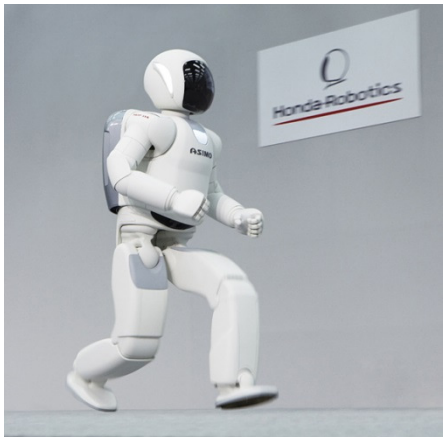


Robotics Group Project - 5CCS2RGP

Dr. Hongbin Liu
Centre for Robotics Research, Informatics

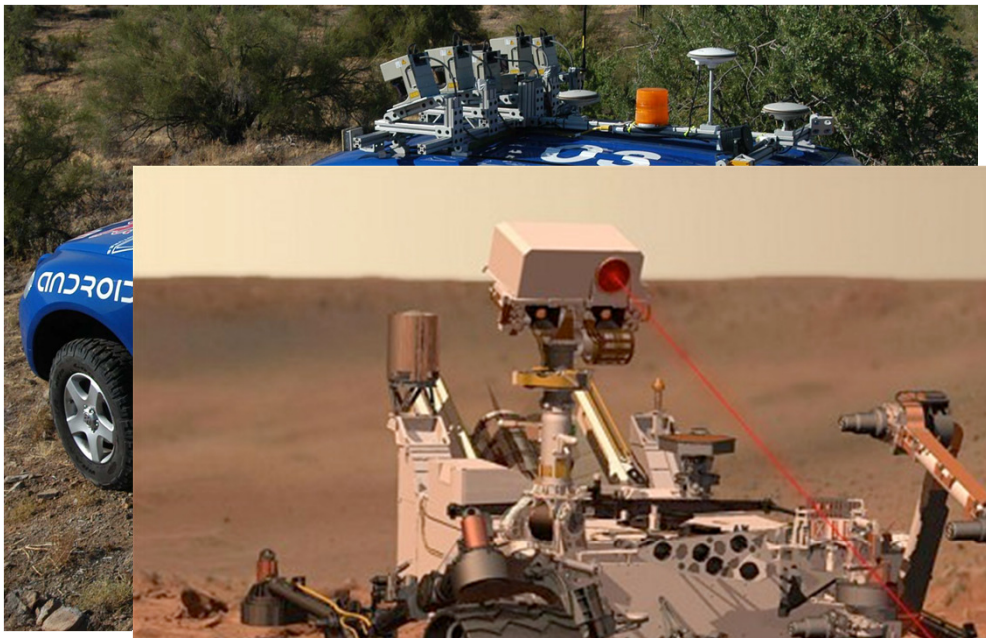
Introduction on Robotic Navigation

Dr. Hongbin Liu
Centre for Robotics Research

Outline

- Robotic Sensing
- Different locomotion
- Robot Intelligence
  - Self-localization
  - Control
  - Planning
  - Classification

