Stephen Baek, Ph.D.

Associate Professor

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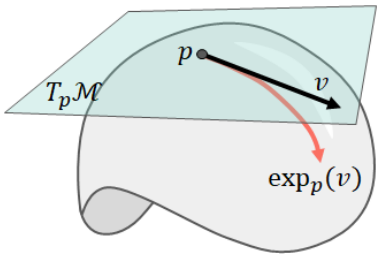

Biography

Stephen Baek is an applied geometer and a data scientist who conducts research in *geometric data analysis*. At the intersection of computational geometry, vision, and machine learning, Baek studies a wide range of multidisciplinary problems, in which shapes play an important role in understanding scientific phenomena. His previous and ongoing research topics include relationships between geometric features and manufacturability, linkages between microstructure morphology and chemico-mechanical behaviors of material systems, roles of tumoral and peritumoral geometry on cancer treatment outcome, socioeconomic bias associated with physical appearance, etc. He has been leading various government- and industry-funded research projects, including projects sponsored by the National Science Foundation (NSF), National Institutes of Health (NIH), Air Force, NASA, Army, U.S. Department of Transportation, Hyundai Motor Company, and many others.

Dr. Baek received his B.S. in Mechanical and Aerospace Engineering from Seoul National University (SNU), Seoul, Korea in 2009 and a Ph.D. degree in 2013 from the same institution for his award-winning study on the statistical space of human body shapes modeled in Riemannian manifolds. He was trained as a postdoctoral scholar at the Institute of Advanced Machinery Design in SNU until 2015. During his training, Baek received the National Science and Engineering Scholarship and the Global Ph.D. Fellowship from the Korean Ministry of Education. He was also awarded the Presidential Postdoc Fellowship from the President of the Republic of Korea. Between 2015 and 2021, Dr. Baek was an Assistant Professor of Industrial Engineering at the University of Iowa, with courtesy appointments at the Departments of Electrical and Computer Engineering, Radiation Oncology, and Applied Mathematical and Computational Sciences. In 2021, he joined the University of Virginia, where he currently holds an appointment as Associate Professor in the School of Data Science and a courtesy appointment in the Department of Mechanical and Aerospace Engineering.

Keywords: Geometric data analysis; Geometric deep learning; Scientific AI/ML; Data-driven design
H-Index: 15, Total Citations: 836 (Google Scholar; Retrieved 09/2022), **Erdõs No.: 5** (AMS; 09/2021)

Education & Training

Postdoc | Institute of Advanced Machinery Design, Seoul National University, Korea, 2013∼2015

Ph.D. | Mechanical and Aerospace Engineering, Seoul National University, Korea, 2009∼2013
Thesis: Nonlinear Analysis of the Space of Human Body Shapes and Its Application to Parametric Human Modeling System (*Best Thesis Award–SNU; Grand Prize (1st place) from 'DELCAM Graduate Thesis Awards'*)

B.S. | Mechanical and Aerospace Engineering, Seoul National University, Korea, 2005∼2009
Thesis: A Modeling Method for 3D Face Model Using Single 2D Front-View Image (*Best Thesis Award*)

Academic Positions & Appointments

Associate Professor (Tenured) | School of Data Science, University of Virginia, Charlottesville, VA, 2021∼Present

Associate Professor (by courtesy) | Department of Mechanical and Aerospace Engineering, University of Virginia, Charlottesville, VA, 2021∼Present

Assistant Professor (by courtesy) | Applied Mathematical and Computational Sciences, University of Iowa, Iowa City, IA, 2018∼2021

Assistant Professor (by courtesy) | Electrical and Computer Engineering, University of Iowa, Iowa City, IA, 2018∼2021

Adjunct Assistant Professor | Radiation Oncology, University of Iowa, Iowa City, IA, 2018∼2021

Assistant Professor | Industrial and Systems Engineering, University of Iowa, Iowa City, IA, 2015∼2021

Honors and Awards

Outstanding Poster Award from the USACM Thematic Conference on Uncertainty Quantification for Machine Learning Integrated Physics Modeling (UQ-MLIP), 2022. (Awarded to my advisee Joseph Choi)

Supervisor of the Year Award from the Pomerantz Career Center, University of Iowa, 2021.

Defense Innovation Award from 2020 Defense TechConnect Innovation Summit and Expo, 2020.

University of Iowa Innovator Award from the University of Iowa Research foundation, 2019

Old Gold Fellowship from the University of Iowa, 2018.

