Ikbeom Jang

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Keywords: Deep Learning | Multi-Modal Medical AI | Data Synthesis

Employment

Hankuk University of Foreign Studies (한국외국어대학교) — South Korea
Assistant Professor of **Computer Engineering** — *Mar 2023 – Present*
- Roles: 1) Director of Graduate School, 2) Administrator of Department's Cluster Server

Affiliated Dept.: 1) Language & AI, 2) AI Data Convergence

Education/Training

Harvard Medical School & MGH — Boston, MA
Postdoctoral Research Fellow in Dept. of Radiology — *Sep 2019 – Feb 2023*
- MGH/MIT/HMS Athinoula A. Martinos Center for Biomedical Imaging
- Mentors: David Salat, Bruce Fischl, Jayashree Kalpathy-Cramer

Purdue University — West Lafayette, IN
M.S. & Ph.D. in Electrical and Computer Engineering — *Aug 2013 – May 2019*
- Dissertation topic: 1) **Multi-modal analysis** of diffusion tensor imaging and gyroscope/accelerometer for athletes, 2) Medical image quality assessment using CNN and **transfer learning**
- Advisor: Thomas Talavage

Yonsei University — South Korea
B.S. in Electrical and Electronics Engineering — *Mar 2007 – Feb 2013*

International AI Challenge

A-AFMA-Localization: Automatic amniotic fluid measurement from ultrasound images (IEEE ISBI 2021) — *Mar 19, 2021*
- Achievement: **1st Place (Winner)**, gave an oral presentation at **IEEE ISBI 2021**
- Task: To predict MVP landmark coordinates in ultrasound images that are used to calculate a measure of the amount of amniotic fluid surrounding a fetus in-utero.
- Significance: Modeled a weakly supervised 3D segmentation network to predict regions of amniotic fluid without ground truth segmentations. Used computer vision post processing to optimize estimating MVP landmarks.

ABCD Neurocognitive Prediction Challenge (MICCAI 2019) — *Mar 24, 2019*
- Achievement: **4th Place**, gave a talk at **ABCD-NP & MICCAI 2019**, paper published.
- Task: To develop a model for predicting fluid intelligence from T1-weighed MRI (8.5K subjects in total).
- Significance: Modeled an ensemble of multimodal 3D CNN that takes 3D parcellated T1 MRI images from multiple brain regions, volumetric features, and demographic data. Trained each network corresponding to each parcellated brain region and ensembled in the end to overcome the limitations of small GPU memory.

Industry Experience

Wecover Platforms (AI startup) — Cambridge, MA
Co-founder — *Mar 2021 – Jun 2022*
- Projects: AI solutions for ultrasound and dental CT, AI OCR/NLP tools, Automation platform for insurance/reinsurance businesses, Risk assessment modeling for P&C insurance
- Responsibilities: R&D, Initiate & manage projects, Lead international & national competitions
- Other: Raised pre-seed/seed round from 3 investors, supported/funded by MIT Sandbox

NVIDIA — Holmdel, NJ
Deep Learning Intern at *Autonomous Driving team* — *May 2018 – Aug 2018*
- Projects: Generate synthetic data for training (driving trajectory & corresponding video), Modify CNN-LSTM model architecture, Reimplement data prep & training infrastructure for scalability
- Responsibilities: Algorithm, Data preprocessing, Interfacing with sensors, Writing tests, Code review

Earlens (Medical startup at Silicon Valley) — Menlo Park, CA
Research Intern at *Custom Products R&D team* — *Jun 2016 – Aug 2016*
- Projects: estimate and optimize the performance and power efficiency, 3-D tracking with infrared cameras to estimate the location and angle of the device when patients are in motion.
- Responsibilities: 3-D Computer vision, Image processing, 3-D Geometry Calculation, Data collection, Data mining/analysis, Algorithm automation, Mechanical optimization

Teaching Experience

Professor – Hankuk University of Foreign Studies — South Korea, *Mar 2023 – Present*

- Courses: Natural Language Processing, Deep Learning, Big Data Processing, Social Network Analysis (Graph Theory), Electric Circuits, Computational Thinking, SW Research Project

Instructor (full-time) – Purdue University — West Lafayette, IN, *Jun 2015 – Aug 2015*

- Signals and Systems (ECE 301): LTI system, Fourier series, Fourier and Z transform, Sampling theory, etc.
- Responsibility: Coordinating course with TA and grader, Lecturing, Development of exams, homework, and quizzes, Proctoring and grading exams, and Holding office hours.

