CURRICULUM VITAE

Dosik Hwang, Ph.D.
Professor
School of Electrical and Electronic Engineering
Yonsei University, Seoul, KOREA
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EDUCATION

• Ph.D., Bioengineering, May 2006
University of Utah, Salt Lake City, Utah, USA

EXPERIENCES

09/2008 – Present	Assistant/Associate/Full Professor, School of Electrical and Electronic Engineering, Yonsei University, Seoul, Korea
09/2015 – 08/2016	Visiting Scholar, Radiology, University of California, San Diego, USA
06/2006 – 08/2008	Postdoctoral Fellow, Brain Imaging Center, University of Colorado - Magnetic Resonance Imaging

HONORS AND AWARDS

05/2022	Magna Cum Laude Merit Award – Deep Learning - International Society for Magnetic Resonance in Medicine
12/2021	Challenge Winner #1 – crossMoDa Challenge – MICCAI 2021
06/2021	Summa Cum Laude Merit Award – Deep Learning Magna Cum Laude Merit Award (I) – Deep Learning Magna Cum Laude Merit Award (II) – Deep Learning - International Society for Magnetic Resonance in Medicine
08/2020	Summa Cum Laude Merit Award – Deep Learning - International Society for Magnetic Resonance in Medicine
11/2020	3rd Rank, fastMRI Challenge 2020 by Facebook & NYU, USA
11/2019	4th Rank, fastMRI Challenge 2019 by Facebook & NYU, USA
03/2019	1st Rank and the Best Award, A.I. HeLP Challenge 2018 by Asan Medical Center & Minitry of Health and Welfare, Korea
04/2017	Summa Cum Laude Merit Award (I) – Deep Learning - International Society for Magnetic Resonance in Medicine
04/2017	Summa Cum Laude Merit Award (II) – Deep Learning - International Society for Magnetic Resonance in Medicine
09/2013	Presidential Distinguished Research Award, Yonsei University
09/2013	Presidential Distinguished Teaching Award, Yonsei University
03/2013	Best Paper Award, Korean Society for Magnetic Resonance in Medicine
05/2012	Yonsei Graduate Best Paper Award, Yonsei University
05/2012	Magna Cum Laude Merit Award - International Society for Magnetic Resonance in Medicine

TECHNOLOGY TRANSFER

03/2019	AI Diagnosis based on Medical Images Patent Technology Transfer

- Co-Principal Investigator

03/2018 Recognition & Classification Techniques Patent Technology Transfer
- Principal Investigator

08/2012 Biomedical Techniques Patent Technology Transfer
- Principal Investigator

PUBLICATIONS

• ***Thesis***

Doctor of Philosophy in Bioengineering, Iterative Reconstruction for Single Photon Emission Computed Tomography, University of Utah, USA, 2006

