

Application of an automated statistical method to detect star clusters in the Small Magellanic Cloud.



Drazinos P. ⁽¹⁾, Hatzidimitriou D. ⁽¹⁾, Strantzalis A. ⁽¹⁾, Zezas A. ⁽²⁾ and Antoniou V. ⁽³⁾

⁽¹⁾ University of Athens, School of Physics, Department of Astrophysics, Astronomy and Mechanics, Panepistimiopolis, Zografos, GR15784, Greece

⁽²⁾ Department of Physics and ITCP University of Crete, 71003, Heraklion, Greece

⁽³⁾ Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA

Introduction – Aims

We have applied an automated statistical method in multi filter observations of four fields covering the central region of SMC. The observations were performed by V. Antoniou, A. Zezas and D. Hatzidimitriou with the 6.5m Magellan Telescope at Las Campanas observatory in Chile. Photometric and astrometric studies for the observations were performed by Strantzalis (2012). Our aims are:

- Compare our study with published catalogs, Bica et al (2000), Bonnato and Bica (2010) and Glatt et al (2010).
- Verify the existence of the cataloged clusters.
- Use the verification process to refine the cluster identification criteria
- Use our automated method to identify new clusters and to supplement the investigated catalogs.

Method

• For the identification of star clusters we use a modified Friend of Friend (FoF) algorithm (Drazinos et al 2013) alongside other techniques as isopleth contours, radial profiles and CMD's of the identified clusters. Our study is divided in two phases.

• During the initial phase we use our automated technique in two filters, I and B, to search and identify known clusters in order to define the search parameters of our method (Piatti et al 2016).

1. The FoF algorithm is applied with no prior knowledge of the published catalogs to identify clusters.

2. Use surface density isopleth contours of the area where the clusters are located in order to verify the existence of known clusters apart from the FoF algorithm.

3. Make radial profiles of clusters.

4. Compare their CMD's with the background.

• Clusters must have surface density values above 3σ and they should be identified in both filters, I and B.

• The verified clusters are used to refine our search criteria that will be used in the FoF algorithm.

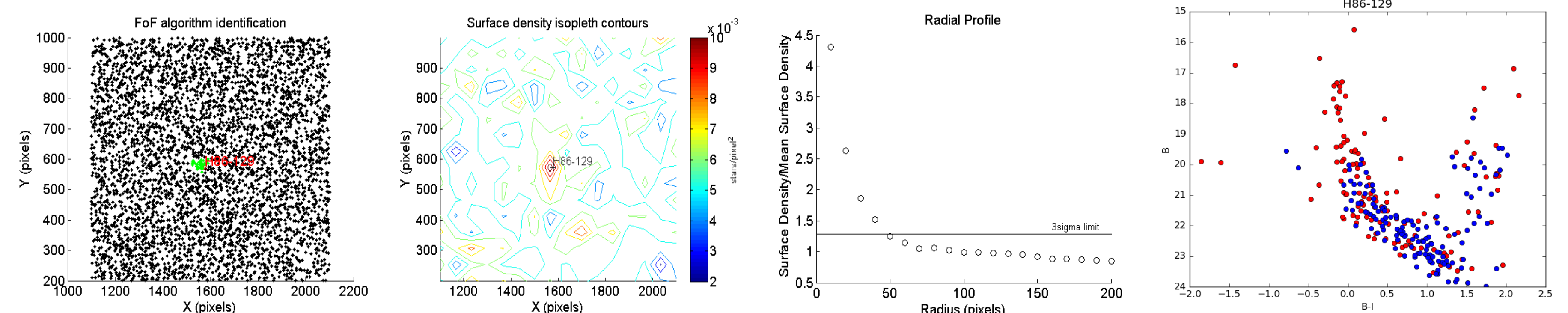
• During the next phase we will apply the established search parameters for the discovery of new star clusters.

