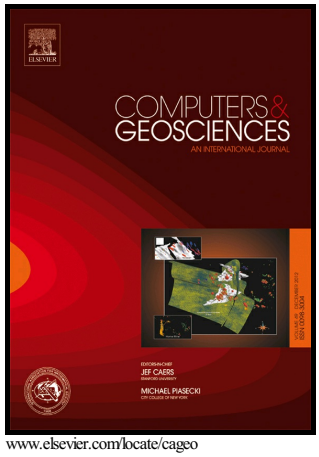
Contour-based automatic crater recognition using digital elevation models from Chang'E Missions

Wei Zuo, Zhoubin Zhang, Chunlai Li, Rongwu Wang, Linjie Yu, Liang Geng



www.elsevier.com/locate/cageo

PII: S0098-3004(16)30192-3
DOI: http://dx.doi.org/10.1016/j.cageo.2016.07.013
Reference: CAGEO3802

To appear in: *Computers and Geosciences*

Received date: 14 February 2015
Revised date: 4 May 2016
Accepted date: 22 July 2016

Cite this article as: Wei Zuo, Zhoubin Zhang, Chunlai Li, Rongwu Wang, Linjie Yu and Liang Geng, Contour-based automatic crater recognition using digital elevation models from Chang'E Missions, *Computers and Geosciences* http://dx.doi.org/10.1016/j.cageo.2016.07.013

Contour-based automatic crater recognition using digital elevation models from Chang'E Missions

Wei Zuo[a,b], Zhoubin Zhang[a,b], Chunlai Li[a,b*], Rongwu Wang[c], Linjie Yu[c], Liang Geng[a,b]

[a]*Key Laboratory of Lunar and Deep Space Exploration, Chinese Academy of Sciences, Beijing 100012,China*

[b]*National Astronomical Observatories, Chinese Academy of Sciences, Beijing 100012,China*

[c]*College of Textiles, Donghua University, Shanghai, 200051, China.*

[*] *Corresponding author, E-mail:* licl@nao.cas.cn

Abstract:

In order to provide fundamental information for exploration and related scientific research on the Moon and other planets, we propose a new automatic method to recognize craters on the lunar surface based on contour data extracted from a digital elevation model (DEM). Through DEM and image processing, this method can be used to reconstruct contour surfaces, extract and combine contour lines, set the characteristic parameters of crater morphology, and establish a crater pattern recognition program. The method has been tested and verified with DEM data from Chang'E-1 (CE-1) and Chang'E-2 (CE-2), showing a strong crater recognition ability with high detection rate, high robustness, and good adaptation to recognize various craters with different diameter and morphology. The method has been used to identify craters with high precision and accuracy on the Moon. The results meet requirements for supporting exploration and related scientific research for the Moon and planets.

Keywords:

lunar surface crater; automatic recognition; image processing; pattern recognition; contour surface; contour line; digital elevation model

1. Introduction

Craters, a special geomorphic landscape with obvious morphological characteristics, are widely distributed on the lunar surface. They have been a hot topic over many years in lunar and planetary science. The automatic recognition of craters is the foundation of scientific research on the Moon and planets. A large amount of information on craters, especially on their numbers (Neukum et al., 1975; Neukum et al., 2001; Michael et al., 2003; Shylaja, 2005; Plesko et al., 2006; Sawabe et al., 2006), distribution (Stöffler et al., 2001; Morota et al., 2008; Hiesinger et al., 2010), and morphology (Craddock et al., 2000; Gan et al., 2009; Craddock et al., 2011; Zhou et al., 2011; Wang et al., 2012) are of great significance for studying the history of the impact, geological unit chronology and evolution of the Moon. To date, automatic crater recognition methods can mainly be classified as optical image data recognition and digital elevation model (DEM) recognition, according to the different data