• ***International Journal Papers (SCI)***

1. **Dosik Hwang** and Gengsheng L. Zeng, "A New Simple Iterative Reconstruction Algorithm for SPECT Transmission Measurement," *Medical Physics*, vol. 32, pp. 2312-2319, 2005.
2. **Dosik Hwang** and Gengsheng L. Zeng, "Reduction of Noise Amplification in SPECT Using Smaller Detector Bin Size," *IEEE Transactions on Nuclear Science,* vol. 52, pp. 1417-1427, 2005.
3. **Dosik Hwang** and Gengsheng L. Zeng**,** "Convergence Study of an Accelerated ML-EM Algorithm Using Bigger Step Size," *Physics in Medicine and Biology,* vol. 51, pp. 237-252, 2006.
4. Srikantan Nagarajan, Oleg Portniaguine, **Dosik Hwang,** Chris Johnson and Kensuke Sekihara, "Controlled Support MEG Imaging," *NeuroImage*, vol. 33, pp. 878-885, 2006.
5. Yiping P. Du, Renxin Chu, **Dosik Hwang**, Mark S. Brown, Bette K. Kleinschmidt-DeMasters, Debra Singel, and Jack H. Simon, "Fast Multi-Slice Mapping of the Myelin Water Fraction Using Multi-Compartment Analysis of T2* Relaxation at 3 Tesla – A Preliminary Post-Mortem Study," *Magnetic Resonance in Medicine*, vol. 58, pp. 865-870, 2007.
6. **Dosik Hwang**, Yiping P. Du, "Improved Myelin Water Quantification Using Spatially Regularized Non-negative Least Squares Algorithm," *Journal of Magnetic Resonance Imaging*, vol. 30, pp. 203-208, 2009.
7. **Dosik Hwang,** Dong-Hyun Kim, Yiping P. Du, "In Vivo Multi-slice Mapping of Myelin Water Content Using T_2* Decay," *NeuroImage*, vol. 52, pp. 198-204, 2010.
8. **Dosik Hwang*,** Hyunjin Chung, Yoonho Nam, Yiping P. Du, Ung Jang, "Robust mapping of the myelin water fraction in the presence of noise: the synergic combination of anisotropic diffusion filter and spatially regularized nonnegative least squares algorithm," *Journal of Magnetic Resonance Imaging*, vol. 34, pp. 189-195, 2011.
9. **Dosik Hwang***, Jeong-Whan Lee, Gengsheng L Zeng, "SPECT Reconstruction with Sub-Sinogram Acquisitions," *International Journal of Imaging Systems and Technology*, vol. 21, pp. 247-252, 2011.
10. Ung Jang, **Dosik Hwang*,** "High-quality multiple T2(*) contrast MR images from low-quality multi-echo images using temporal-domain denoising methods," *Medical Physics*, Vol. 39, No. 1, pp. 468-474, January, 2012.
11. Young-Jae Lee, Pil-Jae Lee, Kyeong-Seop Kim, Wonse Park, Kee-Deog Kim, **Dosik Hwang**, Jeong-Whan Lee, "Toothbrushing Region Detection Using Three-Axis Accelerometer and Magnetic Sensor," *IEEE Transactions on Biomedical Engineering*, Vol. 59, No. 3, pp. 872-881, March, 2012.
12. Jun-Uk Chu, Kang-Il Song, Sungmin Han, Soo Hyun Lee, Jinseok Kim, Ji Yoon Kang, **Dosik Hwang**, Jun-Kyo Francis Suh, Kuiwon Choi, and Inchan Youn, "Improvement of signal-to-interference ratio and signal-to-noise ratio in nerve cuff electrode systems," *Physiological Measurements*, Vol. 33, pp. 943-967, May, 2012.