Lab Instructor & Teaching Assistant – Digital Signal Processing (ECE 438), Purdue University — West Lafayette, IN, *Aug 2014 – Dec 2018*

- Topics: frequency analysis, sampling and reconstruction, interpolation and decimation, waveform quantization, DFT and FFT, digital filter design, speech recognition and synthesis, image processing, random processes, etc
- Responsibility: instructing lab sessions, lab development, syllabus & rubric development, office hours, grading

Guest Lecturer – Harvard University, Purdue University, etc.

Publications (5 yrs)

*: Corresponding author, †: Co-first author

Under Review (7):

1. Moon, J. & **Jang, I.***, 2024. Facial Wrinkle Segmentation Dataset and Algorithm for Cosmetic Dermatology: Weakly Supervised Pretraining and Supervised Finetuning. *Under review in NeurIPS*
2. Kim, S. & **Jang, I.***, 2024. Cyclic 2.5D perceptual loss for cross-modal 3D image synthesis: T1 MRI to Tau-PET. *Under review in Neuroimage*
3. Kim, H., Nam, Y, Ko, Y., **Jang, I.***, 2024. Multi-modal deep learning of genomic and neuroimaging data: developmental disorder risk prediction from premature neonates. *Under review in Pattern Recognition*
4. Mattson, P., Zhang, C., …, **Jang, I.**, et al. 2024. Datasets2030: Data for the next decade of ML. *Under review in Scientific Reports*
5. Kim, S., Kim, D., Park, Y., **Jang, I.***, 2024. A Deep Neural Network with Soft Ordinal Embedding for PAI Assessment after Endodontic Treatment from Periapical Radiographs. *Under review in CLINICCAI*
6. Jang, J., Baek, G., **Jang, I.***, 2024. Advancing Multiscale Structural Mapping for Alzheimer's Disease using Local Gyrification Index. *Under review in CLINICCAI*
7. Jo, C., Yang, J., **Jang, I.***, 2024. Preoperative Rotator Cuff Tear Prediction from Shoulder Radiographs using a Convolutional Block Attention Module-Integrated Neural Network. *Under review in CLINICCAI*

Peer-Reviewed Articles (20):