Best Paper Award from International Conference on Maintenance and Rehabilitation of Constructed Infrastructure Facilities, 2017.

Most Cited Articles in Computer-Aided Design since 2011, Elsevier, 2016.

Best Paper Award from 2015 Annual Conference of the Society of CAD/CAM Engineers, 2015.

Best Paper Award from 2014 Summer Conference of the Society of CAD/CAM Engineers, 2014.

Bronze Prize from 15th Korea CAD/CAM Software Competition, 2014.

Grand Prize from the 1st Delcam Korea & the Society of CAD/CAM Engineers Best Graduate Thesis Awards, 2014.

Best Paper Award from 2014 Annual Conference of the Society of CAD/CAM Engineers, 2014.

Best Student Paper from 2014 Annual Conference of the Society of CAD/CAM Engineers, 2014.

Best Ph.D. Thesis from the School of Mechanical and Aerospace Engineering at Seoul National University, 2014.

Presidential Postdoc Fellowship from the President of Republic of Korea, 2014–2015.

Top 25 Hottest Articles Published in Computer-Aided Design in 2012, Elsevier, 2012.

Bronze Prize from 13th Korea CAD/CAM Software Competition, 2012.

Global Ph.D. Fellowship from the Korean Ministry of Education, 2011–2013.

Best Paper of the Year from Transactions of the Society of CAD/CAM Engineers, 2011.

Best Paper of the Year from Transactions of the Society of CAD/CAM Engineers, 2010.

Bronze Medal from 2009 Korea Software Awards, 2010.

Best Bachelor's Thesis from the School of Mechanical and Aerospace Engineering at Seoul National University, 2008.

Outstanding Design Award from Seoul National University Robot Competition, 2008.

Best Product Development Award from Seoul National University CAD/CAM Contest, 2007.

Award for Appreciation in 2007 School Retreat Program from the School of Mechanical and Aerospace Engineering at Seoul National University, 2007.

Outstanding Design Award from Seoul National University Mechanical Design Contest, 2005.

National Science and Engineering Scholarship from the Korean Ministry of Education, 2005-2009.

Professional Activities

Editorial Board Membership / Conference Organization

Associate Editor, Journal of Computing and Information Science in Engineering (JCISE), American Society of Mechanical Engineers (ASME), July 2022–Present.

Associate Editor, Journal of Computational Design and Engineering (JCDE), Oxford University Press, March 2021–Present.

Assistant Editor, Computer-Aided Design and Applications, Taylor & Francis, November 2019–Present.

Topic Co-Chair, International Mechanical Engineering Congress & Exposition (IMECE), American Society of Mechanical Engineers (ASME), October 2021–November 2022.

Editorial Board Member, International Journal of Digital Human, Inderscience, February 2018–Present.

Program Board Member, International Conference on Digital Human Modeling and Applications in Health, Safety, Ergonomics and Risk Management, July 2018–Present.

Organizing Committee, Annual CAD Conferences and Exhibitions, December 2016–Present.

Editorial Board Member, Journal of Computational Design and Engineering, Elsevier, January 2020–February 2021.

Reviewer of Scientific Journals

Computational Design, Computational Geometry, Computer Graphics

Computer-Aided Design, Elsevier.

Journal of Computational Design and Engineering, Elsevier.

Computer-Aided Design and Applications, Taylor & Francis.

Additive Manufacturing, Elsevier.

Journal of Manufacturing Processes, Elsevier.

ASME Journal of Computing and Information Science in Engineering, ASME.

The Visual Computer, Springer.

Computer Graphics and Applications, IEEE.

Computer Animation and Virtual Worlds, Wiley.

Computers & Graphics, Elsevier.

Transactions of the Society of CAD/CAM Engineers.

Machine Learning, Artificial Intelligence

IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), IEEE.

IEEE Transactions on Emerging Topics in Computational Intelligence, IEEE.

Artificial Intelligence in Medicine, Elsevier.

Medical Imaging, Biomedical Engineering, Ergonomics

IEEE Transactions on Biomedical Engineering, IEEE.

Journal of Medical Imaging, SPIE.

PLOS Digital Health, PLOS.

Computer Methods and Programs in Biomedicine, Elsevier.

Physics in Medicine and Biology, IOP Publishing.

Computer Methods in Biomechanics and Biomedical Engineering, Taylor & Francis.

International Journal of Industrial Ergonomics, Elsevier.

