205H POST Bldg., 1680 East-West Rd., Honolulu, HI 96822

(Email: iychun@hawaii.edu, Phone: 808-956-5174)

EDUCATION

Purdue University

West Lafayette, IN, 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

Seoul, South Korea

B.Eng. in Electrical Engineering

Mar. 2002–Feb. 2009

University of Hong Kong

Hong Kong, China Aug. 2007–May 2008

Exchange Student in Electrical and Electronic Engineering

WORK EXPERIENCE

University of Hawai'i at Mānoa

Honolulu, HI, USA

Assistant Professor in Electrical Engineering (tenure-track)

Aug. 2019-

- \bullet Research: Machine learning & AI with big data, optimization, sampling, imaging science
- Teaching: Intro. to Digital Image Processing (EE416, F'19)

University of Michigan

Ann Arbor, MI, USA

Research Fellow in Electrical Engineering and Computer Science Visiting Scholar in Electrical Engineering and Computer Science (supervisor: Prof. Jeffrey Fessler) May 2016–Jul. 2019 May 2019–Jul. 2020

- 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

West Lafayette, IN, USA

Postdoctoral Research Associate in Mathematics

Aug. 2015–May 2016

(supervisor: Prof. Ben Adcock)

• Compressed sensing and parallel acquisition: Theory

Purdue University

West Lafayette, IN, USA

Research Assistant (advisor: Prof. Thomas M. Talavage) Teaching Assistant (advisor: Prof. Michael D. Zoltowski)

Aug. 2010–May 2015 Jan. 2011–May 2011

• Signals and systems (ECE301)

Research Assistant (advisor: Prof. Michael G. Heinz)

Aug. 2011-May 2013

Samsung Advanced Institute of Technology

Graduate Intern (supervisor: Dr. Jung-Bae Kim)

Yongin, South Korea Jun. 2013–Jul. 2013

• Multi-modal (ultrasonography & MRI) image registration

Neuroscience Research Institute

Lecturer (supervisor: Prof. Zang-Hee Cho)

Incheon, South Korea May 2013–Jun. 2013

• Teaching: Intro. to optimization

• Research: High-resolution PET image reconstruction

Intel Labs

Hillsboro, OR, 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

Seoul, South Korea

Public Interest Service Personnel

Jun. 2003–Sep. 2005

PUBLICATION

Preprints

(The asterisks (*) indicate equal contributions.)

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, Sep. 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

Hongki Lim, Il Yong Chun, Yuni K. Dewaraja, and Jeffrey A. Fessler, "Improved low-count quantitative PET reconstruction with an iterative 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

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," *Nature Photonics* (to appear), Oct. 2019.

Il Yong Chun and Jeffrey A. Fessler, "Convolutional analysis operator learning: Acceleration and convergence," *IEEE Trans. Image Process.*, 29(1):2108–2122, 2020. [Online] Available: http://arxiv.org/abs/1802.05584

Il Yong Chun and Ben Adcock, "Uniform recovery from subgaussian multi-sensor measurements," *Appl. Comput. Harmon. Anal.*, 48(2):731–765, Mar. 2020. [Online] Available: http://arxiv.org/abs/1610.05758

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

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*, 24:101930, Jul. 2019.

- 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," in *Proc. Med. Image Compt. and Computer Assist. Interven. (MICCAI)*, pp. 31–40, Shenzhen, China, Oct. 2019. [Online] Available: http://arxiv.org/abs/1908.01287

Conference Papers & Abstracts

- Siqi Ye, Yong Long, and Il Yong Chun, "Momentum-Net for low-dose CT image reconstruction," submitted to *IEEE Intl. Conf. Image Process. (ICIP)*, Feb. 2020.
- Zhipeng Li, Il Yong Chun, and Yong Long, "Image-domain material decomposition using an iterative neural network for dual-energy CT," accepted to *IEEE Intl. Symp. Biomed. Imag. (ISBI)*, Jan. 2020.
- Zhengyu Huang, Jeffrey A. Fessler, Theodore B. Norris, **Il Yong Chun** "Light-field reconstruction and depth estimation from focal stack images using convolutional neural networks," *Proc. IEEE Intl. Conf. on Acoust., Speech, and Signal Process. (ICASSP)* (to appear), Barcelona, Spain, May 2020. (Invited paper)
- Caroline Crockett, David Hong, **Il Yong Chun**, and Jeffrey A. Fessler, "Incorporating handcrafted filters in convolutional analysis operator learning for ill-posed inverse problems," in *Proc. IEEE Intl. Workshop on Compt. Adv. in Multi-Sensor Adaptive Process. (CAMSAP)* (to appear), Guadeloupe, West Indies, Dec. 2019. (**Invited paper**)
- 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," *J. Nuc. Med.* (Abs. Book), 60(s1):42, May 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. (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 Symp. (NSS) and Med. Imag. Conf. (MIC)*, pp. 1–4, 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 Workshop (ICMEW)*, 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. Conf. (EMBC)*, 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. Conf. (EMBC)*, 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 -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.

TALKS <u>Conference Presentations</u>

"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 poster)

"BCD-Net for low-dose CT reconstruction: Acceleration, convergence, and generalization,"

Med. Image Compt. and Computer Assist. Interven. (MICCAI) (Selected poster)

Oct. 2019

Dec. 2019

[&]quot;Application of trained Deep BCD-Net to iterative low-count PET image reconstruction"

"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"

Intl. Conf. on 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)*

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)

Jul. 2016

"Robust detection of axonal abnormalities in high school collision-sport athletes: longitudinal single subject analysis"

Intl. Soc. Maq. Res. Med. (ISMRM) (E-poster)

May 2015

"Non-convex compressed sensing CT reconstruction based on tensor discrete Fourier slice theorem" *IEEE Eng. Med. Biol. Conf. (EMBC)*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) (E-poster)

Apr. 2013

Seminar Presentations

"ML & AI for breaking imaging limits" ECE seminar, Michigan State University (ECE)

Mar. 2019

"ML & AI for breaking imaging limits" EE seminar, the 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 methor Communications & signal processing seminars, the University of Michigan (Ex | |
| | "Compressed sensing and parallel acquisition" Communications & signal processing seminars, the University of Michigan (E | ECS) Jan. 2016 |
| HONORS AND AWARDS | Travel Funds for Purdue Engineering Ph.D. Candidates, Purdue Univ. | Sep. 2014 |
| | Travel Funds, 12 th Fully 3D | Jun. 2013 |
| | Magna Cum Laude Merit Award, $21^{\rm st}$ ISMRM | Apr. 2013 |
| | Award of Trainee (Educational) Stipend, 21^{st} ISMRM | Apr. 2013 |
| | Semester High Honor, Korea Univ. | Dec. 2005–Jun. 2007 |
| | Honors Scholarship, Korea Univ. | Feb. 2006–Aug. 2007 |
| DDODDGGIONAL | | |

PROFESSIONAL Reviewer for the following journals: EXPERIENCE

- 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

Reviewer for the following proceedings:

Graduate Committee, EE Department

• IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2018–20

University of Hawai'i, Mānoa

Membership:

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

| Member | Aug. 2019– |
|---|--|
| Purdue Electrical Engineering Korean Assovice President | ociation (PEEKA) Purdue Univ. Aug. 2011–Aug. 2012 |

Academic Society of Communication Engineering

Korea Univ.

President

Mar. 2006–Jun. 2007

VISA STATUS H1-B

MILITARYRepublic of Korea ArmySouth KoreaSERVICEPrivateJun. 2003 – Sep. 2005

PROGRAM SKILL

ACTIVITIES

MATLAB, Python, C, and C++