13. Ung Jang, Yoonho Nam, Dong-Hyun Kim, **Dosik Hwang***, "Improvement of the SNR and resolution of susceptibility-weighted venography by model-based multi-echo denoising," *NeuroImage*, Vol. 70, pp. 308-316, 2013
14. OhIn Kwon, EungJe Woo, Yiping P. Du, **Dosik Hwang***, "A Tissue-Relaxation-Dependent Neighboring Method for Robust Mapping of the Myelin Water Fraction," *NeuroImage*, Vol. 74, pp. 12-21, 2013.
15. Byungmin Kang, O. Choi, J. D. Kim, and **Dosik Hwang***, "Noise reduction in magnetic resonance images using adaptive non-local means filtering," *Electronics Letters*, Vol. 49 (5), p.324-326, 28 February 2013.
16. Jun-Uk Chu, Kang-Il Song, Sungmin Han, Soo Hyun Lee, Ji Yoon Kang, **Dosik Hwang**, Jun-Kyo Francis Suh, Kuiwon Choi, and Inchan Youn, "Gait phase detection from sciatic nerve recordings in functional electrical stimulation systems for foot drop correction," *Physiological Measurements*, Vol. 34, pp. 541-565, 2013.
17. Jun-Uk Chu, Kang-Il Song, Ahnsei Shon, Sungmin Han, Soo Hyun Lee, Ji Yoon Kang, **Dosik Hwang**, Jun-Kyo Francis Suh, Kuiwon Choi, Inchan Youn, "Feedback control of electrode offset voltage during functional electrical stimulation," *Journal of Neuroscience Methods*, Vol. 218, pp. 55-71, 2013.
18. Sung-Min Gho, Chunlei Liu, Wei Li, Ung Jang, Eung Yeop Kim, **Dosik Hwang**, Dong-Hyun Kim, "Susceptibility Map-Weighted Imaging (SMWI) for Neuroimaging," *Magnetic Resonance in Medicine*, 2014.
19. Younguk Kim, Jongduk Baek, **Dosik Hwang***, "Ring Artifact Correction Using Detector Line-ratios in Computed Tomography," *Optics Express*, Vol. 22, No. 11, pp. 13380-13392, 2014.
20. Sunghee Estelle Park, Kang-Il Song, Jun-Kyo Francis Suh, **Dosik Hwang**, Inchan Youn, "A time-course study of behavioral and electrophysiological characteristics in a mouse model of different stages of Parkinson's disease using 6-hydroxydopamine," *Behavioural Brain Research*, Vol. 284, pp. 153-157, May 1, 2015 (Epub Feb 2015).
21. Yoonho Nam, Jongho Lee, **Dosik Hwang**, Dong-Hyun Kim, "Improved estimation of myelin water fraction using complex model fitting," *NeuroImage*, Vol. 116, pp. 214-221, 2015.
22. Hyoung Suk Park, **Dosik Hwang**, Jin Keun Seo, "Metal Artifact Reduction for Polychromatic X-ray CT based on a Beam Hardening Corrector," *IEEE Transactions on Medical Imaging*, Vol. 35, No. 2, pp. 480 – 487, February 2016.
23. Sunjung Kim, **Dosik Hwang***, "Murmur-adaptive Compression Technique for Phonocardiogram Signals," *Electronics Letters*, Vol. 52 (3), pp. 183-184, 2016 (Feb,4).
24. **Dosik Hwang**, Sewon Kim, Nirusha A. Abeydeera, Sheronda Statum, Koichi Masuda, Christine B. Chung, Palanan Siriwanarangsun, Won C. Bae*, "Quantitative magnetic resonance imaging of the lumbar intervertebral discs," *Quantitative Imaging in Medicine and Surgery*, Vol. 6, No. 6, pp. 744-755, Dec 9, 2016
25. Kang-il Song, Jun-Uk Chu, Sunghee E. Park, **Dosik Hwang**, Inchan Youn, "Ankel-Angle Estimation from Blind Source Separated Afferent Activity in the Sciatic Nerve for Closed-Loop Functional Neuromuscular Stimulation System," *IEEE Transactions on Biomedical Engineering*, Vol. 64, No. 4, pp. 834-843, April, 2017
26. Taejoon Eo, Taeseong Kim, Yohan Jun, Hongpyo Lee, Sung Soo Ahn, Dong-Hyun Kim, **Dosik Hwang***, "High-SNR Multiple T2(*)-Contrast Magnetic Resonance Imaging Using a Robust Denoising Method Based on Tissue Characteristics," *Journal of Magnetic Resonance Imaging*, Vol. 45, No. 6, pp. 1835-1845, June, 2017 (DOI: 10.1002/jmri.25477).
27. Younguk Kim, Daejoong Oh, **Dosik Hwang***, "Small-scale noise-like moiré pattern caused by detector sensitivity inhomogeneity in computed tomography," *Optics Express*, Vol. 25, No. 22, pp. 27127-27145, Oct 30, 2017 (https://doi.org/10.1364/OE.25.027127).
28. Yujin Lee, **Dosik Hwang***, "Periodicity-based nonlocal-means denoising method for electrocardiography in low SNR non-white noisy conditions," *Biomedical Signal Processing and Control*, Vol. 39, pp. 284-293, 2018.
29. Jang, J., Bang, K., Jang, H., & **Hwang, D*.** (2018), "Quality Evaluation of No-reference MR

Images Using Multidirectional Filters and Image Statistics," *Magnetic Resonance in Medicine*, 2018 Sep;80(3):914-924 (doi: 10.1002/mrm.27084).

