Accurate detection of ellipses with false detection control at video rates using a gradient analysis

Huixu Dong , Dilip K. Prasad , I-Ming Chen

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Highlights

- This paper presents an ellipse detection method that combines the advantages of arc extraction and arc grouping to guarantee the effectiveness of ellipse detection and optimizes the computation cost.
- In the step of smooth arc extraction, we propose a novel approach of identifying the precise splitting points (sudden changes) in order to achieve better segmentations from curves to smooth arcs that may belong to ellipses. A coarse search for sudden changes is first performed with a big range, and then such points are determined with a finer scope.
- We present a novel method to estimate the ellipse centre by an iterative mean-shift clustering algorithm, which improves its robustness to noise and obtains a more precise centre comparing the existing methods that determine ellipse centres.
- We adopt the ratio of half of the circumference of the bounding box enclosing an arc and the sum of the semi-axes lengths to measure the integrity of ellipse to improve the detection accuracy.
- We propose a new approach of false determination control to determine detection results based on the intrinsic geometric attribute of ellipse expressed by a mathematical model, which avoids false detections effectively.

* Corresponding author. Tel./Fax: +65-6790 5568/ 6793 5921
E-mail address: dong0076@e.ntu.edu.sg (Huixu Dong)