Yongwan Lim

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RESEARCH INTERESTS

Magnetic Resonance Imaging (MRI)
- Real-time imaging, compressed sensing, image reconstruction, image deblurring, artifact correction

Signal and Image Processing
- Machine learning, deep learning, optimization, inverse problems

EMPLOYMENT

Research Scientist Feb 2021–present
Ming Hsieh Department of Electrical and Computer Engineering
University of Southern California (USC), Los Angeles, CA, USA

Researcher Jun 2014–Jun 2015
Image Media Research Center
Korea Institute of Science and Technology (KIST), Seoul, Korea

EDUCATION

Ph.D., Electrical and Computer Engineering, Computer Science (minor) Dec 2020
University of Southern California, Los Angeles, CA, USA
- Dissertation: *Improved real-time MRI of speech production*
- Advisors: Krishna S. Nayak, Ph.D. and Shrikanth S. Narayanan, Ph.D.

M.S., 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.

B.S., Electronic Engineering, Feb 2012
Sogang University, Seoul, Korea

RESEARCH EXPERIENCE

Graduate Research Assistant Aug 2015– Dec 2020
Magnetic Resonance Engineering Lab, Signal Analysis and Interpretation Lab,
Speech Production and Articulation kNowledge (SPAN) group, USC

An Open Speech MRI Dataset
- Initiate and lead 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 75+ subjects (100+ hours) for various linguistic studies.
- Conduct curation of a large data corpus including pre- and post-processing, technical validation, anonymization, and preparation for code and data repository.

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

Deblurring for Real-Time MRI
- Developed a model-based image deblurring algorithm.
- Invented data-driven deblurring algorithms based on a model-based data generation, convolutional neural networks and attention mechanism; attained 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 organs during natural speech at 14 fps (13× acceleration).
- Invented a novel MR sequence and reconstruction pipeline based on MR hardware limits and an inherent tradeoff among spatial coverage and temporal resolution.

Research Intern Jul 2018

Samsung Fire & Marine Insurance, Seoul, Korea

- Constructed a deep learning method for document classification.

Research Intern Jun 2014–Jun 2015

Image Media Research Center, Korea Institute of Science and Technology (KIST), Seoul, Korea

- Developed a sensor fusion algorithm to imporve computer vision failure case in 3D tracking for augmented reality system with smartphones.

Graduate Research Assistant Feb 2012–Feb 2014

Image Computing System Lab, KAIST, Daejeon, Korea

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

Undergraduate Research Assistant Jun 2011–Jan 2012

Image Processing Lab, Sogang University, Seoul, Korea

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

Journal Publications

9. **Y. Lim**†, A. Toutios†, et al, "A multispeaker dataset of raw and reconstructed speech production real-time MRI video and 3D volumetric images," *Scientific Data*. 2021. In review.

8. Y. Tian, **Y. Lim**, Z. Zhao, D. Byrd, S. Narayanan, and K. S. Nayak, "Aliasing artifact mitigation in spiral real-time MRI," *Magnetic Resonance in Medicine.* 2021. Early view online. (IF: 3.635)

7. K. S. Nayak, **Y. Lim**, A. Campbell-Washburn, and J. Steeden, "Real-time magnetic resonance imaging," *Journal of Magnetic Resonance Imaging.* 2021. Early view online. (IF: 3.954)

6. Z. Zhao†, **Y. Lim**†, D. Byrd, S. Narayanan, and K. S. Nayak, "Improved 3D real-time MRI of speech production," *Magnetic Resonance in Medicine*, vol. 85, no. 6, pp. 3182–3195, Jun. 2021. (IF: 3.635)

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. (IF: 3.635)

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: 3.635)

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: 3.635)

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: 3.635)

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: 3.635)

†: equal contribution

Conference Publications

19. **Y. Lim**, A. Toutios, Y. Bliesener, Y. Tian, S. Narayanan, and K. S. Nayak, "An open dataset for speech production real-time MRI: raw data, synchronized audio, and image," *in Proc. 29th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, May 2021. (Oral presentation)

18. P. Kumar, **Y. Lim**, and K. S. Nayak, "Feasibility of super resolution speech RT-MRI using deep learning," *in Proc. 29th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, May 2021. (E-poster presentation)

17. Y. Tian, **Y. Lim**, Z. Zhao, D. Byrd, S. Narayanan, and K. S. Nayak, "Aliasing artifact reduction in spiral real-time MRI," *in Proc. 29th Int. Society for Magnetic Resonance in Medicine (ISMRM) Scientific Sessions*, May 2021. (E-poster presentation)

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.

Teaching Experience

Lecture Courses

EE 591 - Magnetic Resonance Imaging and Reconstruction, Guest Lecturer, USC — Spring 2019
- Delivered a 2-hours lecture about Nyquist sampling theory

HSS189 - EE Freshmen Seminar, Teaching Assistant, KAIST — Spring 2013
- Prepared and delivered lectures for a large introductory lecture class

Mentoring
- Advised one undergraduate student and five graduate students on independent research projects — 2015–Present

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

Reviewer
- European Journal of Radiology Open — 2021
- 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++, Siemens IDEA/ICE, Java
Languages	Korean and English