Utilizing Motion Sensor Data for Some Image Processing Applications

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Motivation

- Computational photography now moving to ubiquitous mobiles
- Increased computational power. Hence, increased avenues.
- Additional data in the form of motion sensors. Increased scope of research.
- Flexible programming on the mobile camera. Ability to implement algorithms on the fly instead of offline computing.

What do we have in hand

- A mobile that is easy to program.
  - Access to three-axis accelerometer.
  - Access to 5 mp camera with variable focus, exposure time and resolution.
  - Access to TCP communication for sending data to computer.
- A desktop computer that is very fast.
  - Python for writing all the applications.
  - WiFi dongle to receive data wireless.

What did we try

- Image deblurring using semi-blind methods.
- Estimating depth using motion blur and shape from focus.
- Image registration for pure translation and pure rotation cases.
- A little of the image super-resolution.

Image Deblurring – Primer

- Blur induced due to shake of the hand held camera.
- Ill-posed if no more information is available.
- Idea is to get either the PSF directly or get a good initial estimate.
- Trajectory can be estimated using data from accelerometer.
  - No scene depth information. Hence we iterate through a possible set of depths.
  - Drift due to erroneous gravity estimation. Hence we compensate by iterating through a set of possible drifts.

Image Deblurring – Results

Results of non-blind deconvolution using wiener deconvolution

Blurred image. 

Image deblurred using wiener deconvolution.

Image deblurred using state of the art deconvolution algorithm.

Results of semi-blind deconvolution using Punnappurath et al's code.