

# *Il Yong Chun*

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**OBJECTIVE** To seek a tenure-track faculty position, particularly in data science and/or imaging science

**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  
Exchange Student in Electrical and Electronic Engineering Aug. 2007 – May 2008

**WORK EXPERIENCE**

**University of Michigan** Ann Arbor, MI, USA  
Research Fellow in Electrical Engineering and Computer Science May 2016 – Present  
(supervisor: Prof. Jeffrey Fessler)

- Convolutional neural networks: Theory and appl. to extreme imaging
- Block optimization: Theory and appl. to convolutional operator learning
- 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) 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** Yongin, South Korea  
Graduate Intern (supervisor: Dr. Jung-Bae Kim) Jun. 2013 – Jul. 2013

- Multi-modal (ultrasonography & MRI) image registration

**Neuroscience Research Institute** Incheon, South Korea  
Lecturer (supervisor: Prof. Zang-Hee Cho) May 2013 – Jun. 2013

- Lecture: Introduction 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

**Il Yong Chun**, Hongki Lim<sup>(\*)</sup>, Zhengyu Huang<sup>(\*)</sup>, and Jeffrey A. Fessler, “Momentum-Net: Fast and convergent recurrent neural network for inverse problems,” preprint, Dec. 2018.

**Il Yong Chun**, David Hong, Ben Adcock, and Jeffrey A. Fessler, “Convolutional analysis operator learning: Dependence on training data and compressed sensing recovery guarantees,” preprint, Jul. 2018.

Ikbeom Jang, **Il Yong Chun**, Eric L. Breedlove, Larry J. Leverenz, Eric A. Nauman, and Thomas M. Talavage, “Axonal impairment in high school football athletes: Longitudinal study using diffusion weighted imaging,” preprint, Oct. 2017.

(The asterisks (\*) indicate equal contributions.)

### Submitted 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,” submitted to *Nature*, Sep. 2018.

**Il Yong Chun** and Jeffrey A. Fessler, “Convolutional analysis operator learning: Acceleration, convergence, application, and neural networks,” submitted to *IEEE Trans. Image Process.*, Jan. 2018. [Online] Available: <http://arxiv.org/abs/1802.05584>

Xuehang Zheng<sup>(\*)</sup>, **Il Yong Chun**<sup>(\*)</sup>, Zhipeng Li, Yong Long, and Jeffrey A. Fessler, “Sparse-view X-ray CT reconstruction using  $\ell_1$  prior with learned transform,” submitted, Nov. 2017. [Online] Available: <http://arxiv.org/abs/1711.00905>

(The asterisks (\*) indicate equal contributions.)

### Journal Papers

**Il Yong Chun** and Ben Adcock, “Uniform recovery from subgaussian multi-sensor measurements,” *Appl. Comput. Harmon. Anal.*, 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.*, vol. 27, no. 4, pp. 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*, vol. 63, no. 8, pp. 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.*, vol. 2, no. 4, pp. 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.*, vol. 5, no. 1, pp. 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.*, vol. 40, no. 2, pp. 92–97, May 2015.

### Conference Papers & Abstracts

**Il Yong Chun**, Hongki Lim<sup>(\*)</sup>, Zhengyu Huang<sup>(\*)</sup>, and Jeffrey A. Fessler, “Fast and convergent iterative signal recovery using trained convolutional neural networks,” (to appear) in *Proc. Annual Allerton Conf. on Commun., Control, and Comput.*, Monticello, IL, Oct. 2018. **(Invited paper)**

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

Hongki Lim, Jeffrey A. Fessler, Yuni K. Dewaraja, **Il Yong Chun**, “Application of trained deep BCD-Net to iterative low-count PET image reconstruction,” (to appear) in *Proc. IEEE Nuclear Science Symposium (NSS) and Medical Imaging Conference (MIC)*, 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*, Zagori, Greece, Apr. 2018, pp 1–5, [Online] Available: <http://arxiv.org/abs/1802.07129>.

Cameron J. Blocker<sup>(\*)</sup>, **Il Yong Chun**<sup>(\*)</sup>, 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*, Zagori, Greece, Apr. 2018, pp 1–5.
- 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.*, Pacific Grove, CA, Nov. 2017, pp 1859–1863. **(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)*, Tallinn, Estonia, Jul. 2017, pp 460–464.
- Il Yong Chun**, Xuehang Zheng, Yong Long, and Jeffrey A. Fessler, “Sparse-view X-ray CT reconstruction using  $\ell_1$  regularization with learned sparsifying transform,” in *Proc. Intl. Mtg. on Fully 3D Image Recon. in Rad. and Nuc. Med. (Fully 3D)*, Xi’an, China, Jun. 2017, pp 115–119.
- 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)*, Seattle, WA, Jul. 2016, pp 1–6. [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)*, Cambridge, UK, Aug. 2016, pp 270–274. [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)*, Chicago, IL, Aug. 2014, pp. 2424–2427.
- 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)*, Chicago, IL, Aug. 2014, pp. 5141–5144.
- 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)*, Lake Tahoe, CA, Jun. 2013, pp. 30–33.
- 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  $L_p(0 < p < 1)$ -quasi-norm with fewer measurements than using  $L_1$ -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.

(The asterisks (\*) indicate equal contributions.)

