

Using Heaps in Recursive Hierarchical Segmentation of Data

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A modification to increase processing speed has been made in the algorithm and implementing software reported in "Modified Recursive Hierarchical Segmentation of Data" (GSC-14681-1), *NASA Tech Briefs*, Vol. 30, No. 6 (June 2006), page 51. That software performs recursive hierarchical segmentation of data having spatial characteristics (e.g., spectral-image data). The segmentation process includes an iterative subprocess, in each iteration of which it is necessary to determine a best pair of regions to merge [merges

being justified by one or more measure(s) similarity of pixels in the regions]. In the previously reported version of the algorithm and software, the choice of a best pair of regions to merge involved the use of a fully sorted list of regions. That version was computationally inefficient because a fully sorted list is not needed: what is needed is only the identity of the pair of regions characterized by the smallest measure of dissimilarity. The present modification replaces the use of a fully sorted list with the use of data heaps,

which are computationally more efficient for performing the required comparisons among dissimilarity measures. The modification includes the incorporation of standard and modified functions for creating and updating data heaps.

*This program was written by James C. Tilton of Goddard Space Flight Center. Further information is contained in a TSP (see page 1).
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Tool for Statistical Analysis and Display of Landing Sites

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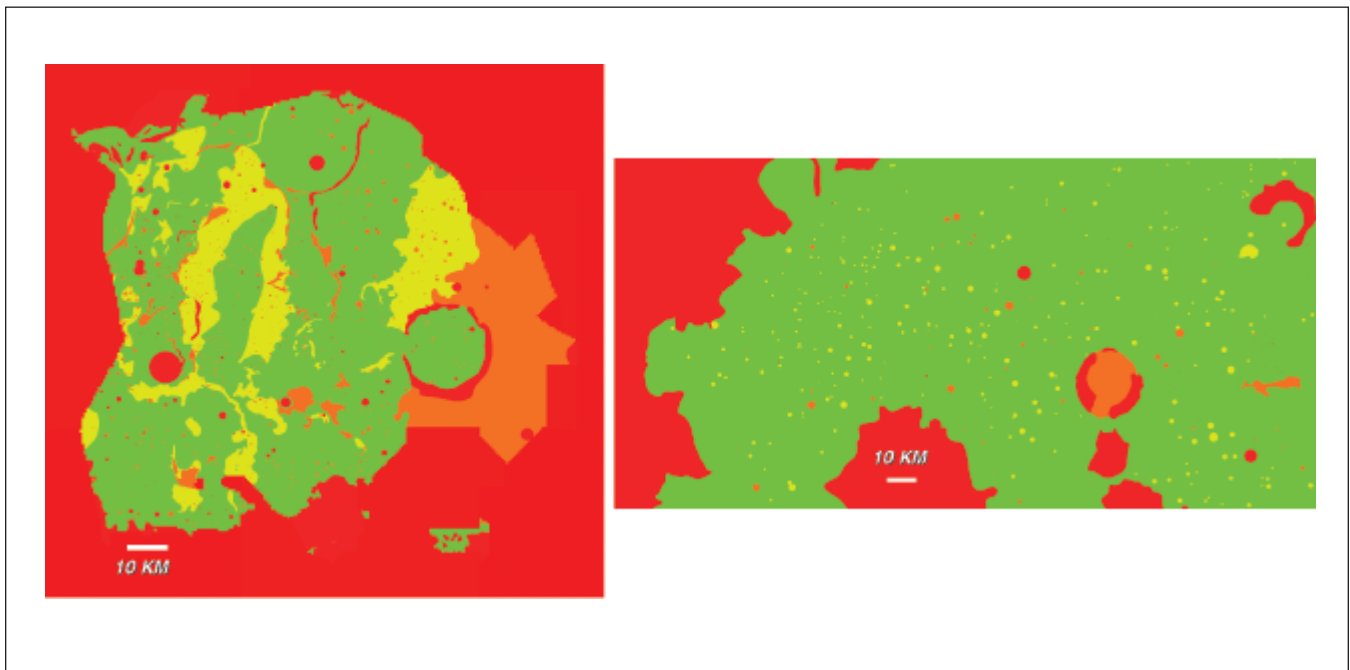
MarsLS is a software tool for analyzing statistical dispersion of spacecraft-landing sites and displaying the results of its analyses. Originally intended for the Mars Explorer Rover (MER) mission, MarsLS is also applicable to landing sites on Earth and non-MER sites on Mars. MarsLS is a collection of interdependent MATLAB scripts that utilize the MATLAB graphical-user-interface software environment to display landing-site data (see figure) on calibrated image-maps of the Martian or other terrain. The landing-site data comprise latitude/longitude pairs generated

by Monte Carlo runs of other computer programs that simulate entry, descent, and landing. Using these data, MarsLS can compute a landing-site ellipse — a standard means of depicting the area within which the spacecraft can be expected to land with a given probability. MarsLS incorporates several features for the user's convenience, including capabilities for drawing lines and ellipses, overlaying kilometer or latitude/longitude grids, drawing and/or specifying lines and/or points, entering notes, defining and/or displaying polygons to indicate hazards or

areas of interest, and evaluating hazardous and/or scientifically interesting areas. As part of such an evaluation, MarsLS can compute the probability of landing in a specified polygonal area.

This program was written by Geoffrey Wawrzyniak, Brian Kennedy, Philip Knocke, and John Michel of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-35239.



Martian Landing Site Hazard Maps are shown for Spirit (Gusev) and Opportunity (Meridiani). Here, red = not survivable; green = plains; orange = eroded craters; and yellow = subdued craters.