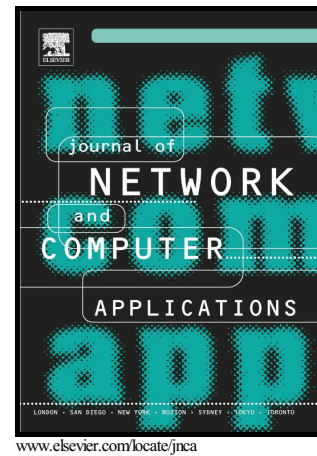


Distributed Asteroid Discovery System for Large
Astronomical Data

Chi-Sheng Huang, Meng-Feng Tsai, Po-Hsuan
Huang, Li-Ding Su, Kuei-Sheng Lee



PII: S1084-8045(17)30115-7
DOI: <http://dx.doi.org/10.1016/j.jnca.2017.03.013>
Reference: YJNCA1885

To appear in: *Journal of Network and Computer Applications*

Received date: 30 October 2016
Revised date: 1 February 2017
Accepted date: 14 March 2017

Cite this article as: Chi-Sheng Huang, Meng-Feng Tsai, Po-Hsuan Huang, Li Ding Su and Kuei-Sheng Lee, Distributed Asteroid Discovery System for Large Astronomical Data, *Journal of Network and Computer Applications* <http://dx.doi.org/10.1016/j.jnca.2017.03.013>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Distributed Asteroid Discovery System for Large Astronomical Data

Chi-Sheng Huang, Meng-Feng Tsai*, Po-Hsuan Huang, Li-Ding Su, Kuei-Sheng Lee

Department of Computer Science and Information Engineering, National Central University, No. 300, Zhongda Rd., Zhongli District, Taoyuan City 32001, Taiwan, ROC.

vcshuang@csie.ncu.edu.tw

mftsai@csie.ncu.edu.tw

102522006@cc.ncu.edu.tw

104522077@cc.ncu.edu.tw

995402017@cc.ncu.edu.tw

*Corresponding Author: Department of Computer Science and Information Engineering, National Central University, Taiwan, ROC. Tel.: +886 3 4227151 ext. 35311; Fax: +886 3 4222681.

Abstract

Thanks to the advanced technology in astronomical observations, astronomers have collected massive data sets. One of the research tasks is to discover asteroids based on observational data. However, with the fast-growing volume of astronomical data sets, this task becomes enormously relied on computing power. Therefore, the cloud-enable distributed computation and super powerful computation power can offer a good solution to this field. We adopt the Hough transform to link the sequential DETECTIONS of asteroids, and also design a distributed algorithm to process this task on distributed cloud environment for flexible and efficient calculation. Our designs are developed on MapReduce and Spark frameworks. We also utilizes HDFS and HBase in order to reduce disk I/O overhead and increase reliability and scalability. The system architecture is built on the OpenStack which allocates hardware resources flexibly. Our experiment results show significant improvements of calculation time. We believe this will help astronomers to interactively access and analyze data to discover asteroids. The system can also incrementally update DETECTIONS linking with new observed data. It also provides the visual interface to inspect the linked DETECTIONS of asteroids.

Keywords: Big Data; Cloud Computing; Distributed System; Asteroid Track; Hough Transform Algorithm

1. Introduction

With the rapid development of observation technology in astronomical research projects, the Astronomical Survey Data has been soon amassed petabyte-level scale (Carilli and Rawlings, 2004; Huijse et al., 2014; Stephens et al., 2015). Thus, utilizing big data analytics becomes one of the most recent trends of astronomical research.

Astronomy is a quite varied research for natural science, from asteroid detection to cosmology. To discover asteroids, especially those potential Earth impactors, is one of the important field of astronomy. Asteroids are small objects following the Keplerian law to orbit around the Sun. Some of them are resourceful, which possess valuable materials (e.g., noble metal, water...etc.) (Ross, 2001; Elvis, 2014; Andrews et al., 2015), and some of them are dangerous, which could possible impact the Earth and cause catastrophic damages (i.e., potential hazardous

Download English Version:

<https://daneshyari.com/en/article/4955862>

Download Persian Version:

<https://daneshyari.com/article/4955862>

[Daneshyari.com](https://daneshyari.com)