## HONORS AND AWARDS

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

## TALKS

### Seminar Presentations

|   |           |
|---|-----------|
| “Breaking imaging limits via ML & AI”<br><i>Seminar</i> , Shanghai Jiao Tong University (UM-SJTU JI)  | Sep. 2018 |
| “Breaking imaging limits via ML & AI”<br><i>Special Seminar</i> , Ulsan National Institute of Science and Technology (ECE)  | Sep. 2018 |
| “Breaking imaging limits via ML & AI”<br><i>Seminar</i> , Yonsei University (CSE)   | Aug. 2018 |
| “Breaking imaging limits”<br><i>Colloquium</i> , Ohio State University (ECE)  | Mar. 2018 |
| “Breaking imaging limits”<br><i>Seminar</i> , Texas Tech University (ECE)   | Feb. 2018 |
| “Convolutional dictionary learning using a fast block proximal gradient method”<br><i>Communications &amp; signal processing seminars</i> , University of Michigan (EECS) | Apr. 2017 |
| “Compressed sensing and parallel acquisition”<br><i>Communications &amp; signal processing seminars</i> , University of Michigan (EECS)                                   | Jan. 2016 |

### Conference Presentations

|  |           |
|--|-----------|
| “Application of trained Deep BCD-Net to iterative low-count PET image reconstruction”<br><i>IEEE Nuclear Science Symposium (NSS) and Medical Imaging Conference (MIC)</i>  | Nov. 2018 |
| “Signal recovery using trained CNNs: Relation to compressed sensing and application to sparse-view CT”<br>Special session on <i>Machine learning advances in medical imaging</i><br>on <i>Asilomar Conf. on Signals, Syst., and Comput. (Invited talk)</i> | Oct. 2018 |
| “Convergent iterative signal recovery using trained convolutional neural networks”<br>Special session on <i>Computational imaging and inverse problems</i><br>on <i>Annual Allerton Conf. on Commun., Control, and Comput. (Invited talk)</i>              | Oct. 2018 |
| “From convolutional analysis operator learning (CAOL) to convolutional neural network (CNN)”<br>Minisymposium on <i>Recent advances in convolutional sparse representations</i><br>on <i>SIAM Conf. on Imaging Science (IS) (Invited talk)</i>             | Jun. 2018 |
| “Deep BCD-Net using identical encoding-decoding CNN structures for iterative image recovery”<br><i>IEEE Image, Video, and Multidim. Signal Process. (IVMSP) Workshop</i>   | Jun. 2018 |

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|--|------------|
| “Low-rank plus sparse tensor models for light-field reconstruction from focal stack data”<br><i>IEEE Image, Video, and Multidim. Signal Process. (IVMSP) Workshop</i>  | Jun. 2018. |
| “Physics-driven deep training of dictionary-based algorithms for image reconstruction”<br><i>Asilomar Conf. on Signals, Syst., and Comput. (Invited talk)</i>  | Nov. 2017  |
| “Convergent convolutional dictionary learning using adaptive contrast enhancement (CDL-ACE):<br>Application of CDL to image denoising”<br><i>Sampling Theory and Appl. (SampTA)</i>  | Jul. 2017  |
| “Efficient sparse-view X-ray CT reconstruction using $\ell_1$ regularization with learned sparsifying transform”<br><i>Intl. Mtg. on Fully 3D Image Recon. in Rad. and Nuc. Med. (Fully 3D)</i>  | Jun. 2017  |
| “DTI reveals persistent effects on white matter in football players with history of sports-related concussion”<br><i>IN Neuroimaging Symp.</i>   | Nov. 2016  |
| “Optimal sparse recovery for multi-sensor measurements”<br><i>IEEE Inf. Theory Workshop (ITW) 2016</i>   | Aug. 2016  |
| “Sparsity and parallel acquisition: Optimal uniform and nonuniform recovery guarantees”<br><i>Workshop on Sparsity and Compressive Sensing in Multimedia (MM-SPARSE)</i><br><i>IEEE Intl. Conf. on Multimedia and Expo (ICME) 2016</i> | Jul. 2016  |
| “Robust detection of axonal abnormalities in high school collision-sport athletes: longitudinal single subject analysis”<br><i>Intl. Soc. Mag. Res. Med. (ISMRM)</i>   | May 2015   |
| “Non-convex compressed sensing CT reconstruction based on tensor discrete Fourier slice theorem”<br><i>IEEE Eng. Med. Biol. Soc. (EMBS)</i>  | Aug. 2014  |
| “Efficient compressed sensing statistical X-ray/CT reconstruction from fewer measurements”<br><i>Intl. Mtg. on Fully 3D Image Recon. in Rad. and Nuc. Med. (Fully 3D)</i>  | Jun. 2013  |
| “Robust detection of progressive white matter abnormalities in mTBI using DW-MRI”<br><i>Intl. Soc. Mag. Res. Med. (ISMRM)</i>  | Apr. 2013  |

**PROFESSIONAL Reviewer for the following journals:  
EXPERIENCE**

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

**Reviewer for the following proceedings:**

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

**Membership:**

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

|                    |   |                                       |
|--------------------|---|---------------------------------------|
| <b>ACTIVITIES</b>  | <b>Purdue Electrical Engineering Korean Association (PEEKA)</b><br>Vice President | Purdue Univ.<br>Aug. 2011 – Aug. 2012 |
|                    | <b>Academic Society of Communication Engineering</b><br>President                 | Korea Univ.<br>Mar. 2006 – Jun. 2007  |
| <b>VISA STATUS</b> | H1-B  |                                       |

**MILITARY  
SERVICE**

Republic of Korea Army  
Private

South Korea  
Jun. 2003 – Sep. 2005

**PROGRAM  
SKILL**

MATLAB, Python, C, and C++