Yongwan Lim

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PROFILE
- New PhD graduate with expertise in MRI, Signal and Image Processing, Medical Imaging, Machine (Deep) Learning;
- Deep understanding in medical image formation process;
- Familiar with machine learning, deep learning, and computer vision;
- Hands-on experience in modern data-driven techniques such as convolutional neural networks;
- Experienced in MATLAB, Python, C/C++;

RESEARCH INTERESTS

Machine (Deep) Learning
- Supervised- and self-supervised learning in image processing, computer vision, and so on;

Computational Imaging
- Magnetic resonance imaging (MRI); compressive sensing, reconstruction, image deblurring;
- Image processing, computational photography;

EDUCATION

PhD, Electrical and Computer Engineering, Computer Science (minor) *Expected,* Fall 2020
University of Southern California (USC), Los Angeles, CA, USA
- Thesis: *Improved real-time MRI of speech production*
- Advisors: Krishna S. Nayak, Ph.D. and Shrikanth S. Narayanan, Ph.D.
- GPA: 3.79/4

Master of Science, Electrical Engineering, Feb 2014
Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea
- Thesis: *Free-breathing abdominal MR imaging for reduction of respiratory motion artifacts*
- Advisor: HyunWook Park, Ph.D.
- GPA: 4.26/4.3

Bachelor of Science, Electrical Engineering, Feb 2012
Sogang University, Seoul, Korea
- GPA: 3.88/4.3 (Major: 4.19/4.3), *Summa Cum Laude*

RESEARCH EXPERIENCE

Graduate Research Assistant Aug 2015 – present
Magnetic Resonance Engineering Lab and Signal Analysis and Interpretation Lab, USC
Advisors: Krishna S. Nayak, Ph.D. and Shrikanth S. Narayanan, Ph.D.

Computational Imaging Techniques in Real-Time MRI
- Designed and implemented reconstruction algorithms for real-time MRI, based on sparse signal model, hardware limitation, and MR physics in Matlab and Python.
- Achieved 6-7× acceleration in imaging by reconstructing highly under-sampled data.
- Constructed and explored self-supervised reconstruction using convolutional and recurrent neural networks for real-time MRI.

An Open Speech MRI Dataset
- Initiate and lead the project for machine learning applications; facilitate open-source developing and new technology incubation for data-driven methods in dynamic MRI.
- Serve as an MRI technician for collecting and processing morphological and functional speech MRI data from >72 subjects (>100 hours) for various linguistic studies.
- Curate a large data corpus including pre- and post-processing, technical validation, anonymization, and preparation for code and data repository.
- Explore self-supervised representation learning techniques for speech MRI via video alignment task; facilitate speech scientific questions such as inter- and intra-speaker variability.

Deblurring for Real-Time MRI
- Developed a model-based image deblurring algorithm.
- Devised a model-based framework for synthesizing training data.

- Invented data-driven image deblurring algorithms based on convolutional neural networks and attention mechanism; Achieved scan time efficiency (2×) with comparable image quality

3D Real-Time MRI for Speech Production

- Led technical development in a cross-functional team of linguists, audio engineers, and MRI scientists.
- Achieved a 3D real-time imaging for speech production; enabled visualizing moving vocal articulators during natural speech at 14 fps (13× acceleration).
- Invented a novel MR sequence and reconstruction pipeline based on MR hardward limits and an inherent tradeoff among spatial coverage and temporal resolution.

Research Summer Intern July 2018

Samsung Fire & Marine Insurance, Seoul, Korea

- Developed a deep learning method for document classification

Research Intern June 2014 – June 2015

Image Media Research Center, Korea Institute of Science and Technology (KIST), Seoul, Korea
Advisor: Jaein Hwang, Ph.D.

- Improved computer vision failure case in 3D tracking algorithm for augmented reality system with smartphones by implementing sensor fusion

Graduate Research Assistant Feb 2012 – Feb 2014

Image Computing System Lab, KAIST, Daejeon, Korea
Advisor: HyunWook Park, Ph.D.

- Reduced respiratory motion artifacts in abdominal MRI by implementing efficient data acquisition and reconstruction methods

Undergraduate Research Assistant June 2011 – Jan 2012

Image Processing Lab, Sogang University, Seoul, Korea
Advisor: Rae-Hong Park, Ph.D.

- Developed a 3D environment reconstruction method using the Kinect sensor and its visualization via tracking head position from a webcam

Journal Publications

8. **Y. Lim**, Y. Bliesener, Y. Tian, S. Narayanan, and K. S. Nayak, "An open dataset for real-time speech production MRI: raw data, synchronized audio, and images," *Scientific Data*. In preparation.

