Il Yong Chun

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EDUCATION

Purdue University   USA
Ph.D. in Electrical and Computer Engineering   Aug. 2009–Aug. 2015
- Thesis title: Advances in medical imaging and image reconstruction
- Advisors: Prof. Thomas M. Talavage and Prof. Ben Adcock

Korea University   South Korea
B.Eng. in Electrical Engineering   Mar. 2002–Feb. 2009

University of Hong Kong   Hong Kong
Exchange Student in Electrical and Electronic Engineering   Aug. 2007–May 2008

WORK EXPERIENCE

University of Hawai'i, Mānoa   USA
Assistant Professor in Electrical Engineering   Aug. 2019–
- Research: Machine learning & AI with big data, optimization, sampling, imaging science
- Teaching: Intro. to Digital Image Processing (EE416, F'19)

University of Michigan   USA
Research Fellow in Electrical Engineering and Computer Science   May 2016–Present
(supervisor: Prof. Jeffrey Fessler)
- Iterative neural networks: Theory and appl. to extreme imaging
- Block optimization: Theory and appl. to learning convolutional regularizers
- Tensor decomposition and appl. to light-field photography

Purdue University   USA
Postdoctoral Research Associate in Mathematics   Aug. 2015–May 2016
(supervisor: Prof. Ben Adcock)
- Compressed sensing and parallel acquisition: Theory

Purdue University   USA
Research Assistant (advisor: Prof. Thomas M. Talavage)   Aug. 2010–May 2015
Teaching Assistant (advisor: Prof. Michael D. Zoltowski)   Jan. 2011–May 2011
- Signals and systems (ECE301)
Research Assistant (advisor: Prof. Michael G. Heinz)   Aug. 2011–May 2013

Samsung Advanced Institute of Technology   South Korea
Graduate Intern (supervisor: Dr. Jung-Bae Kim)   Jun. 2013–Jul. 2013
- Multi-modal (ultrasonography & MRI) image registration

Neuroscience Research Institute   South Korea
Lecturer (supervisor: Prof. Zang-Hee Cho)   May 2013–Jun. 2013
- Teaching: Intro. to optimization
- Research: High-resolution PET image reconstruction

Intel Labs   USA
Graduate Intern (supervisor: Dr. Willem M. Beltman)   May 2011–Jul. 2011
- Blind source separation of convolutive speech mixtures in mobile environment

Gangnam-gu and Yeongdeungpo-gu District Offices   South Korea
Public Interest Service Personnel   Jun. 2003–Sep. 2005

PUBLICATION
(The asterisks (∗) indicate equal contributions.)

Preprints

Dehui Zhang$^{(*)}$, Zhen Xu$^{(*)}$, Zhengyu Huang$^{(*)}$, Audrey Rose Gutierrez, **Il Yong Chun**, Cameron J. Blocker, Che-Hung Liu, Miao-Bin Lien, Gong Cheng, Zhe Liu, Jeffrey A. Fessler, Theodore B. Norris, and Zhaohui Zhong, "3D position tracking with a graphene-based transparent multi-focal-plane imaging system and feedforward neural network," preprint, Jun. 2019.

Xiyu Zhang, Haowei Xiang, **Il Yong Chun**, Mert Pilanci, and Jeffrey A. Fessler, "Accelerated convolutional operator learning," preprint, Jun. 2019.

Submitted Journal Papers

Il Yong Chun, Zhengyu Huang[(*)], Hongki Lim[(*)], and Jeffrey A. Fessler, "Momentum-Net: Fast and convergent iterative neural network for inverse problems," submitted to *IEEE Trans. Pattern Anal. Mach. Intell.*, Jul. 2019. [Online] Available: `http://arxiv.org/abs/1907.11818`

Miao-Bin Lien, Che-Hung Liu, **Il Yong Chun**, Saiprasad Ravishankar, Hung Nien, Minmin Zhou, Jeffrey A. Fessler, Theodore B. Norris, and Zhaohui Zhong, "Ranging and light field imaging with transparent photodetectors," submitted to *Nature Photonics*, Jul. 2019.