Robots for Autonomous Navigation



Mars Rover

LittleDog -Boston Dynamics

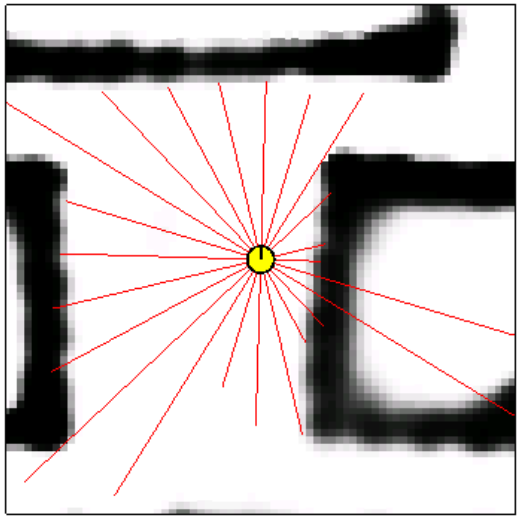
Robotic Sensory System

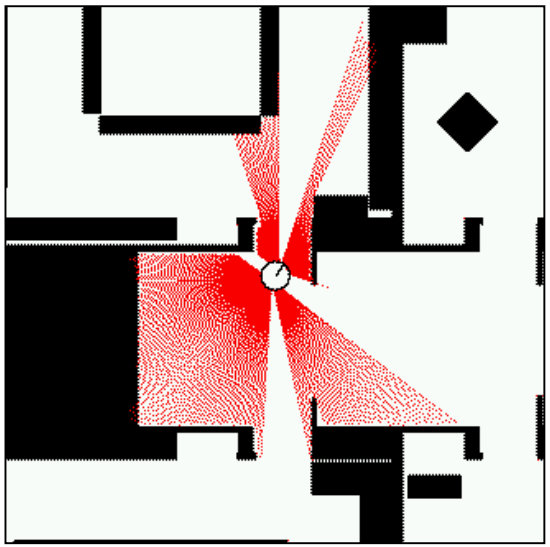
- How a robot feel the outside world and itself

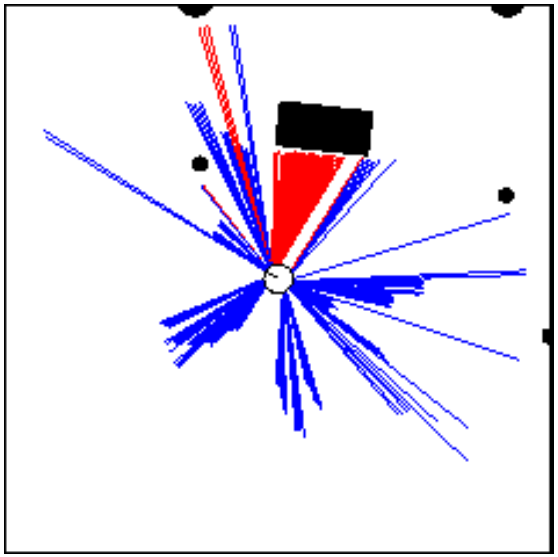
Sensors for Robotic Navigation

- Contact sensors: Bumpers, Touch Sensor, Force Sensor
- Internal sensors
  - Accelerometers (spring-mounted masses)
  - Gyroscopes (spinning mass, laser light)
  - Compasses, inclinometers (earth magnetic field, gravity)
- Proximity sensors
  - Sonar (time of flight)
  - Radar (phase and frequency)
  - Laser range-finders (triangulation, tof, phase)
  - Infrared (intensity)
- Visual sensors: Cameras
- Satellite-based sensors: GPS