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31. Jun, Y., Eo, T., Kim, T., Shin, H., **Hwang, D.***, Bae, S., Park, Y., Lee, H., Choi, B., Ahn, S. (2018), "Deep-learned 3D black-blood imaging using automatic labelling technique and 3D convolutional neural networks for detecting metastatic brain tumors," *Scientific Reports*, 8: 9450.
32. Oh, D., Kim, S., Park, D., Choi, S., Song, H., Choi, Y., Moon, S., Baek, J., **Hwang, D.*** (2018), "Correction of severe beam-hardening artifacts via a high-order linearization function using a prior-image-based parameter selection method," *Medical Physics*, 45(9), Sep 2018. doi: 10.1002/mp.13072.
33. Lee, Y., Kim, S., Suh, J., **Hwang, D.*** (2018), "Learning Radiologist's Step-by-Step Skill for Cervical Spinal Injury Examination: Line drawing, Prevertebral Soft Tissue Thickness Measurement, and Detection of the Swelling in Radiographs," *IEEE Access*, Vol. 6, No. 1, pp. 55492-55500, December, 2018.
34. Jang, H., Bang, K., Jang, J., **Hwang, D.*** (2018), "Inverse Tone Mapping Operator Using Sequential Deep Neural Networks Based on Human Visual System," *IEEE Access*, Vol. 6, No. 1, pp. 52058-52072, December, 2018.
35. Kim, S., Bae, W.C., Masuda, K., Chung, C.B., **Hwang, D.*** (2018), "Semi-Automatic Segmentation of Vertebral Bodies in MR Images of Human Lumbar Spines," *Applied Sciences*, 2018, 8, 1586; doi:10.3390/app8091586.
36. Kim, S., Bae, W.C., Masuda, K., Chung, C.B., **Hwang, D.*** (2018), "Fine-Grain Segmentation of the Intervertebral Discs from MR Spine Images Using Deep Convolutional Neural Networks: BSU-Net," *Applied Sciences*, 2018, 8, 1656; doi:10.3390/app8091656.
37. Jang, J., Jang, H., Eo, T., Bang, K., **Hwang, D.*** (2018), "No-reference Automatic Quality Assessment for Colorfulness-Adjusted, Contrast-Adjusted, and Sharpness-Adjusted Images Using High-Dynamic-Range-Derived Features," *Applied Sciences*, 2018, 8, 1688; doi:10.3390/app8091688.
38. Jun, Y., Eo, T., Shin, H., Kim, T., Lee, H., **Hwang, D.*** (2019), "Parallel Imaging in Time-of-flight Magnetic Resonance Angiography using Deep Multistream Convolutional Neural Networks," *Magnetic Resonance in Medicine*, 2019;00:1–14. https://doi.org/10.1002/mrm.27656
39. Taehoon Kim, Gwangmook Kim, Hyeohn Kim, Hong-Jib Yoon, Taeseong Kim, Yohan Jun, Tae-Hyun Shin, Shinill Kang, Jinwoo Cheon, **Dosik Hwang**, Byung-wook Min & Wooyoung Shim (2019), "Megahertz-wave-transmitting conducting polymer electrode for device-to-device integration," *Nature Communications*, 2019:10:653, https://doi.org/10.1038/s41467-019-08552-z
40. **Dosik Hwang**, DaeEun Kim, "Special Features on Intelligent Imaging and Analysis," *Applied Sciences*, 2019, 9, 4804; doi:10.3390/app9224804
41. In Yong Park, Junsik Eom, Hanbyol Jang, Sewon Kim, Sanggeon Park, Yeowool Huh, and **Dosik Hwang***, "Deep Learning-Based Template Matching Spike Classification for Extracellular Recordings," *Applied Sciences*, 2020, 10, 301; doi:10.3390/app10010301
42. Hanbyol Jang, Kihun Bang, Jinseong Jang, **Dosik Hwang***, "Dynamic Range Expansion Using Cumulative Histogram Learning for High Dynamic Range Image Generation," *IEEE Access*, Vol. 8, No. 1, pp. 38554-38567, February 24th, 2020 (DOI: 10.1109/ACCESS.2020.2975857, eISSN: 2169-3536)
43. Taejoon Eo, Hyungseob Shin, Yohan Jun, Taeseong Kim, **Dosik Hwang***, "Accelerating Cartesian MRI by domain-transform manifold learning in phase-encoding direction," *Medical Image Analysis*, Vol. 63, pp. 101689, July, 2020 (DOI: https://doi.org/10.1016/j.media.2020.101689, ISSN: 1361-8415)
44. Sewon Kim, Hanbyol Jang, Jinseong Jang, Young Han Lee, **Dosik Hwang***, "Deep-learned short tau inversion recovery imaging using multi-contrast MR images," *Magnetic Resonance in Medicine*, 84(6), 2994-3008 (2020)