Computers in Biology and Medicine, Elsevier.

Journal of Bone and Joint Surgery

Service Activities

National/Regional

Discussion Co-Lead, U.S. Army Tech Forecasting Workshop on Disruptive Energetics, DEVCOM ARL, Technology Forecasting Office, June 2022.

President, Korean-American Scientists and Engineers Association (KSEA) Iowa City Chapter, November 2017–October 2019.

Review Panelist, National Science Foundation (NSF) Civil, Mechanical and Manufacturing Innovation (CMMI) Division, November 2017–December 2017.

Reviewer, NASA Iowa Space Grant Consortium Scholarship, August 2016.

University

Reviewer, Packard Faculty Fellowship Nomination Committee, University of Virginia, February 2022–March 2022.

Collegiate

Committee Member, PhD Program Committee, School of Data Science, University of Virginia, September 2021–Present.

Committee Member, Faculty Search Committee, School of Data Science, University of Virginia, November 2021–May 2022.

Faculty Advisor, UI Hyperloop Team, University of Iowa, September 2019–May 2021.

Committee Member, Engineering Technology Committee (ETC), Engineering Faculty Council (EFC), University of Iowa, September 2018–May 2021.

Faculty Member, College of Engineering Initiative for Artificial Intelligence, University of Iowa, September 2018–May 2021.

Departmental

Committee Member, Industrial Engineering Graduate Program Committee, University of Iowa, August 2017–May 2021.

Coordinator, Big Data Analytics Elective Focus Area (EFA), August 2019–May 2021.

Academic Advisor, Alpha Pi Mu, University of Iowa, September 2015–August 2017.

Coordinator, Design and Manufacturing Elective Focus Area (EFA), October 2015–August 2019.

Department Secretary, University of Iowa, August 2016–August 2017.

IE Program Secretary, University of Iowa, August 2015–August 2016.

Professional Memberships

Member, Institute of Electrical and Electronics Engineers (IEEE), 2018–Present.

Member, American Association for the Advancement of Science (AAAS), 2018–Present.

Member, Korean-American Scientists and Engineers Association (KSEA), 2015–2019.

Member, Society of CAD/CAM Engineers, 2013–2015.

Student Member, Korean Society of Mechanical Engineers, 2013–2014.

Student Member, Society of CAD/CAM Engineers, 2009–2013.

Media Appearances

Featured in **CBS The Doctors TV Show**: "Do People with Higher BMIs Make Less Money?" September 2021.

Interview with **Virginia Public Radio**: "Understanding the Beauty Premium," September 2021.

Featured in **UVA Today**: "Research Worlds Collide to Find Richer Link Between Body Image and Income," September 2021.

Featured in **Daily Mail**: "How your BODY SHAPE affects your salary: Short men and obese women earn $1,000 less a year than taller, thinner people, study warns," August 2021.

Featured in **PsyPost**: "Deep machine learning study finds that body shape is associated with income," August 2021.

Featured in **The Daily Iowan**: "UI researchers use artificial intelligence to identify cancer biomarkers," March 2020.

Panelist. *Emerging Technology in Business Panel*, EntreFest: The Largest Gathering of Iowa's Entrepreneurial and Innovation Community, Cedar Rapids, IA, May 2018.

Panelist. *The Future of Technology*, Corridor Business Journal, Cedar Rapids, IA, March 2018.

Panelist. *Artificial Intelligence: The 4th Industrial Revolution*, Business Record Magazine, Des Moines, IA, March 2018.

Featured in **Business Record**: "Event Preview: Artificial intelligence, the 4th industrial revolution," February 2018.

Featured in **The Daily Iowan**: "Downtown mural promotes education on renewable energy," January 2018.

Interview with **Press-Citizen**: "Iowa City students troubleshoot in makerspaces," November 2016.

Column in **Kyosu Shinmun** (KOR), July 2014.

Artworks and Exhibitions

Live Geometry: A durational performance and gallery event, Dada Futures, Iowa City, IA, April 2018.

A device for measuring the sonification of everyday things, 2018 National Conference on Education for the Ceramic Arts (NCECA), Pittsburgh, PA, March 2018.

STEAM Wall Project: Interactive art installation at Robert A. Lee Recreation Center in Iowa City, Funded by The City of Iowa City Public Art Program, 2017.

Live Geometry: Can data create an art form?, Funded by Arts and Humanities Initiative (AHI) Award, University of Iowa, 2017.