7. Z. Zhao†, **Y. Lim**†, D. Byrd, S. Narayanan, and K. S. Nayak, "Improved 3D real-time MRI of speech production," *Magnetic Resonance in Medicine*. 2020. Under review.

6. K. S. Nayak, **Y. Lim**, A. Campbell-Washburn, and J. Steeden, "Real-time magnetic resonance imaging," *Journal of Magnetic Resonance Imaging*. 2020. In press.

5. **Y. Lim**, Y. Bliesener, S. Narayanan, and K. S. Nayak, "Deblurring for spiral real-time MRI using convolutional neural networks," *Magnetic Resonance in Medicine*, vol. 84, no. 6, pp. 3438–3452, Dec. 2020.

4. **Y. Lim**, Y. Zhu, S. G. Lingala, D. Byrd, S. Narayanan, and K. S. Nayak, "3D dynamic MRI of the vocal tract during natural speech," *Magnetic Resonance in Medicine*, vol. 81, no. 3, pp. 1511–1520, Mar. 2019. (IF: 3.858)

3. **Y. Lim**, S. G. Lingala, S. Narayanan, and K. S. Nayak, "Dynamic off-resonance correction for spiral real-time MRI of speech," *Magnetic Resonance in Medicine*, vol. 81, no. 1, pp. 234–246, Jan. 2019. (IF: 3.858)

2. S. G. Lingala, Y. Zhu, **Y. Lim**, A. Toutios, Y. Ji, W-C. Lo, N. Seiberlich, S. Narayanan, K. S. Nayak, "Feasibility of spiral through-time GRAPPA for low latency accelerated real-time MRI of speech," *Magnetic Resonance in Medicine*, vol. 78, no. 6, pp. 2275–2282, Dec. 2017. (IF: 3.858)

1. J. S. Choi, H. S. Seo, **Y. W. Lim**, Y. J. Han, and H. W. Park, "Sliding TOF: Sliding time of flight MR angiography using a dynamic image reconstruction method," *Magnetic Resonance in Medicine*, vol. 72, no. 3, pp. 1177–1183, Mar. 2015. (IF: 3.858)

†: equal contribution

Conference Publications

16. **Y. Lim**, S. Narayanan, and K. S. Nayak, "Attention-gated convolutional neural networks for off-resonance correction of spiral real-time MRI," *in Proc. 28th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, Aug, 2020. (Oral presentation)
Recipient of a Magna Cum Laude Merit Award

15. Z. Zhao, **Y. Lim**, D. Byrd, S. Narayanan, and K. S. Nayak, "Improved 3D real-time MRI with Stack-of-Spiral (SOSP) trajectory and variable density randomized encoding of speech production," *in Proc. 28th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, Aug, 2020. (Oral presentation)
Recipient of a Magna Cum Laude Merit Award

14. **Y. Lim**, S. Narayanan, and K. S. Nayak, "Deblurring for spiral real-time MRI using convolutional neural networks," *Medical Imaging with Deep Learning*, Montréal, Canada, July 2020.

13. Z. Zhao, **Y. Lim**, D. Byrd, S. Narayanan, and K. S. Nayak, "Improved 3D real-time MRI with Stack-of-Spiral (SOSP) trajectory and variable density randomized encoding of speech production," *in Proc. ISMRM Workshop on Data Sampling and Image Reconstruction*, Sedona, Arizona, Jan. 2020. (Oral presentation)

12. **Y. Lim**, Y. Bliesener, S. Narayanan, and K. S. Nayak, "Calibrationless deblurring of spiral RT-MRI of speech production using convolutional neural networks," *in Proc. 27th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, Montreal, Canada, May 2019. (Power pitch presentation)

11. S. G. Lingala, **Y. Lim**, S. Kruger, and K. S. Nayak, "Improved spiral dynamic MRI of vocal tract shaping at 3 Tesla using dynamic off resonance artifact correction," *in Proc. 27th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, Montreal, Canada, May 2019. (Oral presentation)

10. S. Sudhakara, **Y. Lim**, W. Chen, S. Narayanan, and K. S. Nayak, "Low-latency reconstruction for real-time speech MRI," *in Proc. 27th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, Montreal, Canada, May 2019. (E-poster presentation)

9. **Y. Lim**, Y. Zhu, S. G. Lingala, D. Byrd, S. Narayanan, and K. S. Nayak, "3D real-time MRI of vocal tract shaping," *in Proc. 26th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, p. 3541, Paris, France, June 2018. (E-poster presentation)