Hongki Lim, **Il Yong Chun**, Yuni K. Dewaraja, and Jeffrey A. Fessler, "Improved low-count quantitative PET reconstruction with a variational neural network," submitted to *IEEE Trans. Med. Imag.*, May 2019. [Online] Available: `http://arxiv.org/abs/1906.02327`

Xuehang Zheng[(*)], **Il Yong Chun**[(*)], Zhipeng Li, Yong Long, and Jeffrey A. Fessler, "Sparse-view X-ray CT reconstruction using ℓ_1 prior with learned transform," submitted to *IEEE Trans. Comput. Imag.*, Feb. 2019. [Online] Available: `http://arxiv.org/abs/1711.00905`

Journal Papers

Il Yong Chun and Jeffrey A. Fessler, "Convolutional analysis operator learning: Acceleration and convergence," *IEEE Trans. Image Process.* (to appear), Aug. 2019. [Online] Available: `http://arxiv.org/abs/1802.05584`

Ikbeom Jang, **Il Yong Chun**, Bari Sumra, Evan L. Breedlove, Brian R. Cummiskey, Taylor A. Lee, Roy J. Lycke, Victoria N. Poole, Trey E. Shenk, Diana O. Svaldi, Gregory G. Tamer, Jr., Larry J. Leverenz, Eric A. Nauman, and Thomas M. Talavage, "Every hit matters: White matter integrity changes in high school football athletes are correlated with repetitive head acceleration event exposure," *Neuroimage: Clinical* (to appear), Jul. 2019.

Il Yong Chun[(*)], David Hong[(*)], Ben Adcock, and Jeffrey A. Fessler, "Convolutional analysis operator learning: Dependence on training data," *IEEE Signal Process. Lett.*, 26(8):1137–1141, Aug. 2019. [Online] Available: `http://arxiv.org/abs/1902.08267`

Il Yong Chun and Ben Adcock, "Uniform recovery from subgaussian multi-sensor measurements," *Appl. Comput. Harmon. Anal.* (to appear), Nov. 2018. [Online] Available: `http://arxiv.org/abs/1610.05758`

Il Yong Chun and Jeffrey A. Fessler, "Convolutional dictionary learning: Acceleration and convergence," *IEEE Trans. Image Process.*, 27(4):1697–1712, Apr. 2018. [Online] Available: `https://arxiv.org/abs/1707.00389`

Il Yong Chun and Ben Adcock, "Compressed sensing and parallel acquisition," *IEEE Trans. Inf. Theory*, 63(8):4860–4882, May 2017. [Online] Available: `http://arxiv.org/abs/1601.06214`

Il Yong Chun, Song Noh, David J. Love, Thomas M. Talavage, Stephen Beckley, and Sherman J. Kisner, "Mean squared error (MSE)-based excitation pattern design for parallel transmit and receive SENSE MRI image reconstruction," *IEEE Trans. Comput. Imag.*, 2(4):424–439, Dec. 2016.

Il Yong Chun, Ben Adcock, and Thomas M. Talavage, "Efficient compressed sensing SENSE pMRI reconstruction with joint sparsity promotion," *IEEE Trans. Med. Imag.*, 5(1):354–368, Jan. 2016.

Il Yong Chun, Xianglun Mao, Eric L. Breedlove, Larry J. Leverenz, Eric A. Nauman, and Thomas M. Talavage, "DTI detection of longitudinal WM abnormalities due to accumulated head impacts," *Dev. Neuropsychol.*, 40(2):92–97, May 2015.

