(1)
Geometrix
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(2)
Definitions
Safe landing site: a location not exceeding the thresholds for slope nor roughness
Threshold for extreme slope: ground angle to vertical < 10 degrees
Threshold for roughness: highest point of surface under lander < 0.39 m + height of the plane defined by the lander's feet
False Positive: Pixel incorrectly identified as safe
False Negative: Pixel incorrectly identified as unsafe

(3)
Algorithm Outline
1. Initialize (1000,1000) numpy array **solution** with zeros.
2. Set **solution**[20:979, 20:979] to 255 as points that may be allowable. Edges are not allowed.
3. Blocks out points of extreme slope.
4. Blocks out points of roughness.
5. Output solution to solutions/<datasetname>.pgm

(4)
Slope: Pseudocode

(5)
Roughness: Pseudocode

(6)
Performance Summary
Slope: O(N^2)
Roughness: O(N^2 + X)
Total computation complexity: O(N^2 + X)
Memory Usage: (500^2 + 1000^2)*32 bits = 5 MB

(7)
Performance on Training Data Set 1 (Maps and error rates)

(8)
Performance on Training Data Set 2

(9)
Performance on Training Data Set 3

(10)
Performance on Training Data Set 4

(11)
Choosing parameters
Grid search over range of possible values for constants a and r that minimize overall error rate on training data

(12)
References:

On parameter optimization and grid search:

Bergstra, J., Bardenet, R., Bengio, Y., & Kegl, B. (2011). *Algorithms for Hyper-Parameter Optimization*. Retrieved from http://papers.nips.cc/paper/4443-algorithms-for-hyper-parameter-optimization.pdf

Hsu, C. W., Chang, C. C., & Lin, C. J. (2010, April 15). *A Practical Guide to Support Vector Classification*. Retrieved from http://www.csie.ntu.edu.tw/~cjlin/papers/guide/guide.pdf

NumPy data types:
http://docs.scipy.org/doc/numpy/reference/arrays.dtypes.html