

3D Motion Flow Estimation using Local All-Pass Filters

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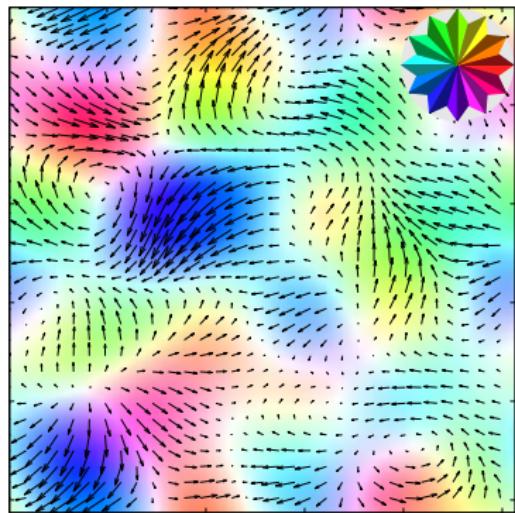
15th April 2016

Validation - Estimating a Smoothly Varying Motion

Synthetic Conditions:

(a) Volumetric Images

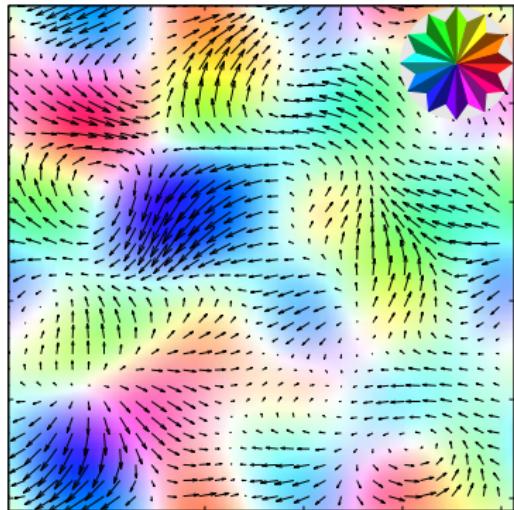
↳ Maximum motion displacement = 8 Voxels



(b) Smoothly Varying Motion

Validation - Estimating a Smoothly Varying Motion

Synthetic Conditions:



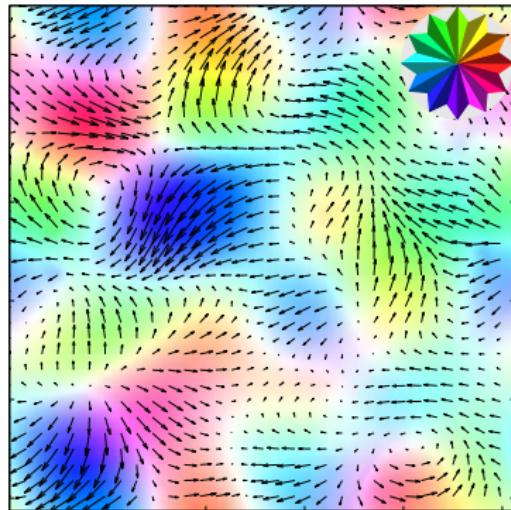
(a) xy-Slice Images

(b) Smoothly Varying Motion

↳ Maximum motion displacement = 8 Voxels

Validation - Estimating a Smoothly Varying Motion

Synthetic Conditions:



(a) Registered xy-Slice Images

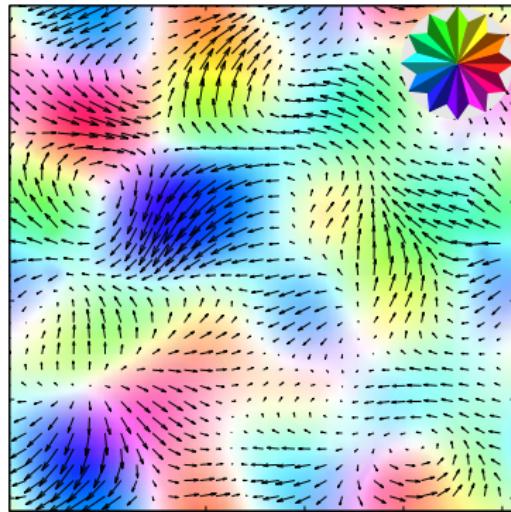
(b) LAP Motion Estimate

Mean Absolute Error = 0.048 voxels, Mean Angular Error = 0.771 degrees
↔ Registration PSNR = 56.4dB

*Image Size = 256 by 256 by 72 voxels

Validation - Estimating a Smoothly Varying Motion

Synthetic Conditions:



(a) Registered xy-Slice Images

(b) LAP Motion Estimate

Mean Absolute Error = 0.048 voxels, Mean Angular Error = 0.771 degrees
↳ Computation Time = 40.8 seconds

*Image Size = 256 by 256 by 72 voxels

Estimating Respiratory Motion in MRI

Real MRI data:

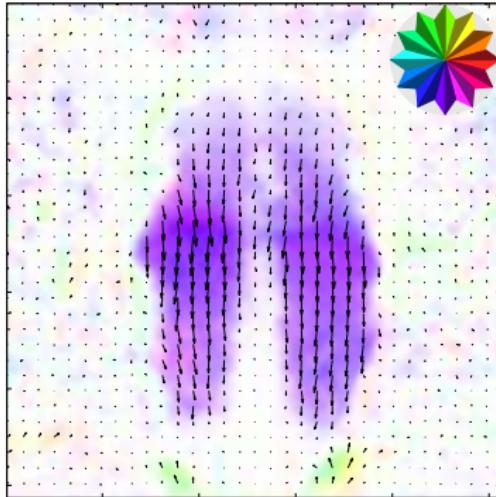
(a) Volumetric Images

(b) Coronal Slice Images

↔ Remove respiratory motion from MRI data

Estimating Respiratory Motion in MRI

Real MRI data:



(a) LAP Motion Estimate
(xy Slice)

(b) Coronal Slice Images

↳ Estimating motion using LAP

Estimating Respiratory Motion in MRI

Real MRI data:

(a) Registered Images

(b) Coronal Slice Images

↳ Perform registration using the LAP motion estimate

Motion Analysis - Tracking

Confocal microscope images of
Arabidopsis root

- ↳ Green fluorescent protein (GFP)
- ↳ 29 Images in sequence

Publication

- J. Li, C. Gilliam & T. Blu, "A multiframe optical flow spot tracker", Proceedings of IEEE International Conference on Image Processing, Québec city, Canada, September 27–30 2015.

Courtesy of Jizhou Li

Motion Analysis - Tracking

Determine underlying motion pattern:

- ↪ One motion field over sequence
- ↪ Obtain knowledge of system dynamics

Publication

- J. Li, C. Gilliam & T. Blu, "A multiframe optical flow spot tracker", Proceedings of IEEE International Conference on Image Processing, Québec city, Canada, September 27–30 2015.

Courtesy of Jizhou Li

Motion Analysis - Tracking

Using motion field build trajectories:

- ↳ Simple spot detection
- ↳ Link spots together

Publication

- J. Li, C. Gilliam & T. Blu, "A multiframe optical flow spot tracker", Proceedings of IEEE International Conference on Image Processing, Québec city, Canada, September 27–30 2015.

Courtesy of Jizhou Li

Motion Analysis - Tracking

↳ Restricting the trajectories by size

Zoomed Region

Publication

- J. Li, C. Gilliam & T. Blu, "A multiframe optical flow spot tracker", Proceedings of IEEE International Conference on Image Processing, Québec city, Canada, September 27–30 2015.

Courtesy of Jizhou Li