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Education

Ph.D. Electrical Engineering, University of California, Santa Cruz, 2010

M.S. Electrical Engineering, University of California, Santa Cruz, 2006

B.S. Electronics Course in Science and Engineering Department, Kinki (Kindai) University, 2001

Research Experience

Postdoctoral Research Fellow — 2010–Present
Supervisor: Professor Boklye Kim — University of Michigan, Ann Arbor, MI

Restoration and Reconstruction in fMRI

Due to the inhomogeneous magnetic field induced by the object-specific non-uniform susceptibility variation, the echo planar images suffer from severe image artifacts. The field inhomogeneity causes spatially variant phase error and signal loss during scanning, which result in geometric distortion and shift-variant blur effects, respectively. In addition, head motion induces field inhomogeneity variation which causes dynamic changes in the image distortion and blur as well as the voxel shifts. Such image degradation and variation hinder functional activation analyses of the time series of images, and hence there is a compelling need for the accurate reconstruction method in fMRI. However, the reconstruction is not an easy task; it includes estimations of the object's motion, susceptibility map, and field map. In this research, I formulate the data model as accurate as possible for each step, and develop efficient and reliable methods.

Research Assistant — 2005–2010
Advisor: Professor Peyman Milanfar — University of California, Santa Cruz

Locally-Adaptive Kernel Regression Methods for Multi-Dimensional Signal Processing

In the research, I studied the *kernel regression* (KR) as a general restoration approach for multidimensional signals. The classic KR is a statistical technique that enables us to regard a variety of image/video restoration tasks as *regression*, and it has a few advantageous properties: (i) the classic KR is a spatially-adaptive point estimation procedure that is capable of finding missing samples (or pixels) and smoothing noise-ridden samples, and (ii) it requires minimal assumptions on the underlying multidimensional data. Furthermore, the data-adaptive KR I proposed locally learns the optimal filter coefficient from not only the spatial positions of the given data but also the radiometric structures of the underlying data. Thus, it is applicable to a wide variety of signal processing tasks, such as denoising, upscaling, interpolation, deblurring, and single/multi-frame super-resolution of images/videos.

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Working Experience

Sharp Laboratories of America, Inc. — Camas, WA
Intern — June 2008–September 2008
Development of spatio-temporal video upscaling algorithm.

Sharp Laboratories of America, Inc. — Camas, WA
Intern — June 2007–September 2007
Development of upscaling algorithm for videos.

Motion DSP — San Mateo, CA
Technical Assistant — 2005–2006
Development of super-resolution algorithm for images and videos.

OUK Co., LTD. — Osaka, Japan
Computer Programmer — 2000–2001
Development of device drivers for a panoramic camera.

Publications

Journal Papers

Takeda, H., and P. Milanfar, "Removing Motion Blur with Space-Time Processing", IEEE Transaction on Image Processing, Vol. 20, No. 10, pp. 2990-3000, October 2011.

Takeda, H.,, P. van Beek, and P. Milanfar, "Spatiotemporal Video Upscaling using Motion-Assisted Steering Kernel (MASK) Regression", (Book chapter) to appear in "High-quality visual experience: creation, processing and interactivity of high-resolution and high-dimensional video signals" , Springer-Verlag, 2010.

Takeda, H., P. Milanfar, M. Protter, and M. Elad, "Superresolution without Explicit Subpixel Motion Estimation", IEEE Transactions on Image Processing, Vol. 18, No. 9, pp. 1958-1975, September, 2009.

Protter, M., M. Elad, H. Takeda, and P. Milanfar, "Generalizing the Non-Local-Means to Super-Resolution Reconstruction", IEEE Transactions on Image Processing, Vol. 16, No. 2, pp. 36-51, January 2009.

Takeda, H., S. Farsiu, and P. Milanfar, "Deblurring Using Regularized Locally-Adaptive Kernel Regression", IEEE Transactions on Image Processing, Vol. 17, No. 4, pp. 550-563, April 2008.

Takeda, H., S. Farsiu, and P. Milanfar, "Kernel Regression for Image Processing and Reconstruction", IEEE Transactions on Image Processing, Vol. 16, No. 2, pp. 349-366, February 2007.

