Exp Astron (2013) 36:591–629
DOI 10.1007/s10686-013-9346-1

ORIGINAL ARTICLE

A quantitative analysis of source detection approaches in optical, infrared, and radio astronomical images

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Received: 7 February 2013 / Accepted: 14 August 2013 / Published online: 19 September 2013
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Abstract A variety of software is used to solve the challenging task of detecting astronomical sources in wide field images. Additionally, computer vision methods based on well-known or innovative techniques are arising to face this purpose. In this paper, we review several of the most promising methods that have emerged during the last few years in the field of source detection. We specifically focus on methods that have been designed to deal with images with Gaussian noise distributions. The singularity of this analysis is that the different methods have been applied to a single dataset consisting of optical, infrared, and radio images. Thus, the different approaches are applied on a level playing field, and the results obtained can be used to evaluate and compare the methods in a meaningful, quantitative way. Moreover, we present the most important strengths and weaknesses of the methods for each type of image as well as an extensive discussion where the methods with best performances are highlighted.

Keywords Data analysis · Image processing · Source detection · Quantitative analysis

1 Introduction

Computer algorithms to detect sources in astronomical images are used to automate a part or the whole process of generating object catalogues in a quick, efficient, and more objective way than a human evaluation. These algorithms use several techniques from the image processing and computer vision domains. They are implemented in a wide variety of software products, whether developed to be distributed as

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