Results

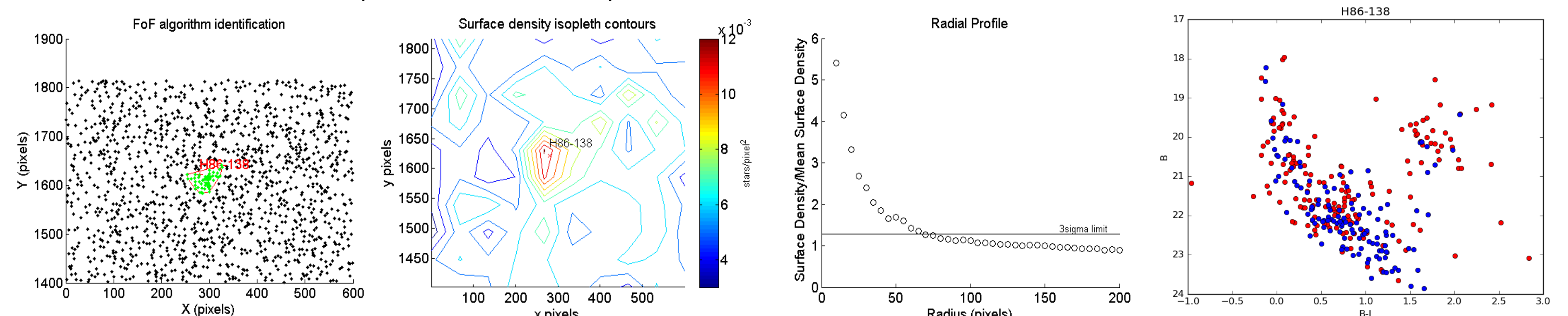
Identification process of known clusters .

Method steps 1-4 :

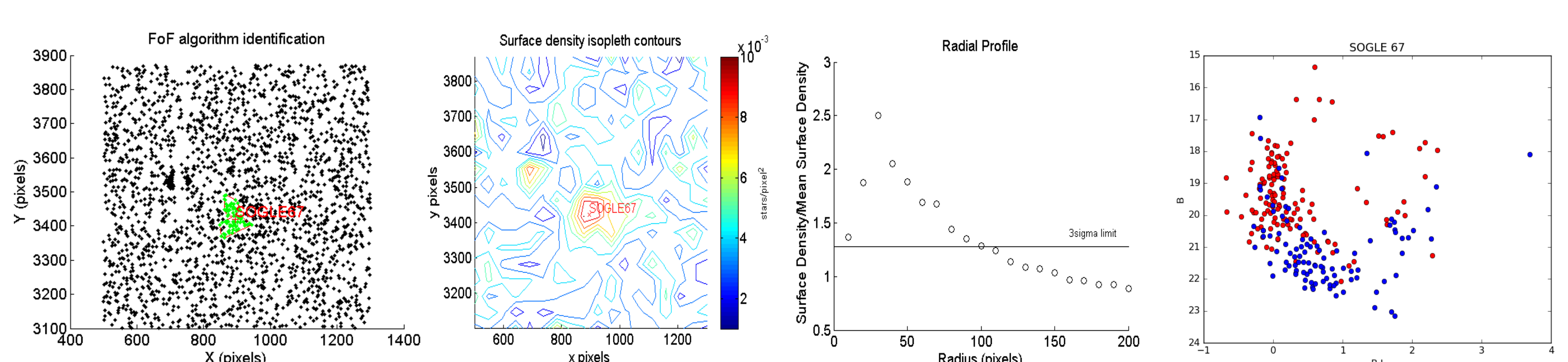
- Cluster H86-129 (Bica et al 2000).