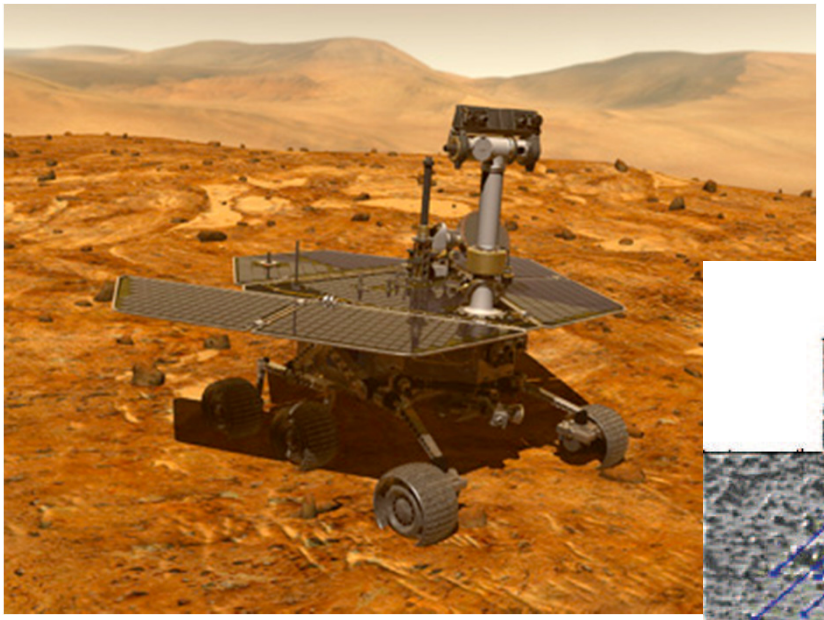
Proximity Sensors



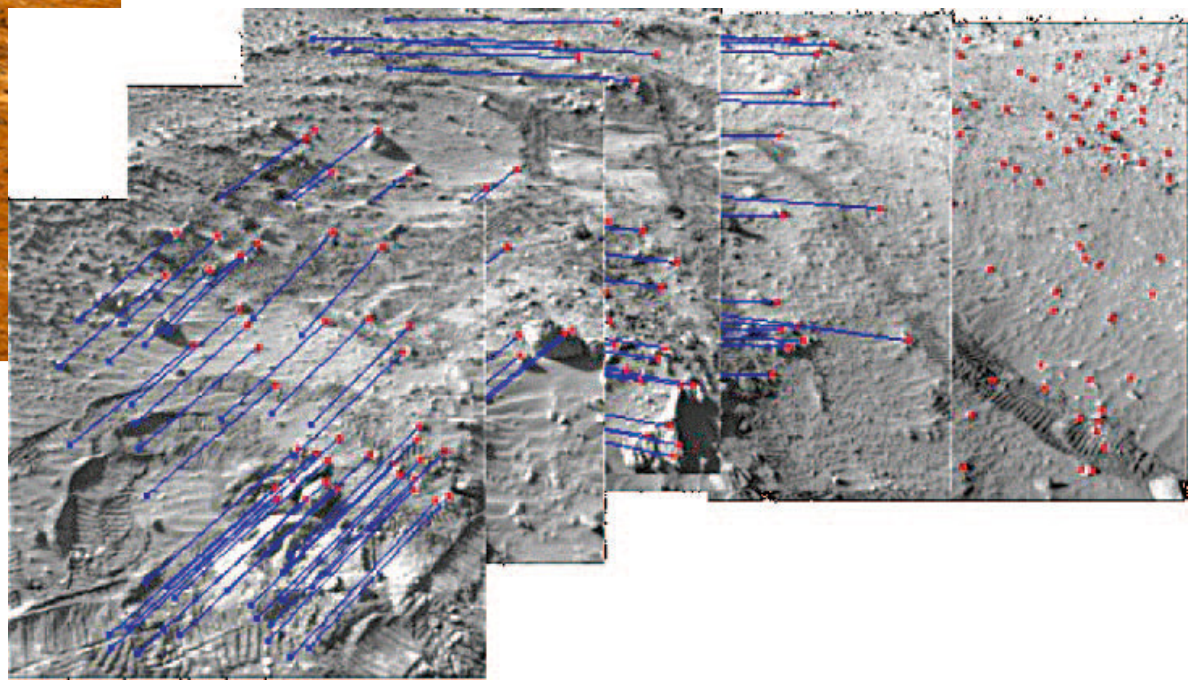




Visual Sensors-Camera

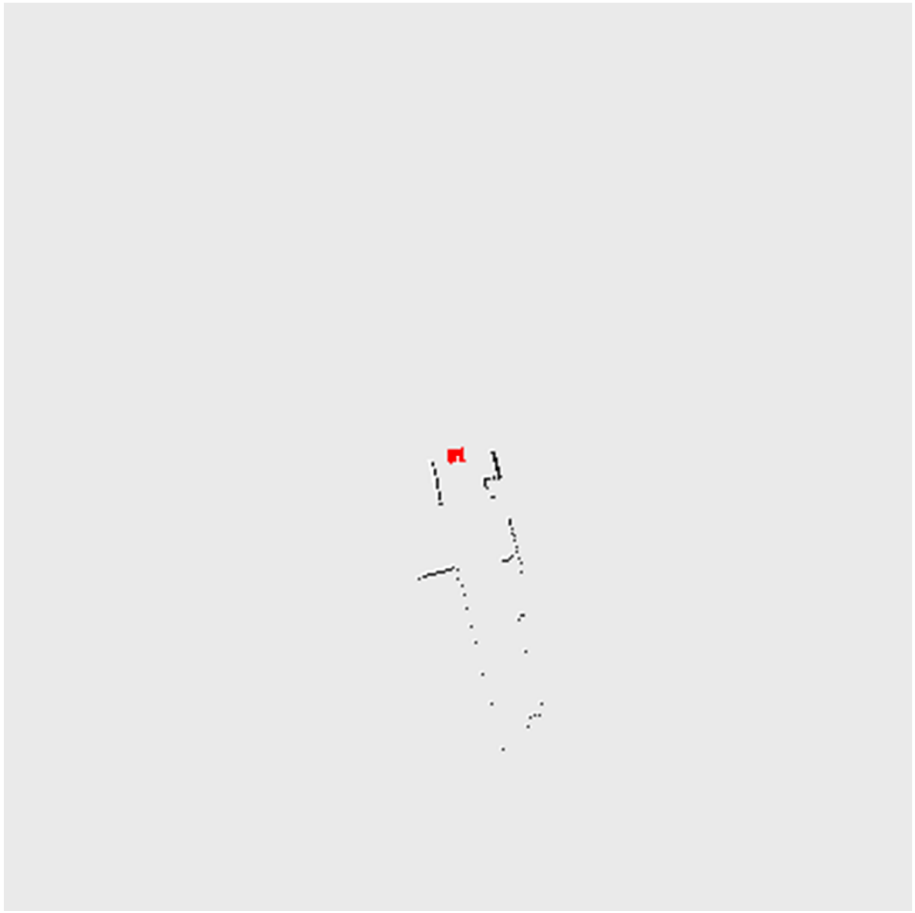


Mars Rover-Opportunity