Selected-Conference Papers

Il Yong Chun[(*)], Xuehang Zheng[(*)], Yong Long, and Jeffrey A. Fessler, "BCD-Net for low-dose CT reconstruction: Acceleration, convergence, and generalization," *Med. Image Compt. and Computer Assist. Inte. (MICCAI)* (to appear), Shenzhen, China, Oct. 2019. [Online] Available: `http://arxiv.org/abs/1908.01287`

Conference Papers & Abstracts

Caroline Crockett, David Hong, **Il Yong Chun**, and Jeffrey A. Fessler, "Incorporating handcrafted filters in convolutional analysis operator learning for ill-posed inverse problems," submitted to *IEEE workshop on Compt. Adv. in Multi-Sensor Adaptive Process. (CAMSAP)*, Jul. 2019.

Hongki Lim, **Il Yong Chun**, Jeffrey A. Fessler, and Yuni K. Dewaraja, "Improved low count quantitative SPECT reconstruction with a trained deep learning based regularizer," in *Proc. Soc. Nucl. Med. and Mol. Imag. (SNMMI)* (to appear), Anaheim, CA, Jun., 2019.

Dehui Zhang, Zhen Xu, Zhengyu Huang, Audrey Rose Gutierrez, **Il Yong Chun**, Cameron J. Blocker, Gong Cheng, Zhe Liu, Jeffrey A. Fessler, Zhaohui Zhong, and Theodore B. Norris, "Graphene-based transparent photodetector array for multiplane imaging," in *Proc. Conf. on Lasers and Electro-Optics (CLEO)*, p. SM4J.2, San Jose, CA, May 2019.

Il Yong Chun, Hongki Lim[(*)], Zhengyu Huang[(*)], and Jeffrey A. Fessler, "Fast and convergent iterative signal recovery using trained convolutional neural networks," in *Proc. Annual Allerton Conf. on Commun., Control, and Comput.*, pp. 155–159, Monticello, IL, Oct. 2018. textbf(Invited paper)

Il Yong Chun and Jeffrey A. Fessler, "Convolutional analysis operator learning: Application to sparse-view CT," in *Proc. Asilomar Conf. on Signals, Syst., and Comput.*, pp. 1631–1635, Pacific Grove, CA, Oct. 2018. **(Invited paper)**

Hongki Lim, Jeffrey A. Fessler, Yuni K. Dewaraja, and **Il Yong Chun**, "Application of trained deep BCD-Net to iterative low-count PET image reconstruction," in *Proc. IEEE Nuclear Science Symposium (NSS) and Medical Imaging Conf. (MIC)* (to appear), Sydney, Australia, Nov., 2018.

Il Yong Chun and Jeffrey A. Fessler, "Deep BCD-Net using identical encoding-decoding CNN structures for iterative image recovery," in *Proc. IEEE Image, Video, and Multidim. Signal Process. (IVMSP) Workshop*, pp. 1–5, Zagori, Greece, Apr. 2018. [Online] Available: `http://arxiv.org/abs/1802.07129`.

Cameron J. Blocker[(*)], **Il Yong Chun**[(*)], and Jeffrey A. Fessler, "Low-rank plus sparse tensor models for light-field reconstruction from focal stack data," in *Proc. IEEE Image, Video, and Multidim. Signal Process. (IVMSP) Workshop*, pp. 1–5, Zagori, Greece, Apr. 2018.

Saiprasad Ravishankar, **Il Yong Chun**, and Jeffrey A. Fessler, "Physics-driven deep training of dictionary-based algorithms for MR image reconstruction," in *Proc. Asilomar Conf. on Signals, Syst., and Comput.*, pp. 1859–1863, Pacific Grove, CA, Nov. 2017. **(Invited paper)**

Il Yong Chun and Jeffrey A. Fessler, "Convergent Convolutional Dictionary Learning using Adaptive Contrast Enhancement (CDL-ACE): Application of CDL to image denoising," in *Proc. Sampling Theory and Appl. (SampTA)*, pp. 460–464, Tallinn, Estonia, Jul. 2017.