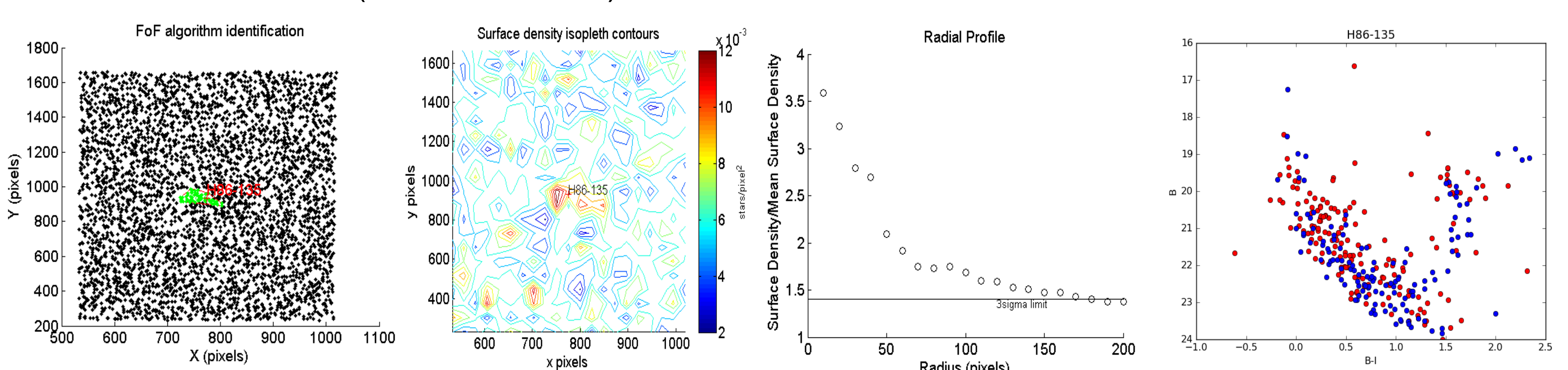
- Cluster H86-138 (Bica et al 2000).



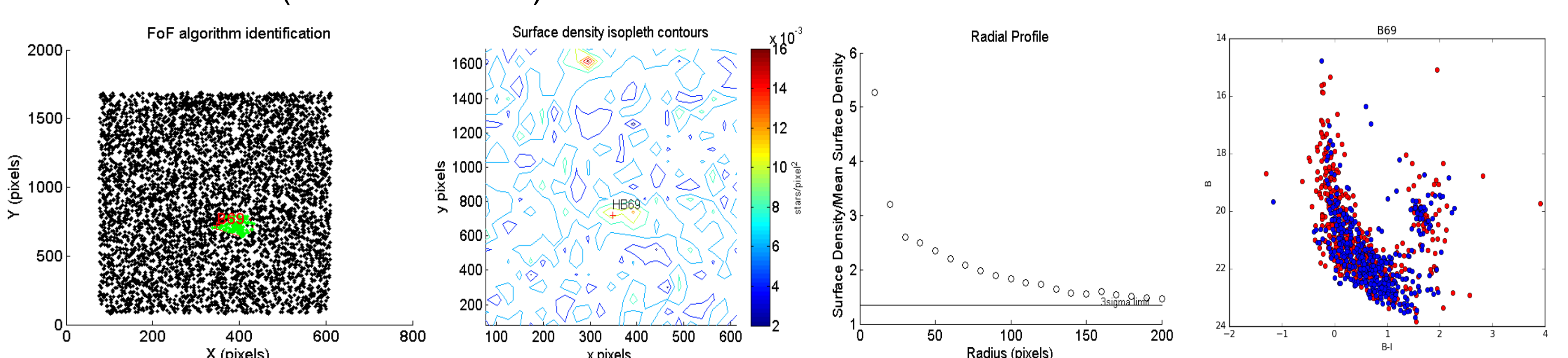
- Cluster SOGLE67 (Bica et al 2000).



- Cluster H86-135 (Bica et al 2000).



- Cluster B69 (Bica et al 2000).



Discussion

The automated algorithm and the above process have been applied in 17 separate fields so far. Seven of the clusters were identified and verified as real. Three clusters had surface density values below 3σ and the rest are in the process of verification. Along with phase one the criteria for phase two have been established as the following:

Cluster radius > 0.11 arcsec and surface density $> 3\sigma$ of the investigated field.

References

1. Bica et al. 2000A&AS,146,57D
2. Bica et al. 2008MNRAS, 389, 678B
3. Drazinos et al. 2013A&A,553A,87D
4. Glatt et al. 2010A&A,517A,50G
5. Piatti et al. 2016MNRAS,460,383P
6. Strantzalis 2012, Msc Thesis