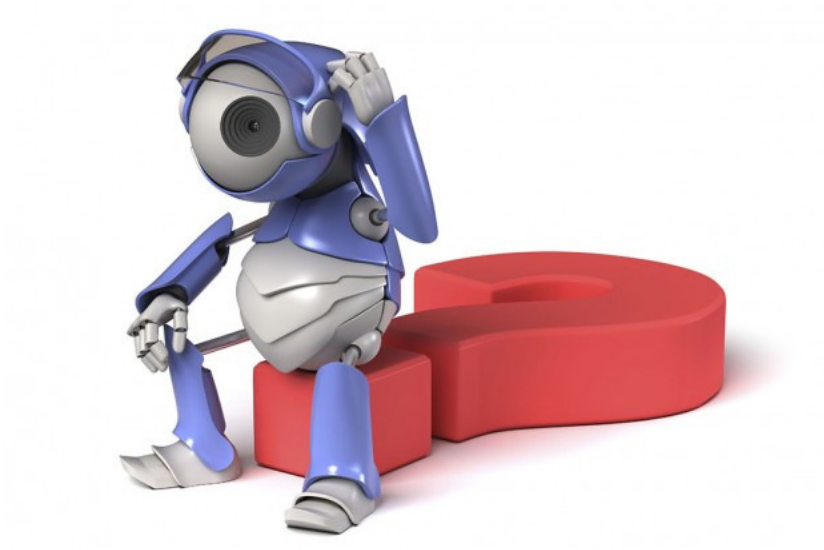
feature tracking for navigation- JPL

Sensor System: distance and direction



Robotic Locomotion

- How a robot move itself in the world

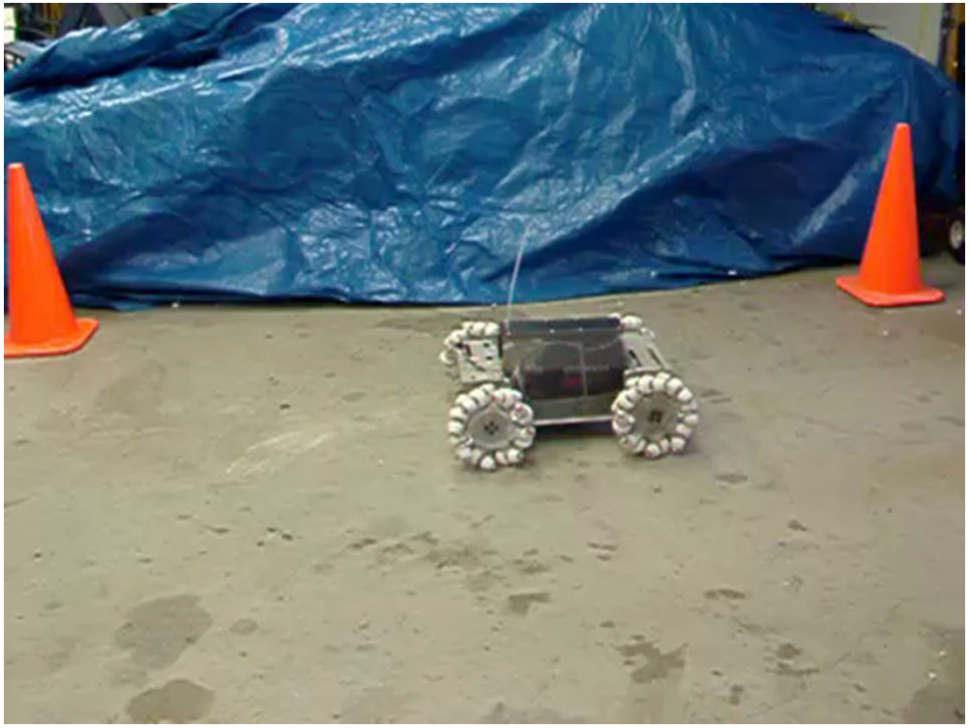


Wheeled locomotion

Synchro-Drive Robot

Wheeled locomotion

Mecanum Wheels



Other Locomotion

- **Bipedal leg locomotion**
- Quadrupedal leg lomotion
- Snake locomotion
- Worm-like locomotion

