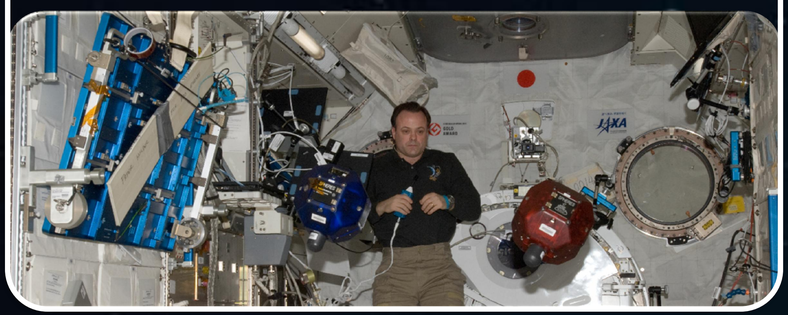
Droids in Space

Vision-based Navigation for Android Robots

Summary

- This project investigates and implements a visual matching algorithm for estimation of relative motion of the camera.
- This is an important step to implementing visual robot navigation system.

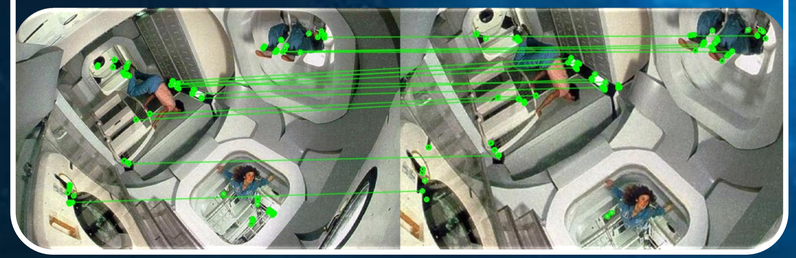


Background

- SPHERES: experimental free-floating robot deployed on the International Space Station
- Current navigation system: triangulation by ultrasonic beacon
  - Requires fixed beacons
  - Limited to bounds contained by beacons
- Goal: vision-based navigation
  - Retrofit Android phones, use built-in camera for navigation
  - Highly scalable –does not require more beacons for more space
  - Flexible in terms of range of tasks – not limited to the bounds of beacons

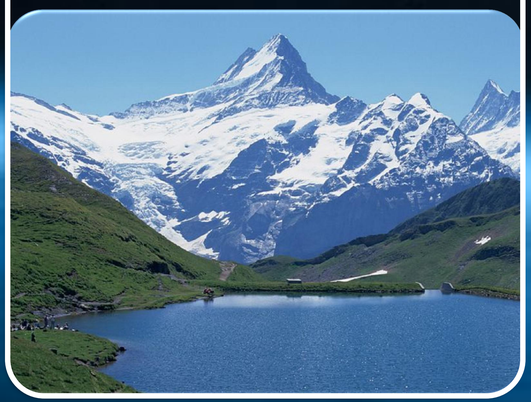
Applications

- Navigation: Determine relative and absolute position from video
- Space station droids can automate simple tasks to free up astronaut time
- Beyond robots:
  - Mobile augmented reality applications
  - Enhanced panorama stitching
  - Capturing 3-D models of scenes using a phone



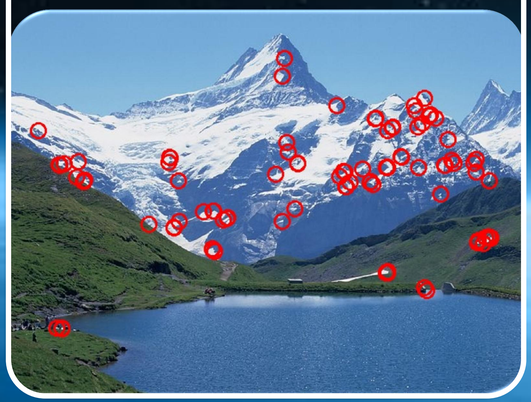
Video/Image Capture

Capture frames from the Android camera



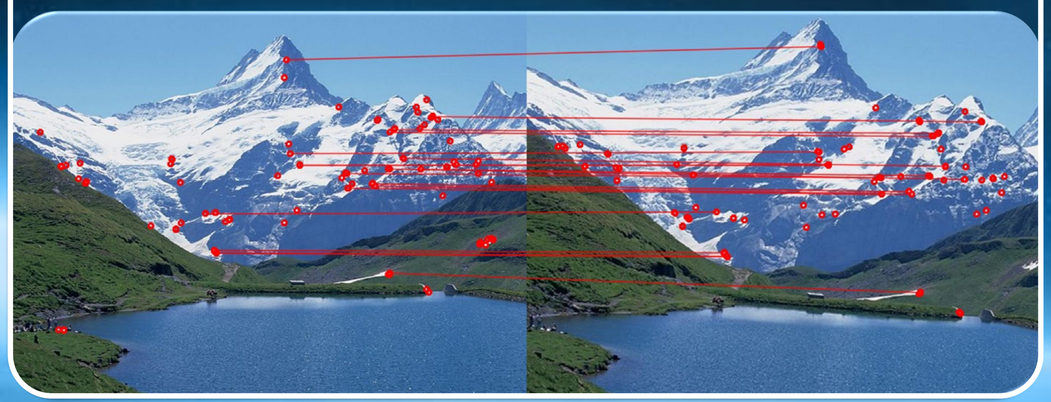
Interest Point Detection

Identify high contrast points in the image using a modified FAST algorithm



Interest Point Description/Matching

- Generate a unique matrix that describes each interest point using ORB descriptors
- Match the corresponding interest points between two frames from the same video



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