1. Jung, J., Kim, M., Jung, S., Oh, E., Oh, S.H. and **Jang, I.***, 2024, Feb. The Curation of Art: Using Slot Filling to Expand Accessibility to The Public. *IEEE International Conference on Big Data and Smart Computing Workshop* (pp. 429-432). Oral.
2. **Jang, I.***, Jang, I., Li, B., Rashid, B., Jacoby, J., Huang, S.Y., Dickerson, B.C., Salat, D.H., 2024. Brain structural indicators of β-amyloid neuropathology. *Neurobiology of Aging*, 136, p. 157-170. IF: 4.7, JCR: 35.1%
3. Xu, X.†, **Jang, I.†**, Zhang, J., Zhang, M., Wang, L., Ye, G., Zhao, A., Zhang, Y., Li, B., Liu, J., Li, B., 2023. Cortical gray to white matter signal intensity ratio as a sign of neurodegeneration and cognition independent of β-amyloid in dementia. *Human Brain Mapping,* 45(1), p.e26532. IF: 5.40, JCR: 17.9%
4. Eisenmann, M., Reinke, A., Weru, V., …, **Jang, I.**, et al., 2023, Jun. Why is the winner the best? *CVPR.* (pp. 19955-19966).
5. Ryu, K., Lee, C., Han, Y., Pang, S., Kim, Y.H., Choi, C., **Jang, I.***, Han, S.S.*, 2023. Multi-planar 2.5D U-Net for image quality enhancement of dental cone-beam CT. *PLoS ONE,* 18(5), p.e0285608. IF: 3.75, JCR: 38.5%
6. A Eisenmann, M., Reinke, A., Weru, V., …, **Jang, I.**, et al. 2022. Biomedical image analysis competitions: The state of the current participation practice. *arXiv preprint* arXiv:2212.08568 (non-peer-reviewed; cited 24 times)
7. Patel, J., Chang, K., Ahmed, S. R., **Jang, I.**, & Kalpathy-Cramer, J., 2022, Jul. Opportunities and Challenges for Deep Learning in Brain Lesions. *International MICCAI Brainlesion Workshop* (pp. 25-36). Springer, Cham.
8. Choi, C., Kim, H., Kang, J.H., …, **Jang, I.**, et al. 2022. Reconfigurable heterogeneous integration using stackable chips with embedded artificial intelligence. *Nature Electronics*, pp.1-8. IF=33.3, JCR=0.18%
9. **Jang, I.***, Li, B., Riphagen, J., Dickerson., B.C., Salat, D.H., 2022. Multiscale structural mapping of Alzheimer's disease neurodegeneration. *Neuroimage: Clinical, 33, p. 102948.* IF: 4.89, JCR: 32.1%
10. **Jang, I.†***, Danley, G.†, Chang, K., Kalpathy-Cramer, J., 2021, Dec. Decreasing Annotation Burden of Pairwise Comparisons with Human-in-the-Loop Sorting: Application in Medical Image Artifact Rating. *NeurIPS Data-Centric AI Workshop.* Oral.
11. Zou, Y. & **Jang, I**.*, 2021, Dec. Engineering AI Tools for Systematic and Scalable Quality Assessment in Magnetic Resonance Imaging. *NeurIPS Data-Centric AI Workshop.* Oral.
12. Ryu, K., Alkan, C., Choi, C., **Jang, I.**, Vasanawala, S., 2021, Oct. K-space refinement in deep learning MR reconstruction via regularizing scan specific SPIRiT-based self consistency. *ICCV 2nd Learning for Computational Imaging Workshop.* Oral.
13. Li, B., **Jang, I.**, Riphagen, J., Almaktoum, R., Yochim K.M., Salat, D.H., 2021. Identifying individuals at risk for Alzheimer's disease based on structural imaging in the Human Connectome Project Aging Cohort. *Human Brain Mapping.* 1-12. IF: 5.40, JCR: 17.9%
14. Li, B., Zhang, M., **Jang, I.**, Ye, G., Zhou, L., He, G., Meng, H., Huang, X., Hai, W., Chen, S., Li, Biao., Liu, Jun., 2021. Amyloid-Beta Influences Memory via Functional Connectivity During Memory Retrieval in Alzheimer's Disease. *Frontiers in Aging Neuroscience*, 13, p.557. IF: 5.70, JCR: 24.2%