Other Locomotions

- Bipedal leg locomotion
- **Quadrupedal leg lomotion**
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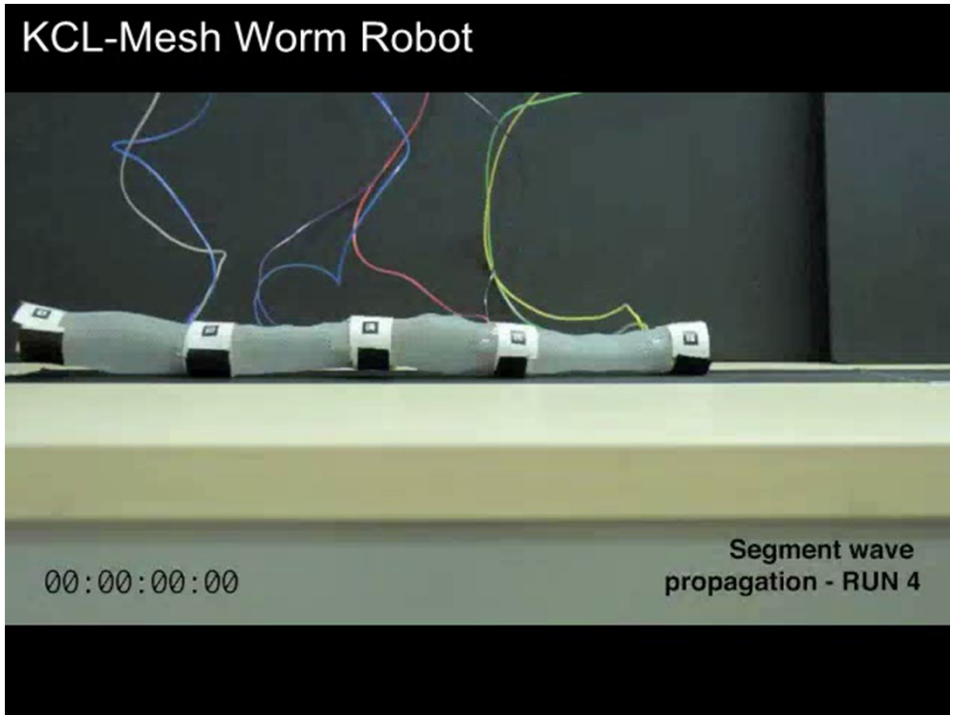
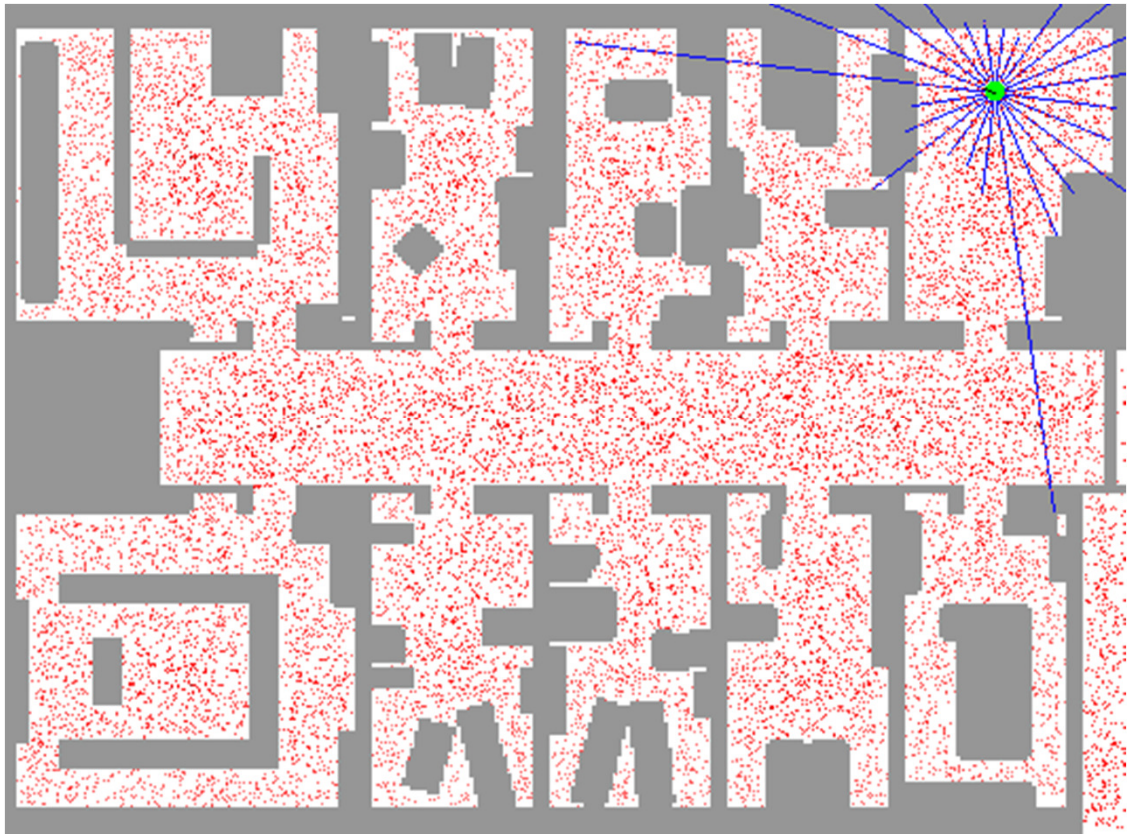


Robotic Intelligence

- How a robot make sense of the information and act smartly ?