Il Yong Chun, Xuehang Zheng, Yong Long, and Jeffrey A. Fessler, "Sparse-view X-ray CT reconstruction using ℓ_1 regularization with learned sparsifying transform," in *Proc. Intl. Mtg. on Fully 3D Image Recon. in Rad. and Nuc. Med. (Fully 3D)*, pp. 115–119, Xi'an, China, Jun. 2017.

Ikbeom Jang, **Il Yong Chun**, Sumra Bari, Yukai Zou, Eric A. Nauman, and Thomas M. Talavage, "DTI reveals persistent effects on white matter in football players with history of sports-related concussion," *IN Neuroimaging Symp.*, Bloomington, IN, Nov. 2016.

Il Yong Chun and Ben Adcock, "Compressed sensing and parallel acquisition: Optimal uniform and nonuniform recovery guarantees," *Shannon Centennial Symposium*, Ann Arbor, MI, Sep. 2016.

Il Yong Chun, Chen Li, and Ben Adcock, "Sparsity and parallel acquisition: Optimal uniform and nonuniform recovery guarantees," in *Proc. IEEE Intl. Conf. on Multimedia and Expo (ICME) 2016, Workshop on Sparsity and Compressive Sensing in Multimedia (MM-SPARSE)*, pp. 1–6, Seattle, WA, Jul. 2016. [Online] Available: `http://arxiv.org/abs/1603.08050`

Il Yong Chun and Ben Adcock, "Optimal sparse recovery for multi-sensor measurements," in *Proc. IEEE Inf. Theory Workshop (ITW)*, pp. 270–274, Cambridge, UK, Aug. 2016. [Online] Available: `http://arxiv.org/abs/1603.06934`

Sumra Bari, **Il Yong Chun**, Larry J. Leverenz, Eric A. Nauman, and Thomas M. Talavage, "DTI

detection of WM abnormalities using randomization test with complete and incomplete pairs," in *Proc. Org. for Hum. Brain Mapp. (OHBM)*, Honolulu, HI, Jun. 2015.

Ikbeom Jang, **Il Yong Chun**, Larry J. Leverenz, Eric A. Nauman, and Thomas M. Talavage, "DWI detection of WM abnormality and relation with collision events in high school athletes," in *Proc. Org. for Hum. Brain Mapp. (OHBM)*, Honolulu, HI, Jun. 2015.

Ikbeom Jang, **Il Yong Chun**, Larry J. Leverenz, Eric A. Nauman, and Thomas M. Talavage, "Robust detection of axonal abnormalities in high school collision-sport athletes: Longitudinal single subject analysis," in *Proc. Intl. Soc. Mag. Res. Med. (ISMRM)*, Toronto, ON, May 2015.

Il Yong Chun, Ben Adcock, and Thomas M. Talavage, "Efficient compressed sensing SENSE parallel MRI reconstruction with joint sparsity promotion and mutual incoherence enhancement," in *Proc. IEEE Eng. Med. Biol. Soc. (EMBS)*, pp. 2424–2427, Chicago, IL, Aug. 2014.

Il Yong Chun, Ben Adcock, and Thomas M. Talavage, "Non-convex compressed sensing CT reconstruction based on tensor discrete Fourier slice theorem," in *Proc. IEEE Eng. Med. Biol. Soc. (EMBS)*, pp. 5141–5144, Chicago, IL, Aug. 2014.

Il Yong Chun, Allan Diaz, Sijia Qiu, Larry J. Leverenz, Eric A. Nauman, and Thomas M. Talavage, "DTI detection of symptomatic and asymptomatic injury due to repetitive hit exposures," *IN Neuroimaging Symp.*, Bloomington, IN, Oct. 2013.

Il Yong Chun and Thomas M. Talavage, "Efficient compressed sensing statistical X-ray/CT reconstruction from fewer measurements," in *Proc. Intl. Mtg. on Fully 3D Image Recon. in Rad. and Nuc. Med. (Fully 3D)*, pp. 30–33, Lake Tahoe, CA, Jun. 2013.

