A Comparative Framework of Source Detection Algorithms and Presenting Noise Reduction Filters for Radio Surveys

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Introduction:

We compared the result of blobcat and pybdsf as two popular radio source detection algorithms. Due to high level of noise in radio images, we present a noise smoothing filter based on linear minimum mean square error to decrease the amount of noise in the images.

Number Count mJIVE-20:

Number count of mJIVE shows us that the survey can not detect bright and specially faint radio sources. It might be because of source detections inefficiency or it might be due to the instrument resolution. Lets find out!

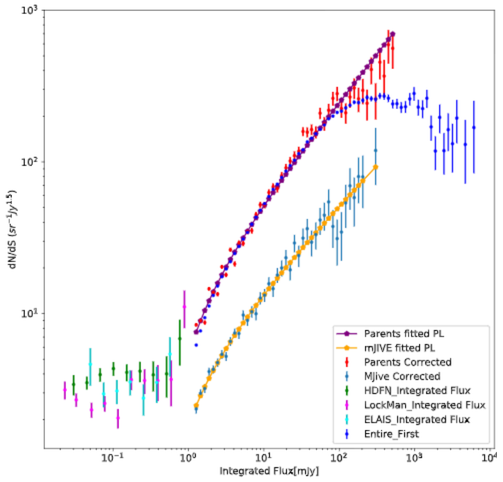

Figure 1: Corrected number count of mJIVE and FIRST surveys compared to deep fields.

Source Detection Algorithms

The results of comparing blobcat and pybdsf on injected mocked sources show that both algorithms have major shortcomings in sources detection.

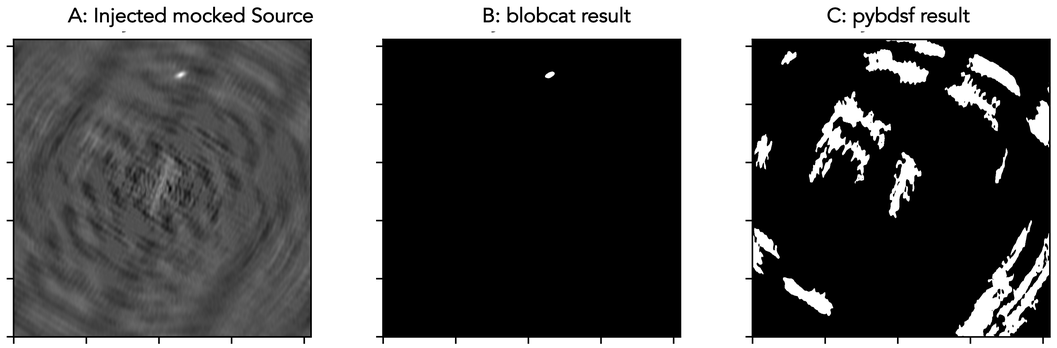

Figure 2: Comparing the result of blobcat and pybdsf on insert mocked source inn MJV03452 residual map. A: injected mocked source, B: blobcat result- source model, C: pybdsf result- source model.

Noise smoothing by Linear Minimum Mean Square Error (LMMSE):

In this approach noise estimation is automatically performed using the image background. The input parameters of the algorithm are the type of noise (Gaussians) and the standard deviation of given noise (measured rms of the image).

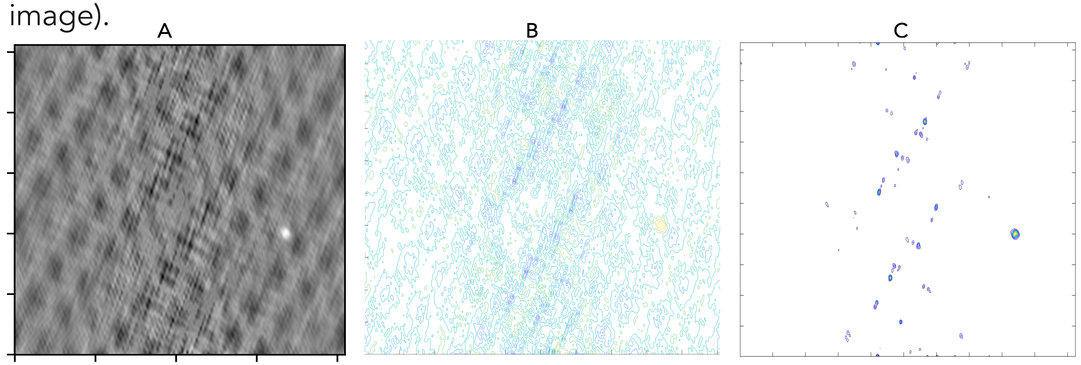

Figure 3: Examples of blobcat failure on source detection. A: MJV02099, B: Contour image of source image , C: LMMSE result

Conclusions

We evaluate and compare the accuracy of source detection algorithms in radio astronomy images using blobcat and pybdsf. These two algorithms are highly dependent on parameters and it is not trivial to optimize them especially when there is high level of noise in the image. Here we present the result of applying a denoising algorithm based on linear minimum mean square error to decrease the amount of noise in the images and improve the quality of source detection algorithms.

Acknowledgments

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Further information

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