Advanced Bayesian Method for Planetary Surface Navigation

For rovers, robots, and autonomous vehicles

Autonomous Exploration, Inc., has developed an advanced Bayesian statistical inference method that leverages current computing technology to produce a highly accurate surface navigation system. The method combines dense stereo vision and high-speed optical flow to implement visual odometry (VO) to track faster rover movements. The Bayesian VO technique improves performance by using all image information rather than corner features only. The method determines what can be learned from each image pixel and weighs the information accordingly. This capability improves performance in shadowed areas that yield only low-contrast images. The error characteristics of the visual processing are complementary to those of a low-cost inertial measurement unit (IMU), so the combination of the two capabilities provides highly accurate navigation.

The method increases NASA mission productivity by enabling faster rover speed and accuracy. On Earth, the technology will permit operation of robots and autonomous vehicles in areas where the Global Positioning System (GPS) is degraded or unavailable.
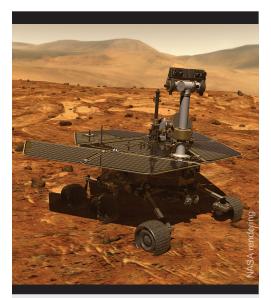
NASA rendering

Phase II Objectives

- ▶ Develop advanced ground-truth data
- ▶ Improve and enhance the Bayesian VO algorithm
- ▶ Transfer the algorithm to a real-time computer
- ▶ Develop the prototype design
- ▶ Construct the prototype module
- ▶ Demonstrate and test the prototype

Applications

NASA

- ▶ Planetary rovers
- ▶ Robots

Commercial

- ▶ Autonomous vehicles
- ▶ Robots

Benefits

- ▶ Low cost
- ▶ Lightweight
- ▶ Fast and accurate
- ▶ More productive

Firm Contact

Autonomous Exploration, Inc.
Julian Center
jcenter@ieee.org
385 High Plain Road
Andover, MA 01810–3234
Phone: 978–269–4120

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