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Selected Conference Papers

Takeda, H., and B. Kim "Magnetic Susceptibility and Field Map Estimation in fMRI time series using a High Resolution Static Field Map", submitted to the 21st annual meeting of International Society for Magnetic Resonance in Medicine (ISMRM 2013).

Takeda, H., and B. Kim, "Linear Phase Shift Correction for Field Map Estimation with Bipolar Gradient Dual-Echo Sequence using the Noise PDF", submitted to the 21st annual meeting of International Society for Magnetic Resonance in Medicine (ISMRM 2013).

Takeda, H., and B. Kim, "Distortion Correction using the Susceptibility Based Field Map Estimation in Echo Planar Imaging Reconstruction", Proceeding of International Society for Magnetic Resonance in Medicine (ISMRM), Melbourne, Australia, May, 2012.

Takeda, H., and P. Milanfar, "Nonlinear Kernel Backprojection for Computed Tomography", Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Dallas, TX, March, 2010.

Takeda, H., P. Milanfar, "An Adaptive Nonparametric Approach to Restoration and Interpolation for Medical Imaging" Proceedings of International Symposium on Biomedical Imaging (ISBI), January 2009.

Takeda, H., P van Beek, and P. Milanfar, "Spatio-Temporal Video Interpolation and Denoising Using Motion-Assisted Steering Kernel (MASK) Regression", Proceedings of IEEE International Conference on Image Processing (ICIP), San Diego, CA, October 2008.

Takeda, H., Hae Jong Seo, and Peyman Milanfar, "Statistical Approaches to Quality Assessment for Image Restoration", To Appear in the special session on "Advanced applications of objective video quality metrics and methods" International Conference on Consumer Electronics, Jan. 2008, Las Vegas, NV

Takeda, H., S. Farsiu, and P. Milanfar, "Higher Order Bilateral Filters and Their Properties", Proceedings of the SPIE Conf. on Computational Imaging, San Jose, January 2007.

Takeda, H., S. Farsiu, and P. Milanfar, "Robust Kernel Regression for Restoration and Reconstruction of Images from Sparse Noisy Data", Proceedings of the International Conference on Image Processing (ICIP), Atlanta, GA, October 2006.

Scientific Software

Takeda, H., S. Farsiu, and P. Milanfar (2007): `Kernel Regression-Based Image Processing ToolBox for MATLAB`, `http://www.soe.ucsc.edu/~htakeda/KernelToolBox.htm`, A experimental program for image denoising and interpolation.

Takeda, H., S. Farsiu, and P. Milanfar (2008): `Regularized Kernel Regression-Based Deblurring (AKTV) for MATLAB`, `http://www.soe.ucsc.edu/~htakeda/AKTV.htm`, A experimental program for image deblurring.

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Honors and Awards

Best Paper Award (Image, Video, and Multidimensional Signal Processing Area), IEEE Signal Processing Society, for "Kernel Regression for Image Processing and Reconstruction", 2010.

Outstanding performance in graduate research, Electrical Engineering Department, University of California, Santa Cruz, Spring, 2009.

Magna Cum Laude, Science and Engineering Department, Kinki (Kindai) University, Japan, March 2001.

Class I Information Technology Engineer (currently, Software Design and Development Engineer), Japan, May 2000.

Class II Information Technology Engineer (currently, Fundamental Information Technology Engineer), Japan, October 1998.

Computer Skills

Expert: MATLAB, LaTeX,

Intermediate: C/C++ , Visual C++ , Power Point

Beginner: CUDA

Languages

English and Japanese

Personal References

Professor Peyman Milanfar,
University of California, Santa Cruz,
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Professor Sina Farsiu,
Duke University,
Email: `sina DOT farsiu AT duke DOT edu` (or `farsiu AT soe DOT ucsc DOT edu`)

Professor Michael Elad,
Technion - Israel Institute of Technology,
Email: `elad AT cs DOT technion DOT ac DOT il`

Peter van Beek, Ph.D.,
Sharp Laboratories of America, Inc.,
Email: `pvanbeek AT sharplabs DOT com`