15. Yao, J., Yang, H.C., Wang, J.H., Liang, Z., Talavage, T.M., Tamer Jr, G.G., **Jang, I.**, and Tong, Y., 2021. A novel method of quantifying hemodynamic delays to improve hemodynamic response, and CVR estimates in CO2 challenge fMRI. *Journal of Cerebral Blood Flow & Metabolism*, p.0271678X20978582. IF: 6.60, JCR: 17.6%
16. **Jang I.**, Pang, S., Ryu, K., Choi, C., et al. 2021. Weakly supervised segmentation for automated amniotic fluid measurement in prenatal ultrasound. *IEEE ISBI Workshop*. Oral.
17. Zou Y., Zhu W., Yang H.C., **Jang, I.**, Vike N.L., Svaldi D.O., Shenk T.E., Poole V.N., Breedlove E.L., Tamer Jr, G.G., Leverenz L.J., Dydak U., Nauman E.A., Tong Y., Talavage T.M., Rispoli J.V., 2021. Development of brain atlases for early-to-middle adolescent collision-sport athletes. *Scientific reports,* 11, 6440. IF: 5.00, JCR: 25.0%
18. **Jang, I.***, Chun, I.Y., Brosch, J.R., Bari, S., Zou, Y., Cummiskey, B.R., Lee, T.A., Lycke, R.J., Poole, V.N., Shenk, T.E., and Svaldi, D.O., Tamer, J.J., Dydak, U., Leverenz, L.J., Nauman, E.A., and Talavage, T.M., 2019. Every hit matters: White matter diffusivity changes in high school football athletes are correlated with repetitive head acceleration event exposure. *Neuroimage: Clinical*, 24, p.101930. IF: 4.35, JCR: 25.0%
19. Zou Y., **Jang I.**, Reese T.G., Yao J., Zhu W., Rispoli J.V., 2019, Oct. Cortical and Subcortical Contributions to Predicting Intelligence Using 3D ConvNets. Challenge in Adolescent Brain Cognitive Development Neurocognitive Prediction. *ABCD-NP in conjunction with MICCAI*. Lecture Notes in Computer Science, vol 11791. Springer, Cham.
20. Bari, S., Svaldi, D.O., **Jang, I.**, Shenk, T.E., Poole, V.N., Lee, T., Dydak, U., Rispoli, J.V., Nauman, E.A. and Talavage, T.M., 2019. Dependence on subconcussive impacts of brain metabolism in collision sport athletes: an MR spectroscopic study. *Brain imaging and behavior*, *13*(3), pp.735-749. IF: 3.39, JCR: 32.1%

Peer-Reviewed Abstracts (7):

1. **Jang, I.**, Hoffmann, M., Singh, N.M., Balbastre, Y., Chen, L., Rockenbach, M.A.B.C., Dalca, A., Aganj, I., Kalpathy-Cramer, J., Fischl, B., Frost, R., 2023, Jun. Clinical evaluation of k-space correlation informed motion artifact detection in segmented multi-slice MRI. *ISMRM.*
2. **Jang, I.**, Frost, R.S., Hoffmann, M., Singh, N.M., Chen, L., Guidon, A., Rockenbach, M.A.B.C., Comeau, D.S., Bizzo, B.C., Chang, K. and Witham, S., 2022, May. Automated MRI k-space Motion Artifact Detection in Segmented Multi-Slice Sequences. *ISMRM.*
3. Singh, N.M., Hoffmann, M., Moyer, D.C., **Jang, I.**, Chen, L., Rockenbach, M.A.B.C., Guidon, A., Aganj, I., Kalpathy-Cramer, J., Adalsteinsson, E. and Fischl, B., 2022, May. Joint Neural Network for Fast Retrospective Rigid Motion Correction of Accelerated Segmented Multislice MRI. *ISMRM.*
4. Salat, D.H., Almaktoum, R., …, **Jang, I.**, et al., 2021, Dec. Baseline neuroimaging characteristics in the randomized pivotal study of renew NCP-5 for the treatment of mild cognitive impairment (MCI) due to Alzheimer's disease or mild dementia of the Alzheimer's type. *Alzheimer's & Dementia*, 17, e057740.
5. **Jang, I.**, Li, B., Riphagen, J., Dickerson, B.C., Salat, D.H., 2021, Jun. Multi-scale Structural Imaging of Alzheimer's Disease Neurodegeneration. *OHBM.*
6. Yang, H.C., Yao, J., …, **Jang, I.**, et al., 2019, Jun. Characterizing Physiological Components of Near-Infrared Spectroscopy Signal Under Hypercapnia. *OHBM.*
7. **Jang, I.**, Lee, T., Shenk, T.E., Poole, V.N., Nauman, E.A., Leverenz, L.J., and Talavage, T.M., 2019, May. Low-Magnitude Hits Matter: Single-Season Longitudinal DTI Study on Asymptomatic High School Football Players. *ISMRM.*