Work Experience

Associate Professor, School of Data Science, University of Virginia, Charlottesville, VA, August 2021–Present.

Assistant Professor, Department of Industrial and Systems Engineering, University of Iowa, Iowa City, IA, August 2015–May 2021.

Visiting Research Associate, Ronald E. Mc*NAIR* Center for Aerospace Innovation and Research, University of South Carolina, Columbia, SC, October 2014.

Senior Researcher, Institute of Advanced Machinery and Design, Seoul National University, Seoul, Korea, September 2013–July 2015.

Technical Research Personnel, Republic of Korea Army (Alternative Military Duty), October 2011–February 2015.

Graduate Research Assistant, Human-Centered CAD Laboratory, Seoul National University, Seoul, Korea, March 2009–August 2013.

Design Engineer (Part-time), Department for Robot Arm Design, Hurotech Co. Ltd., Seoul, Korea, March 2008–October 2008.

Undergraduate Research Assistant, Human-Centered CAD Laboratory, Seoul National University, Seoul, Korea, September 2007–February 2009.

Research Projects

Ongoing Projects

NSF 2118393 | $1,739,367 | 10/2021∼09/2025
Title: *DMREF: Physics-Informed Meta-Learning for Design of Complex Materials*

Source: National Science Foundation (NSF)
Role: Principal Investigator
Description: This project will explore novel physics-aware machine learning formulations to facilitate design of complex materials.

NIH (1 R01 NS115800-01A1) | $2,122,253 | 09/2020∼06/2025
Title: *Water and chloride movement in neurons during seizure activity*
Source: National Institutes of Health (NIH)
Role: Co-Investigator (PI: Joseph Glykys)
Description: This project aims to study water and chloride movement in neurons during seizure and changes of neuronal morphology thereby using deep learning.

NASA (NNH19ZDA001N-HTMS) | $1,236,519 | 07/2020∼06/2023
Title: *Investigating the Mechanisms of Particle Energization in Collisionless Heliospheric Shocks*
Source: National Aeronautics and Space Administration (NASA)
Role: Co-Investigator (PI: Gregory Howes)
Description: The goal of this project is to understand physics of collisionless heliospheric shocks by analyzing patterns from space experiments and simulations using convolutional neural networks.

DOD/AFOSR (FA9550-19-1-0318) | $7,500,000 | 06/2019∼05/2024
Title: *Integrating multiscale modeling and experiments to develop a meso-informed predictive capability for explosives safety and performance*
Source: U.S. Department of Defense, Air Force Office of Scientific Research (AFOSR), Multidisciplinary University Research Initiatives (MURI) Program
Role: Co-Investigator (PI: Thomas Sewell)
Description: The goal of this project is to develop machine learning capacities to predict safety and performance characteristics of explosives.

DOD/AFOSR (FA9550-19-1-02) | $899,563 | 06/2019∼05/2022
Title: *Machine learning mesoscale structure-property-performance relationships of energetic materials for multiscale modeling of shock-induced detonation*
Source: U.S. Department of Defense, Air Force Office of Scientific Research (AFOSR)
Role: Co-Principal Investigator (PI: H.S. Udaykumar)
Description: In this project, we are looking to learn mesoscale structure-property-performance relationships of energetic materials, such as explosives, propellants, and fuels, using deep neural networks.

Past Projects

NSF 2040532 | $999,770 | 09/2020∼05/2021 (No cost extension until 08/2022)
Title: *NSF Convergence Accelerator - Track D: ImagiQ: Asynchronous and Decentralized Federated Learning for Medical Imaging*
Source: National Science Foundation (NSF)
Role: Principal Investigator
Description: This project entails a collaboration among five academic institutions including the University of Iowa, Stanford University, University of Chicago, Harvard University, and Yale University, teamed up with NVIDIA Corporation and four other medical AI startups to advance distributed machine learning (federated learning) for medical imaging.

Inseer #2 | $109,200 | 12/2019∼11/2020 (No cost extension until 11/2022)
Title: *Development of Computer Vision Based Human Activity Data Collection System*
Source: Inseer, Inc.
Role: Principal Investigator
Description: The goal of this project is to develop an imaging facility to collect images and videos of various human activities for the purpose of training convolutional neural networks for vision-based ergonomic analysis.