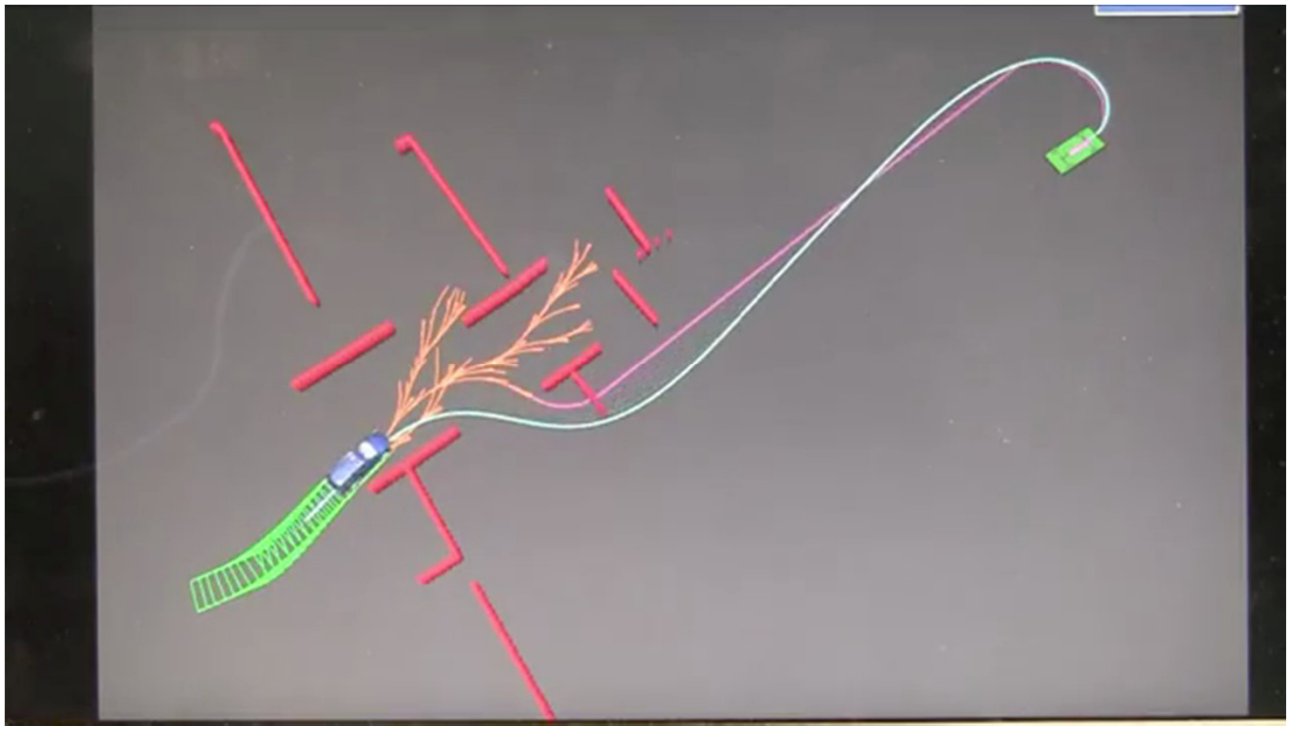
Self Localisation

Bayesian Filter
Particle Filter
Kalman Filter
…….