8. W. Chen, **Y. Lim**, Y. Bliesener, S. Narayanan, and K. S. Nayak, "Comparison of leading reconstruction techniques for real-time speech MRI," *in Proc. 26th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, p. 3516, Paris, France, June 2018. (E-poster presentation)

7. **Y. Lim**, S. G. Lingala, S. Narayanan, and K. S. Nayak, "Correction of dynamic off-resonance in spiral 2D real-time MRI of speech," *in Proc. 25th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, p. 4017, Honolulu, HI, USA, Apr. 2017. (E-poster presentation)

6. J. Chen, S. G. Lingala, **Y. Lim**, A. Toutios, S. Narayanan, and K. S. Nayak, "Task-based optimization of regularization in highly accelerated speech RT-MRI," *in Proc. 25th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, p. 1409, Honolulu, HI, USA, Apr. 2017. (Poster presentation)

5. **Y. Lim**, S. G. Lingala, A. Toutios, S. Narayanan, and K. S. Nayak, "Improved depiction of tissue boundaries in vocal tract real-time MRI using automatic off-resonance correction," *in Proc. Interspeech*, pp. 1765–1769, San Francisco, CA, USA, Sep. 2016. (Poster presentation)

4. S. G. Lingala, A. Toutios, J. Toger, **Y. Lim**, Y. Zhu, Y-C. Kim, C. Vaz, S. Narayanan, and K. S. Nayak, "State of the art MRI protocol for comprehensive assessment of vocal tract structure and function," *in Proc. Interspeech*, pp. 475–479, San Francisco, CA, USA, Sep. 2016. (Oral presentation)

3. J. Toger, **Y. Lim**, S. G. Lingala, S. Narayanan, K. S. Nayak, "Sensitivity of quantitative RT-MRI metrics of vocal tract dynamics to image reconstruction settings," *In Proc. Interspeech*, pp. 165–169, San Francisco, CA, USA, Sep. 2016. (Oral presentation)

2. **Y. W. Lim**, Y. J. Han, and H. W. Park, "A robust data acquisition method for reduced respiratory motion artifact in free-breathing image," *In Proc. Int. Society for Magnetic Resonance in Medicine (ISMRM)*, p. 4368, Milan, Italy, Apr. 2014. (E-poster presentation)

1. **Y. W. Lim**, H.-Z. Lee, N.-E. Yang, and R.-H. Park, "3-D reconstruction using the Kinect sensor and its application to a visualization system," *in Proc. 2012 IEEE Int. Conf. Systems, Man, and Cybernetics*, pp. 3343–3348, Seoul, Korea, Oct. 2012. (Oral presentation)

Patent

2. H. W. Park, **Y. W. Lim**, and Y. J. Han, "Magnetic resonance imaging apparatus and control method," Appl. No.: 14/804678, Filed Date: Jul. 21, 2015, U.S. Pub. No.: US 2016/0018497 A1, Pub. Date: Jan. 21, 2016.

1. H. W. Park, **Y. W. Lim**, and Y. J. Han, "Magnetic resonance imaging device and control method thereof," KOREA 10-2014-0091888, Aug. 2014.

Awards

Travel Awards

- ISMRM Educational Stipend Award 2017–2019
- Travel Grant, Graduate Student Government, USC 2016–2018

Student Awards

- ISMRM Magna Cum Laude Merit Award (top 15% of 4886 abstracts) 2020
- Ming Hsieh Institute PhD Scholar Finalist, USC 2019
- Best Paper Award, 25th Korea Signal Processing Conference Sep 2012
- Golden Medal Award of the Academic Competition, Sogang University Nov 2011
- Merit-based Scholarship (top 15 of 1500), Sogang University 2009–2011

Other Experience

Mentoring

- Advised one undergraduate student and five graduate students on independent research projects 2015–present

Reviewer

- Magnetic Resonance in Medicine 2020
- Journal of Speech, Language, and Hearing Research 2020
- IEEE International Symposium on Biomedical Imaging 2020
- ISMRM Annual Conference 2019
- Precision and Future Medicine 2018

Military Service

- Sergeant (Administrative Specialist) Jan 2007 – Jan 2009
  The Army of Republic of Korea, Choongju, Korea

Software Skills

Tools and Programming:

- Fluent: Python, MATLAB, Bash, LaTeX, Git
- Prior experience: C/C++, Java, and others

Languages

Korean and English