Patents

1. Frost, S.R., **Jang, I.** and Kalpathy-Cramer, J., General Hospital Corp, 2023. Detecting motion artifacts from k-space data in segmented magnetic resonance imaging. U.S. Patent Application 18/305,091.
2. Baek, Y., Kim, K., Kim, M., **Jang, I.**, Jeong, W., Do, N., Yonsei University, 2010. Umbrella Having Standing Member, Republic of Korea, Reg. No.: 1009875800000, Oct 16, 2010

Invited Talks & Seminars

1. "Introduction to FreeSurfer & Its Application for Alzheimer's Imaging Marker Development", **ICMRI**, Nov. 2023. Invited Talk
2. "Retrospective Motion Correction of Accelerated Segmented Multi-slice MRI", KSMRM Advanced MR Imaging, Sep. 2023. Invited Talk
3. "Introduction to FreeSurfer and its application for imaging marker development", ***Seoul St. Mary Hospital***, Jul. 2023. Invited Talk
4. "Statistical Machine Learning & Computer Vision for Neuroimaging and more", BK Seminar at the Dept. of Electrical and Electronic Engineering, ***Yonsei Univ.***, Jun 2023. Seminar
5. "Statistical Machine Learning and Computer Vision for Medical Imaging", ***Yonsei Univ. School of Dentistry***, Jun. 2023. Invited Talk
6. "Recent Advances in AI", *Tech Seminar: Build IT*, *Hankuk Univ. of Foreign Studies*, May. 2023 Seminar
7. "Medical Imaging and Sensing in the Era of AI", ***KAIST-Yonsei*** joint graduate course, May. 2023. Seminar
8. "How AI Meets Medical Imaging & Neuroscience," Colloquium at the Dept of Electronic Engineering, ***Hanyang Univ.***, Apr. 2023. Seminar
9. "MRI multiscale structural mapping for neurodegenerative diseases and its application to Alzheimer's disease," Stroke Research Center, ***Massachusetts General Hospital***, Jan. 2023. Invited Talk
10. "Multi-Scale Structural Mapping (MSSM) of Alzheimer's Disease Neurodegeneration & Neuropathology," *Laboratories for Computational Neuroimaging, the Martinos Center for Biomedical Imaging,* ***Massachusetts General Hospital***, Jan. 2023. Invited Talk
11. "Structural imaging features at multiple scales to study neurodegenerative diseases," *Reproducibility in the AI era session,* ***ESMRMB*** *MRI together workshop*, Dec. 2022. Invited Talk