Il Yong Chun, Allan Diaz, Xiaodong Li, Yun Jang Jin, Larry J. Leverenz, Eric A. Nauman, and Thomas M. Talavage, "DTI detection of symptomatic and asymptomatic injury due to repetitive head blows," in *Proc. Org. for Hum. Brain Mapp. (OHBM)*, Seattle, WA, Jun. 2013.

Il Yong Chun and Thomas M. Talavage, "Fast non-convex statistical compressed sensing MRI reconstruction based on approximated $Lp(0 < p < 1)$-quasi-norm with fewer measurements than using $L1$-norm," in *Proc. Intl. Soc. Mag. Res. Med. (ISMRM)*, Salt Lake City, UT, Apr. 2013.

Il Yong Chun and Thomas M. Talavage, "Edge-preserving non-iterative MAP SENSE MRI reconstruction," in *Proc. Intl. Soc. Mag. Res. Med. (ISMRM)*, Salt Lake City, UT, Apr. 2013.

Il Yong Chun and Thomas M. Talavage, "Sparse Tikhonov-regularized SENSE MRI reconstruction," in *Proc. Intl. Soc. Mag. Res. Med. (ISMRM)*, Salt Lake City, UT, Apr. 2013.

Il Yong Chun, Allan Diaz, Yun Jang Jin, Xiaodong Li, Larry J. Leverenz, Eric A. Nauman, and Thomas M. Talavage, "Robust detection of progressive white matter abnormalities in mTBI using DW-MRI," in *Proc. Intl. Soc. Mag. Res. Med. (ISMRM)*, Salt Lake City, UT, Apr. 2013.

HONORS AND AWARDS	Travel Funds for Purdue Engineering Ph.D. Candidates, Purdue Univ.	Sep. 2014
	Travel Funds, 12th Fully 3D	Jun. 2013
	Magna Cum Laude Merit Award, 21st ISMRM	Apr. 2013
	Award of Trainee (Educational) Stipend, 21st ISMRM	Apr. 2013
	Semester High Honor, Korea Univ.	Dec. 2005–Jun. 2007
	Honors Scholarship, Korea Univ.	Feb. 2006–Aug. 2007

TALKS	**Seminar Presentations**	
	"ML & AI for breaking imaging limits" *ECE seminar*, Michigan State University (ECE)	Mar. 2019
	"ML & AI for breaking imaging limits" *EE seminar*, University of Hawai'i, Mānoa (EE)	Mar. 2019
	"Breaking imaging limits via ML & AI" *Seminar*, Shanghai Jiao Tong University (UM-SJTU JI)	Sep. 2018

"Breaking imaging limits via ML & AI"
Special Seminar, Ulsan National Institute of Science and Technology (ECE)   Sep. 2018

"Breaking imaging limits via ML & AI"
Seminar, Yonsei University (CSE)   Aug. 2018

"Breaking imaging limits"
Colloquium, Ohio State University (ECE)   Mar. 2018

"Breaking imaging limits"
Seminar, Texas Tech University (ECE)   Feb. 2018

"Convolutional dictionary learning using a fast block proximal gradient method"
Communications & signal processing seminars, University of Michigan (EECS)   Apr. 2017

"Compressed sensing and parallel acquisition"
Communications & signal processing seminars, University of Michigan (EECS)   Jan. 2016

Conference Presentations

"Incorporating handcrafted filters in convolutional analysis operator learning for ill-posed inverse problems"
Special session on *Computational biomedical imaging*
IEEE Intl. Workshop on Comput. Adv. in Multi-Sensor Adaptive Process. (CAMSAP)
(Invited talk)   Dec. 2019

"Application of trained Deep BCD-Net to iterative low-count PET image reconstruction"
IEEE Nuclear Science Symposium (NSS) and Medical Imaging Conference (MIC)   Nov. 2018

"Signal recovery using trained CNNs: Relation to compressed sensing and application to sparse-view CT"
Special session on *Machine learning advances in medical imaging*
Asilomar Conf. on Signals, Syst., and Comput. **(Invited talk)**   Oct. 2018