Aisin #2 | $78,600 | 04/2019∼03/2020
Title: *Modeling anthropometrically accurate avatars for vehicle simulations*
Source: Aisin Technical Center of America, Inc.
Role: Principal Investigator
Description: (Classified)

Hyundai Motors | $221,398 | 04/2019∼01/2020
Title: *A study on user experience in autonomous driving scenarios*
Source: Hyundai Motor Company
Role: Principal Investigator
Description: (Classified)

DOT/FHWA (693JJ31750016) | $1,862,640 | 10/2017∼09/2019
Title: *Developing connected simulation to study interactions between drivers, pedestrians, and bicyclists*
Source: U.S. Department of Transportation (DOT), Federal Highway Administration (FHWA) Exploratory Advanced Research (EAR) Program
Role: Co-Principal Investigator (PI: Daniel McGehee)
Description: The goal of this project was to develop virtual reality technologies for interactive simulation among subjects within different simulation environments in order to study the road user behaviors for enhancing road safety.

Inseer #1 | $24,063 | 07/2019∼08/2019
Title: *Development of Cloud-based Video Analysis Framework*
Source: Inseer, Inc.
Role: Principal Investigator
Description: (Classified)

CDC (R49 CE002108-05) | $15,000 | 07/2018∼06/2019
Title: *In-home gait and balance screening for the risk assessment of falls in elderly populations*
Centers for Disease Control and Prevention (CDC), National Center for Injury Prevention and Control (University of Iowa Subaward)
Role: Principal Investigator
Description: The goal of this project was to study elderly gait motions using smart-shoe sensors and develop a predictive model for future risk of fall injury.

Aisin #1 | $250,000 | 10/2017∼03/2019
Title: *Driver state detection via deep learning*
Source: Aisin Technical Center of America, Inc.
Role: Principal Investigator
Description: (Classified)

DOT/UTC (69A3551747131) | $25,933 | 05/2018∼11/2018
Title: *Driver360: A four-dimensional scanning system to better understand drivers*
Source: U.S. Department of Transportation, Office of the Assistant Secretary for Research and Technology (University of Iowa Safer-SIM Subaward)
Role: Principal Investigator
Description: The objective of this project was to construct a four-dimensional scanning system to be installed in a driving simulator.

Old Gold Fellowship | $6,000 | 05/2018∼08/2018
Title: *Deep learning on non-Euclidean domains*
Source: Old Gold Summer Fellowship, University of Iowa
Role: Principal Investigator **Description:** The goal of this project was to develop a mathematical foundation for expanding the basic building blocks of deep neural networks to non-Euclidean domains such as manifolds, graphs, and point clouds.

DOD/ONR (N00014-16-1-2220) | $41,196 | 01/2016∼12/2017
Title: *Malum Terminus: A US Marine Corps simulation system for injury avoidance*
Source: U.S. Department of Defense (DOD) Office of Naval Research (ONR) (University of Iowa Subaward)
Role: Principal Investigator
Description: The goal of this study was to discover the causal effects of various demographic, anthropometric, physiological, and biomechanical factors on musculoskeletal injury and to develop an artificial intelligence-powered simulation tool for predicting potential injury.

DOD/ARL (W911QY-12-C-0009) | $30,000 | 06/2016∼02/2017
Title: *Integrated human model for PPE analysis and design*
Source: U.S. Department of Defense (DOD) Department of Army (University of Iowa Subaward)
Role: Principal Investigator **Description:** The goal of this project was to develop a digital human model for analysis and design of personal protection equipment (PPE) covering a diverse anthropometric population.

Teaching

Instructor Effectiveness

Recognition from the Graduating Classes of 2016, 2018, 2019, 2020 at the University of Iowa

Courses Taught

Instructor, DS 6050 **Deep Learning**, University of Virginia, 2021–Present.

Instructor, ENGR:1300 **Introduction to Engineering Computing**, Core Engineering Course, University of Iowa, 2019.

Instructor, ISE:6380 **Deep Learning**, Graduate Course, University of Iowa, 2018–2021.

Instructor, ISE:4172 **Big Data Analytics**, Undergraduate Elective, University of Iowa, 2018–2020.

Instructor, IE:6232 **Advanced Computer-Aided Design and Manufacturing**, Graduate Course, University of Iowa, 2015–2017.

Instructor, ENGR:2760 **Design for Manufacturing**, Core Engineering Course, University of Iowa, 2016–2018.

Instructor, **Computer-Aided Design**, Graduate Course, Seoul National University, 2014.

Teaching Assistant, **Digital Computer Concept and Practice**, Undergrad Course, Seoul National University, 2011–2012.