45. Eom, J., Park, I., Kim, S., Jang, H., **Hwang, D***, "Deep-learned Spike Representations and Sorting via an Ensemble of Auto-encoders," *Neural Networks*, 134, 131-142 (2021)
46. Shin, H., Lee, J., Eo, T., Jun, Y., Kim, S., **Hwang, D***. (2020), "The Latest Trends in Attention Mechanisms and Their Application in Medical Imaging," *Journal of the Korean Society of Radiology*, 81(6), 1305-1333.
47. Park, Y.*, Jun, Y.*, Lee, Y., Han, K., An, C., Ahn, S.**, **Hwang, D.****, Lee, S. (2021), "Robust Performance of Deep Learning for Automatic Detection and Segmentation of Brain Metastases Using Three-dimensional Black-Blood and Three-dimensional Gradient Echo Imagin," *European Radiology*, https://doi.org/10.1007/s00330-021-07783-3
48. Jun, Y., Shin, H., Eo, T., Kim, T., **Hwang, D***. (2021). Deep Model-based Magnetic Resonance Parameter Mapping Network (DOPAMINE) for Fast T1 Mapping Using Variable Flip Angle Method. *Medical Image Analysis*, 70, 102017, May 2021, https://doi.org/10.1016/j.media.2021.102017
49. Lee, J., Kim, S., Park, I., Eo, T., **Hwang, D.*** (2021), "Relevance CAM: Relevance weighted Class Activation Map for Visual Explanation of Convolutional Neural Networks," *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition* (CVPR), 2021, pp. 14944-14953
50. Jun, Y., Shin, H., Eo, T., **Hwang, D.*** (2021), "Joint Deep Model-based MR Image and Coil Sensitivity Reconstruction Network (Joint-ICNet) for Fast MRI," *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition* (CVPR), 2021, pp. 5270-5279
51. Matthew J. Muckley, Bruno Riemenschneider, Alireza Radmanesh, Sunwoo Kim, Geunu Jeong, Jingyu Ko, Yohan Jun, Hyungseob Shin, **Dosik Hwang**, Mahmoud Mostapha, Simon Arberet, Dominik Nickel, Zaccharie Ramzi, Philippe Ciuciu, Jean-Luc Starck, Jonas Teuwen, Dimitrios Karkalousos, Chaoping Zhang, Anuroop Sriram, Zhengnan Huang, Nafissa Yakubova, Yvonne W. Lui, and Florian Knoll, "Results of the 2020 fastMRI Challenge for Machine Learning MR Image Reconstruction," *IEEE Trans Med Imaging*, 2021 Sep; 40(9): 2306–2317, doi: 10.1109/TMI.2021.3075856
52. Kim, S., Jang, H., Hong, S., Hong, Y., Bae, W., Kim, S.*, **Hwang, D.*** (2021), "Fat-saturated image generation from multi-contrast MRIs using generative adversarial networks with Bloch equation-based autoencoder regularization," *Medical Image Analysis*, 73, 102198, October 2021, https://doi.org/10.1016/j.media.2021.102198
53. Doohyun Park, Daejoong Oh, MyungHoon Lee, Shin Yup Lee, Kyung Min Shin, Johnson SG Ju, **Dosik Hwang***, "Importance of CT image normalization in radiomics analysis: prediction of 3-year recurrence-free survival in non-small cell lung cancer," *European Radiology*, 2022, https://doi.org/10.1007/s00330-022-08869-2
54. Jinseong Jang and **Dosik Hwang***, "M3T: three-dimensional Medical image classifier using Multi-plane and Multi-slice Transformer," *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition* (CVPR), 2022