12. "Multiscale Structural Mapping of Alzheimer's Disease Neurodegeneration & Neuropathology," *Science on Tap Seminar* at *the Martinos Center for Biomedical Imaging, **Massachusetts General Hospital***, Nov. 2022. Seminar
13. "MultiScale Structural Mapping (MSSM) of Brain Aging and Neuropathology in Alzheimer's Disease", *McCance Center for Brain Health, **Massachusetts General Hospital***, Oct. 2021. Co-presentation with Drs. Salat & Rashid. Seminar
14. "MultiScale Structural Mapping (MSSM) of Brain Aging and Neuropathology in Alzheimer's Disease", *Dept. of Psychology, **Brandeis University***, Oct. 2021. Co-presentation with Drs. Salat & Rashid. Seminar
15. "Detection of Motion Artifact in MRI K-space," *Dept. of Neurology & Radiology, **Seoul St. Mary's Hospital**, The Catholic University of Korea*, Jan. 2021. Seminar
16. "Understanding Alzheimer's Disease and Neuroimaging Research," *BME Neuroscience, Hankuk Univ. of Foreign Studies*, Nov. 2020. Invited Talk
17. "Deep Learning Architectures," *BMI 701 Introduction to Neural Networks, **Harvard University***, Nov. 2020. Invited Talk
18. "Fluid Intelligence Prediction from T1-weighted MRI using a Multimodal Convolutional Neural Network," ***The Purdue Association for Magnetic Resonance**,* West Lafayette, IN, Feb. 2019. Invited Talk
19. "Automated Quality Assurance of Diffusion MR Images Using A Domain Transferred Deep Convolutional Neural Network," ***ISMRM Workshop on Machine Learning**,* Washington D.C., Oct. 2018
20. "Anomaly Detection from High School Football Players: Longitudinal DTI Study with a Large Cohort," *The 6th **ICMRI***, Seoul, South Korea, Mar. 2018. Best Poster Award
21. "Microstructural White Matter Changes in Asymptomatic Football Athletes: Longitudinal DTI Study," *ISMRM Workshop on Advanced Neuro MR: Best Practices for Technical Implementation*, Seoul, South Korea, Mar. 2018.
22. "What Can We Do with Statistics and Machine Learning in MRI?" ***Purdue Association for Magnetic Resonance***, Purdue University, West Lafayette, IN, Jan. 2018. Invited Talk
23. "Deep Learning Applications in Computer Vision and Medicine," *Big Data Theory Seminar, **Purdue Univ.***, West Lafayette, IN, Dec. 2017. Invited Talk
24. "Stepwise Regression to Identify Predictors of Microstructural White Matter Abnormalities in Football Athletes," *The 5th Indiana Neuroimaging Symposium*, West Lafayette, IN, Nov. 2017. Selected as Best-5 Paper
25. "Healthcare-Integrated Automotive: The Car as a Healthcare Device," *2017 Hyundai Global Top Talent Forum*, San Diego, CA, Aug. 2017. Best Proposal Award
26. "Diffusion Tensor Imaging Reveals Persistent Effects on White Matter Microstructure in High School Football Players with History of Sports-Related Concussion," *The 25th **ISMRM***, Honolulu, HI, Apr. 2017. Magna Cum Laude awarded
27. "DTI reveals persistent effects on white matter in football athletes with history of concussion," *The 4th Indiana Neuroimaging Symposium*, Bloomington, IN, Nov. 2016.

Awards and Honors

- Outstanding Faculty in Student Advising – Hankuk Univ. of Foreign Studies — *Mar 03, 2024*
- Best Proposal Award & Prize money (1st place) – The Ministry of Science and ICT of South Korea | Title: Neural Rendering-based Smart Breakage Detection Platform for Shared Mobility — *Dec 13, 2021*
- Good Proposal Award & Prize money (3rd place) – The Ministry of Science and ICT of South Korea | Title: Real-time building aging/risk prediction based on deep learning through multi-modal database construction — *Dec 13, 2021*
- ICMRI Best Poster Award & Scholarship – International Congress on Magnetic Resonance Imaging — *Mar 31, 2018*
- Hyundai Motors Best Proposal Award & Prize Money (1st place) – Hyundai Motor Group | Title: Healthcare-Integrated Automobile — *Aug 19, 2017*
- ISMRM Magna Cum Laude – International Society of Magnetic Resonance in Medicine — *May 11, 2017*
- LG Award for Outstanding Undergraduate Thesis – LG Electronics | Title: Robust Head-Mounted Eye Tracking System Allowing Head Movements — *Nov 08, 2012*
- Honors Student Awards – Yonsei University — *S2007/S2012/F2012*
- Honors Tutor Award – Center for Teaching and Learning, Yonsei University — *Sep 03, 2012*
- Commendation Award – Senator and Top-up Assembly Member, South Korea — *Feb 06, 2007*
- Commendation Award and Medal – Governor of Gangnam-gu, Seoul, South Korea — *Oct 25, 2006*

Fellowship

National Science and Technology Fellowship – National Research Foundation of Korea — *2007 - 2012*
- Full tuition support during undergraduate studies.

Professional Services

Journal Reviewer:

- Neuroimage (IF: 7.4) — *Feb 2023 – Present*

- Human Brain Mapping (IF: 5.40) *Aug 2021 – Present*
- Scientific Reports (IF: 5.00) *Dec 2020 – Present*
- Neuroimage: Clinical (IF: 4.89) *May 2020 – Present*
- Medical Image Analysis (IF: 13.83) *Apr 2020 – Present*