefore requires a smaller amount of memory compared to the pixel-following and vertex-following methods."

Figure 2: please describe not only in the text, but also in the figure caption what "O", "I" and "IO" means. for example: "Types of contour pixels: inner corner pixel (I), ..."

Figure 4: please remove the text-shadow from the description-text on the right side ("d: do not care .. ") depending on the zoom level the pdf is viewed with, the shadow produces ugly artifacts.

L214: change to "The pixel-following algorithm requires start- and stop-criteria to avoid incomplete or infinite contour tracing."

Figure 10: the quality can be slightly improved by making sure that the text is not overlapping with lines / arrows (for example "B: black pixel" is overlapping with an arrow)

L316: please change to something like "The pseudocode of the proposed algorithm is shown in box 'Algorithm 3'."

L340: please change to "we propose"

Figure 15: please shortly describe the problem at hand also in the figure caption, or refer to the text ("see text").

section 5.1 please describe, how the "Total Number" of contour pixels was obtained. Was this done by hand ? or was that done by using some other algorithm and correcting errors made by that algorithm by hand ?

Figure 16: please change to "Visual comparison of two Contour Tracing Methods. (a) MSBF (b) Proposed method."

Figure 17 - please change similarly to Fig. 16.

L404: please change to "As shown in figure 16a, MSBF was not able to trace some of the inner corner pixels, but our proposed method (figure 16b) was able to trace all the corner-pixel types without any inconsistency."

Figure 20: please change to: "Experimental Result for CCITT #1. Contour pixels are shown in black, original image pixels in grey".

Date & Signature

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Date of this review 12 Jan 2016 11:46:57