PATENT

• ***Patents (Registered, Principal Investigator Only)***

1. **US** 10,168,405 B2 (2019/01/01) METHOD AND APPARATUS FOR QUANTIFYING PROPERTIES OF AN OBJECT THROUGH MAGNETIC RESONANCE IMAGING (MRI)
2. **US** 9,989,609 B2 (2018/06/05), METHOD AND APPARATUS FOR ADJUSTING THE PARAMETERS OF A MAGNETIC RESONANCE IMAGE
3. **US** 9,977,109 B2 (2018/05/22), MAGNETIC RESONANCE IMAGING APPARATUS AND OPERATING METHOD FOR THE SAME
4. **US** 9,928,576 B2 (2018/03/27), DENOISING METHOD AND APPARATUS FOR MULTI-CONTRAST MRI.
5. **US** 9,759,796 B2 (2017/09/12), METHOD AND APPARATUS FOR ELIMINATING NOISE IN

MAGNETIC RESONANCE IMAGES.

6. [**Germany**] Patent Granted: METHOD AND APPARATUS FOR ELIMINATING NOISE IN MAGNETIC RESONANCE IMAGES.
7. [**France**] Patent Granted: METHOD AND APPARATUS FOR ELIMINATING NOISE IN MAGNETIC RESONANCE IMAGES.
8. [**UK**] Patent Granted: METHOD AND APPARATUS FOR ELIMINATING NOISE IN MAGNETIC RESONANCE IMAGES.
9. **US** 9,506,896 B2 (2016/11/29), METHOD AND APPARATUS FOR DETECTING AN ENVELOPE FOR ULTRASONIC SIGNALS.
10. **US** 9,241,671 B2 (2016/01/26), APPARATUS AND METHOD FOR REMOVING NOISE FROM BIOSIGNALS.
11. **US** 9,119,546 B2 (2015/09/01), R-PEAK DETECTION APPARATUS AND CONTROL METHOD THEREOF.

12. [Korean Patent] 10-2039472 (2019/10/28), 컴퓨터 단층촬영 영상 재구성 장치 및 방법
13. [Korean Patent] 10-2022165 (2019/09/09), 자기 공명 영상 장치 및 자기 공명 영상 장치의 재촬영 제어 방법
14. [Korean Patent] 10-2010304 (2019/08/07), 심전도 신호를 이용한 사용자 인증 방법 및 장치
15. [Korean Patent] 10-1929127 (2018/12/07), Apparatus and method for diagnosis based on medical images (using deep learning, PCT filed)
16. [Korean Patent] 10-1928213 (2018/12/05), Apparatus and method for brain tumor detection and medical image generation (using deep learning)
17. [Korean Patent] 10-1886575 (2018/08/01), Apparatus and method for reconstructing under-sampled magnetic resonance image data (using deep learning)
18. [Korean Patent] 10-1840095 (2018/03/13), Apparatus and method for setting region of interest for motion tracking and recording medium thereof
19. [Korean Patent] 10-1804699 (2017/11/28), Method and apparatus for correcting artifacts in a computed tomography image
20. [Korean Patent] 10-1725681 (2017/04/04), Magnetic resonance imaging apparatus using phase spreading method and magnetic resonance imaging apparatus
21. [Korean Patent] 10-2014-0146128 (2016/10/21), Tumor tracking method and apparatus
22. [Korean Patent] 10-1518751 (2015/05/01), Noise removal method and apparatus in multi-contrast MRI
23. [Korean Patent] 10-1359206 (2014/01/28), Magnetic resonance image noise removal method and apparatus
24. [Korean Patent] 10-1232925 (2013/02/06), A real-time tomographic image generation device, a generation method and a medical device using real-time tomographic image
25. [Korean Patent] 10-1172899 (2012/08/03), Apparatus and method for tomographic image generation
26. [Korean Patent] 10-1118549 (2012/02/14), Medical convergence image acquisition device and acquisition method
27. [Korean Patent] 10-1384511 (2014/04/07), CT image acquisition device and acquisition method using correction phantom
28. [Korean Patent] 10-1311279 (2013/09/16), ECG signal detection system and method
29. [Korean Patent] 10-1321885 (2013/10/18), Ultrasound diagnostic system and diagnostic method using bio-signal
30. [Korean Patent] 10-1431646 (2014/08/20), Apparatus for processing data, method for processing data, computer-readable recording medium