"Convergent iterative signal recovery using trained convolutional neural networks"
Special session on *Computational imaging and inverse problems*
Annual Allerton Conf. on Commun., Control, and Comput. **(Invited talk)**   Oct. 2018

"From convolutional analysis operator learning (CAOL) to convolutional neural network (CNN)"
Minisymposium on *Recent advances in convolutional sparse representations*
SIAM Conf. on Imaging Science (IS) **(Invited talk)**   Jun. 2018

"Deep BCD-Net using identical encoding-decoding CNN structures for iterative image recovery"
IEEE Image, Video, and Multidim. Signal Process. (IVMSP) Workshop   Jun. 2018

"Low-rank plus sparse tensor models for light-field reconstruction from focal stack data"
IEEE Image, Video, and Multidim. Signal Process. (IVMSP) Workshop   Jun. 2018.

"Physics-driven deep training of dictionary-based algorithms for image reconstruction"
Asilomar Conf. on Signals, Syst., and Comput. **(Invited talk)**   Nov. 2017

"Convergent convolutional dictionary learning using adaptive contrast enhancement (CDL-ACE): Application of CDL to image denoising"
Sampling Theory and Appl. (SampTA)   Jul. 2017

"Efficient sparse-view X-ray CT reconstruction using ℓ_1 regularization with learned sparsifying transform"
Intl. Mtg. on Fully 3D Image Recon. in Rad. and Nuc. Med. (Fully 3D)   Jun. 2017

"DTI reveals persistent effects on white matter in football players with history of sports-related concussion"
IN Neuroimaging Symp.   Nov. 2016

"Optimal sparse recovery for multi-sensor measurements"
IEEE Inf. Theory Workshop (ITW) 2016   Aug. 2016

"Sparsity and parallel acquisition: Optimal uniform and nonuniform recovery guarantees"

Workshop on Sparsity and Compressive Sensing in Multimedia (MM-SPARSE)
IEEE Intl. Conf. on Multimedia and Expo (ICME) 2016   Jul. 2016

"Robust detection of axonal abnormalities in high school collision-sport athletes: longitudinal single subject analysis"
Intl. Soc. Mag. Res. Med. (ISMRM)   May 2015

"Non-convex compressed sensing CT reconstruction based on tensor discrete Fourier slice theorem"
IEEE Eng. Med. Biol. Soc.'(EMBS)   Aug. 2014

"Efficient compressed sensing statistical X-ray/CT reconstruction from fewer measurements"
Intl. Mtg. on Fully 3D Image Recon. in Rad. and Nuc. Med. (Fully 3D)   Jun. 2013

"Robust detection of progressive white matter abnormalities in mTBI using DW-MRI"
Intl. Soc. Mag. Res. Med. (ISMRM)   Apr. 2013

PROFESSIONAL EXPERIENCE

<u>Reviewer for the following journals:</u>

- IEEE Transactions on Image Processing
- IEEE Transactions on Medical Imaging
- IEEE Transactions on Computational Imaging
- IEEE Signal Processing Letters
- SIAM Journal on Imaging Sciences
- Journal of X-Ray Science and Technology
- Medical Image Analysis

<u>**Reviewer for the following proceedings:**</u>

- IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2019
- IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2018

<u>**Membership:**</u>

- Member in IEEE
- Affiliated member in IEEE special interest group on computational imaging

ACTIVITIES

Purdue Electrical Engineering Korean Association (PEEKA)   Purdue Univ.
Vice President   Aug. 2011–Aug. 2012

Academic Society of Communication Engineering   Korea Univ.
President   Mar. 2006–Jun. 2007

VISA STATUS   H1-B

MILITARY SERVICE   Republic of Korea Army   South Korea
Private   Jun. 2003 – Sep. 2005

PROGRAM SKILL   MATLAB, Python, C, and C++