

Term Project: Crater Classification on Mars Crater Data Set

Assigned Date: Tuesday, March 2, 2010

Educational Goal

Apply Artificial Intelligence and Machine Learning techniques to real-world Mars crater data.

Team

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Phase I: Data Collection and Analysis

(200 points)

Due: 5:30 PM Thursday, March 10, 2010

Requirements

- **Literature Review:** Write a comprehensive literature review of crater identification techniques within the last 20 years. There is no length requirement for this paper, however, it must list, review, and discuss current and historically important techniques in crater identification. This paper must also have a discussion section which summarizes the state of the art and states possible future directions. Paper must be properly cited and organized.
- **Framework Identification:** Crawl the Internet and find computer vision and machine learning frameworks or libraries on object detection which may be useful for crater detection. Special attention should be paid to those frameworks and libraries which have been used in recent papers. Write a short summary of each of these software packages, including such information as website, license, ease of use, features, level of support, and possible uses.
- **Data Organization:** The Knowledge Discovery Lab currently has crater data from Mars, such as raw images, labeled training sets, previous experiment data and crater feature data. Find and organize all of this data, separating files into their categories. Learn how to interpret files which contain crater data. Write a short summary of what data files exist, how to read and use this data, and relate it to frameworks / libraries or previous research as necessary.
- **Prototype Implementation:** Program a prototype of algorithmic crater detection. Create or find a function based on the AdaBoost implementation in OpenCV to extract and export Haar-like features. The OpenCV implementation of this algorithm needs to be completely understood. Generate a training set from an image in the Mars crater data set, and use another image as a test set. Train the model on the training set, and generate a strong Haar-like feature classifier. Run the classifier on the test set. The results of this prototype will be compared to previous results and used to benchmark the performance of future crater detection algorithms.

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Submission Requirements

1. Write a literature review to aggregate data from previous research on crater detection. Submit the paper copy of the report, and retain a soft copy as well. Paper copy should be stapled together.
2. Write a document listing some frameworks and libraries which can be used in crater identification. Submit the document as above.
3. Write a document listing all the experimental data which we may use. Submit the document as above.
4. Organize all experimental data into one folder, with sub-folders for each type of data. The data organization document mentioned above should complement this folder such that the document will allow a user to understand what files in the folder represent, and how to use them.
5. Compress and submit the source code of the prototype, along with the test set(s), training set, and graphical and numerical results.