Mathematical Learning Theory

Autonomous Navigation of a MicroAerial Vehicles

USC IMI

MicroAerial Vehicle (MAV)

Uses:

- assess extent of a hazardous release using chemical and radiological sensors
- explore / map terrain in real time using a variety of sensors
- navigate in cluttered environments without maps
- battle assessment
- search
- track

Capabilities and Features:

- environmental and situational awareness
- flight control by video
- additional sensors for flight control: accelerometers, gyros, and GPS
- maneuverability in urban and rural environments
- low cost to construct, operate, and maintain

IMI Researchers

Faculty: P. Binev, R. DeVore, R. Sharpley, V. Temlyakov

Staff: M. Hielsberg, L. S. Johnson

Collaboratoring Institutions

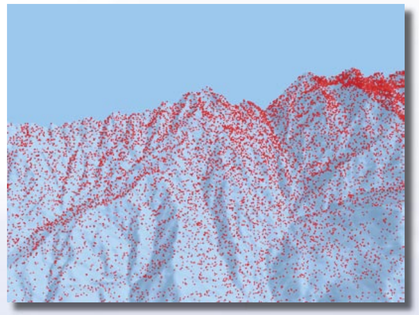
University of Florida – Mechanical & Aeronautical Engineering Departments

Carnegie Mellon University – Robotics Institute

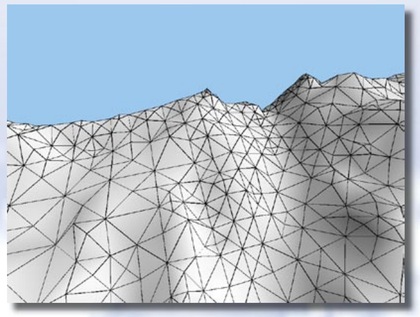
Eglin AFB

Learning (mapping)

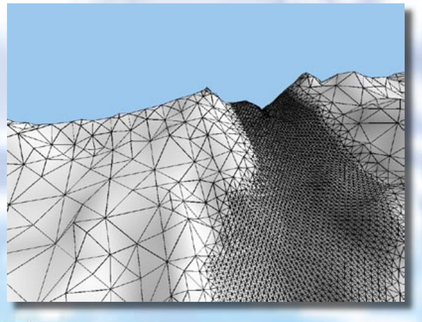
Cloud of points sensed from video during flight.



Learning theory application adaptively constructs a triangulation for assimilated surface.

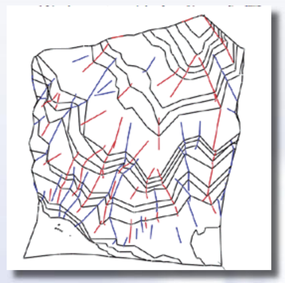


The triangulation and associated local statistics are used to construct an assimilated surface in a multiple-resolution framework. On-line computations of redundant data enable sub-pixel accuracy.



Contour Encoding

Build Morse Structure with priortization of geometric feature classes.



Multiresolution Analysis of Curves

Automated Flight Control

Mathematical Learning to be employed to

- automatically calibrate trim for newly fabricated or damaged microaerial vehicles
- real-time learning of response to actuation of control surfaces

Contact

Janice Long
Office Manager
Industrial Mathematics Institute
University of South Carolina
803-777-7183
http://www.math.sc.edu/~IMI/