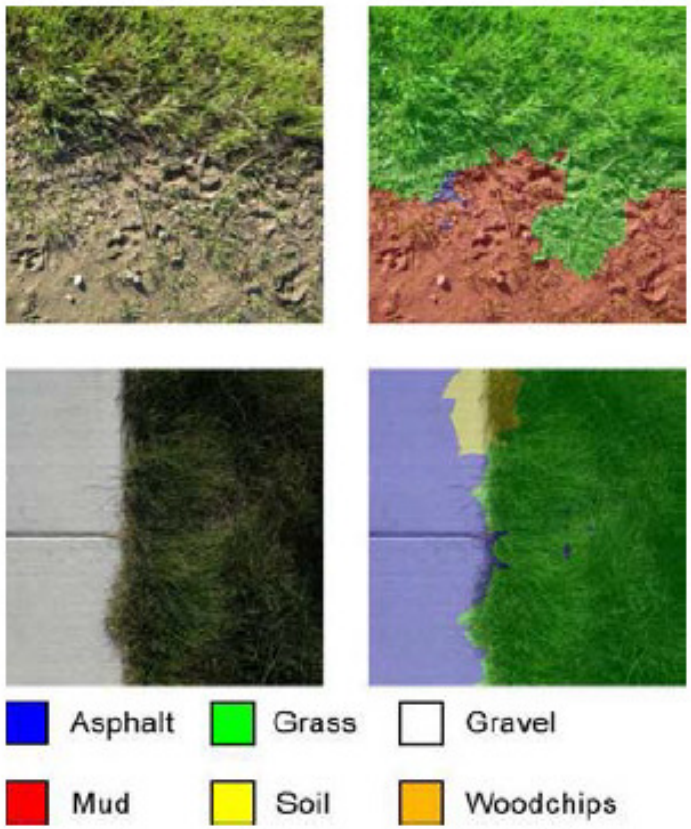


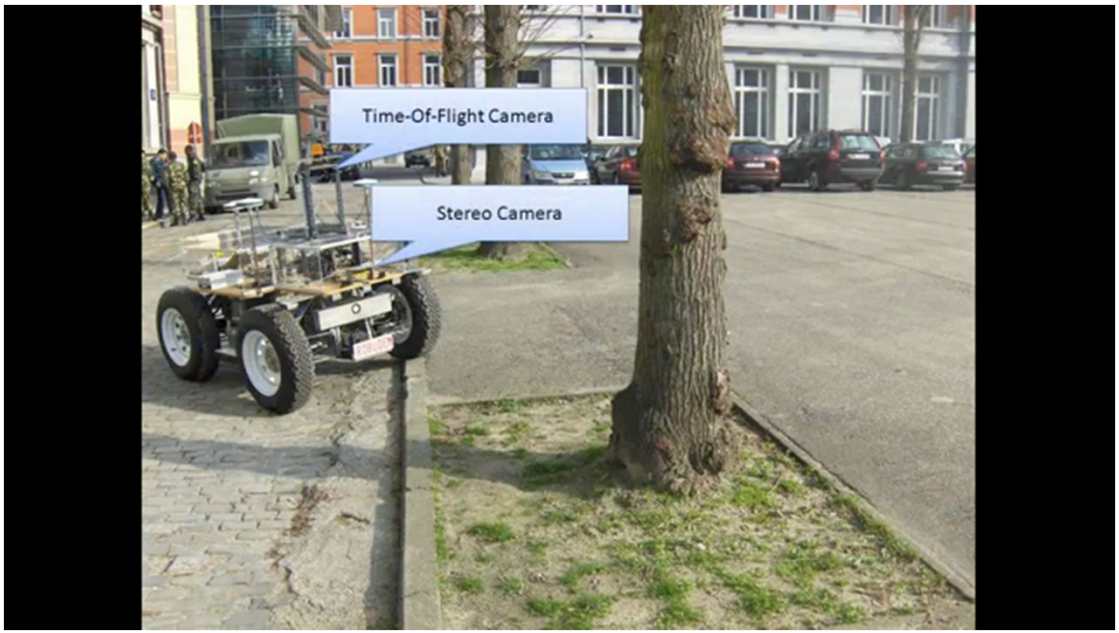
Planning

A* Planning
Potential Field
Visibility graph
Dynamics Programing
…….



Classification





Bring all together for navigation

- Any questions ?
- We go to the lab !