A

The Performance Characteristics of Astronomical Source Finders

YASEEN HAMDULAY, University of Cape Town

MeerKAT and ASKAP will run the biggest Hydrogen surveys ever completed. Our current source finders will be unable to cope with such large surveys. We will look at different source finding algorithms and techniques for accelerating them.

Additional Key Words and Phrases: Source Finding, Astronomy, GPU

ACM Reference Format:
Yaseen Hamdulay, 2015. The Performance Characteristics of Astronomical Source Finders *ACM Trans. Embedd. Comput. Syst.* V, N, Article A (April 2015), 2 pages.
DOI: http://dx.doi.org/10.1145/0000000.0000000

1. INTRODUCTION

Discuss MeerKAT, ASKAP and the performance issues expected with these larger Hydrogen surveys. [Holwerda and Blyth 2010] [Whiting and Humphreys 2012] [Flöer et al. 2014]

2. COMPARISON OF EXISTING SOURCE FINDING ALGORITHMS

[Westerlund et al. 2012] [Popping et al. 2012]

2.1. CNHI

Characterises noise with no parameterization. [Jurek 2012]

2.2. 2D-1D Wavelet Reconstruction

[Flöer and Winkel 2012]

2.3. Smooth and Clip Filter

[Serra et al. 2012]

2.4. Parallel Gaussian

This algorithm is already GPU'ified. Discuss it's mechanism and performance characteristics. [Westerlund and Harris 2014]

3. SOURCE FINDING PLATFORMS

3.1. Duchamp

Most well-known source finder. Makes use of a thresholding algorithm [Whiting 2012]

3.2. SoFiA

Newer source-finder written mostly in Python that implements most existing source-finding algorithms. [Serra et al. 2015]

4. ACCELERATION TECHNIQUES

4.1. Multi-core CPU

Discuss current attempts to make use of parallelism on the CPU to improve performance and it's limitations. [Westerlund and Harris 2014] [Badenhorst 2015]

"Acceleration of the noise suppression component of the DUCHAMP source-finder."

4.2. GPU

Talk about already GPU'ified source-finding algorithms and the fact that athis needs to be repeated for all source-finding algorithms (this is our niche). [Laidler and Kuttel 2013] [Hassan et al. 2011]

5. EXISTING ACCELERATED SOURCE FINDERS

Discuss [Westerlund and Harris 2015] and the algorithm they use.

6. CONCLUSIONS

Acceleration of source finding algorithms is necessary before ASKAP and MeerKAT becomes available. We hope that GPU'ification of these algorithms will allow us to handle the data coming from the new telescopes.

REFERENCES

Badenhorst. 2015. Acceleration of the noise suppression component of the DUCHAMP source-finder. (2015).

Lars Flöer and Benjamin Winkel. 2012. 2d–1d wavelet reconstruction as a tool for source finding in spectroscopic imaging surveys. *Publications of the Astronomical Society of Australia* 29, 3 (2012), 244–250.

Lars Flöer, Benjamin Winkel, and Jürgen Kerp. 2014. Source finding, parametrization, and classification for the extragalactic Effelsberg-Bonn H i Survey. *Astronomy & Astrophysics* 569 (2014), A101.

AH Hassan, Christopher J Fluke, and David G Barnes. 2011. Unleashing the power of distributed CPU/GPU architectures: Massive astronomical data analysis and visualization case study. *arXiv preprint arXiv:1111.6661* (2011).

Benne Willem Holwerda and Sarah-Louise Blyth. 2010. Trumpeting the Vuvuzela: UltraDeep HI observations with MeerKAT. *arXiv preprint arXiv:1007.4101* (2010).

Russell Jurek. 2012. The Characterised Noise Hi source finder: Detecting Hi galaxies using a novel implementation of matched filtering. *Publications of the Astronomical Society of Australia* 29, 3 (2012), 251–261.

Christopher Laidler and Michelle M Kuttel. 2013. Detection of binary pulsars with GPU-accelerated sinusoidal Hough transformations.. In *Astronomical Data Analysis Software and Systems XXII*, Vol. 475. 83.

Attila Popping, Russell Jurek, Tobias Westmeier, Paolo Serra, L Flöer, Martin Meyer, and Baerbel Koribalski. 2012. Comparison of potential ASKAP HI survey source finders. *Publications of the Astronomical Society of Australia* 29, 03 (2012), 318–339.

Paolo Serra, Tom Oosterloo, Raffaella Morganti, Katherine Alatalo, Leo Blitz, Maxime Bois, Frédéric Bournaud, Martin Bureau, Michele Cappellari, Alison F Crocker, and others. 2012. The ATLAS3D project–XIII. Mass and morphology of H i in early-type galaxies as a function of environment. *Monthly Notices of the Royal Astronomical Society* 422, 3 (2012), 1835–1862.

Paolo Serra, Tobias Westmeier, Nadine Giese, Russell Jurek, Lars Flöer, Attila Popping, Benjamin Winkel, Thijs van der Hulst, Martin Meyer, Bärbel S Koribalski, and others. 2015. SoFiA: a flexible source finder for 3D spectral line data. *arXiv preprint arXiv:1501.03906* (2015).

Stefan Westerlund and Christopher Harris. 2014. A Framework for HI Spectral Source Finding Using Distributed-Memory Supercomputing. *Publications of the Astronomical Society of Australia* 31 (2014), e023.

Stefan Westerlund and Christopher Harris. 2015. Performance analysis of GPU-accelerated filter-based source finding for HI spectral line image data. *Experimental Astronomy* 39, 1 (2015), 95–117.

Stefan Westerlund, Christopher Harris, and Tobias Westmeier. 2012. Assessing the Accuracy of Radio Astronomy Source-Finding Algorithms. *Publications of the Astronomical Society of Australia* 29, 3 (2012), 301–308.

Matthew Whiting and Ben Humphreys. 2012. Source-finding for the australian square kilometre array pathfinder. *Publications of the Astronomical Society of Australia* 29, 3 (2012), 371–381.

Matthew T Whiting. 2012. duchamp: a 3D source finder for spectral-line data. *Monthly Notices of the Royal Astronomical Society* 421, 4 (2012), 3242–3256.