Teaching Assistant, **Computer-Aided Design**, Graduate Course, Seoul National University, 2010–2012.

Teaching Assistant, **Computer-Aided Design and Manufacturing**, Undergraduate Elective, Seoul National University, 2010–2012.

Graduate Students Advised

8. **Venous Roshdibenam, Ph.D.**, Industrial and Systems Engineering, University of Iowa, 2018∼2021
   Thesis: *Machine Learning Prediction of Fall Risk in Older Adults Using Timed Up and Go Test Kinematics* (Funding: IPRC/Inseer)

7. **Yusen He, Ph.D.** Industrial and Systems Engineering, University of Iowa, 2017∼2020
   Thesis: *Prediction & Visualization of Lung Cancer Survival Using Convolutional Encoder-Decoder Networks* (Funding: TA/U.S. DOT/Ballard-Seashore Graduate Fellowship)
   Current Position: Data Scientist, Grinnell College

6. **Zhiyu Sun, Ph.D.** Industrial Engineering, University of Iowa, 2016∼2019
   Thesis: *Deep learning on curved surfaces: Manifold-formulation of convolutional neural networks and its operations* (Funding: Startup/ONR)
   Current Position: Research Scientist, Midea

5. **Jessica R. Shull, M.S.**, Industrial and Systems Engineering, University of Iowa, 2019∼2021
   Non-thesis Track.
   Current Position: Systems Engineer, Collins Aerospace

4. **Sehyun Chun, M.S.**, Industrial and Systems Engineering, University of Iowa, 2018∼2021
   Non-thesis Track.

3. **Benjamin R. Perlson, M.S.** Industrial Engineering, University of Iowa, 2016∼2019
   Non-thesis Track.
   Current Position: Innovation Manager, DHL

2. **Zachary J. Nolte, M.S.** Industrial Engineering, University of Iowa, 2015∼2017
   Thesis: *Massive 3D model segmentation through gamification* (Funding: Startup)
   Current Position: Research Engineer, EPIC Systems

1. **Samuel S. Mate, M.S.** Mechanical Engineering, University of Iowa, 2015∼2016
   Thesis: *Anthropometric human modeling based on nonlinear statistical shape analysis* (Funding: Startup)
   Current Position: Physics Teacher, DSST Public Schools

Post-graduate Scholars Mentored

5. **Dominik Mattioli, Ph.D.**, 2021∼Present
4. **Mohammad Shafkat Islam, Ph.D.**, 2021∼Present
3. **Phong Nguyen, Ph.D.**, 2021∼Present
2. **Jerome Charton, Ph.D.**, 2019∼2021
   Current Position: Harvard Medical School
1. **Nima Hamidi Ghalehjegh, Ph.D.**, 2018∼2019
   Current Position: Bayer

Current Students

1. **Joseph B. Choi**, Ph.D. Student, School of Data Science, University of Virginia, 2018∼2024 (expected)
   Thesis: *TBD* (Funding: U.S. DOT, NSF)

Publications

Working Papers

6. Huang, Y., Lin, Q., Baek, S., & Street, N. (2022). *Federated learning on adaptively weighted nodes by bilevel optimization*. arXiv Preprint: arXiv:2207.10751.
5. Nguyen, P. C., Nguyen, Y.-T., Choi, J. B., Seshadri, P. K., Udaykumar, H., & Baek, S. (2022). *Physics-aware recurrent convolutional (PARC) neural networks to assimilate meso-scale reactive mechanics of energetic materials*. arXiv Preprint: arXiv:2204.07234.
4. Choi, B. S., Yoo, S. K., Moon, J., Chung, S. Y., Oh, J., Baek, S., Kim, Y., Chang, J. S., Kim, H., & Kim, J. S. (2022). *A predictive model using a deep segmentation network for acute coronary events (ACE) after breast radiotherapy*.
3. Diaz-Arias, A., Messmore, M., Shin, D., & Baek, S. (2021). *On the role of depth predictions for 3d human pose estimation*. arXiv Preprint: arXiv:2103.02521.
2. Kim, H., Chun, S., Siemonsma, S., & Baek, S. (2021). *NADS-Net+: detecting improper use of seat belts*.
1. Hong, D., Baek, S., & Wang, T. (2020). *Interpretable sequence classification via prototype trajectory*. arXiv Preprint: arXiv:2007.01777.

Journal Articles

36. Nguyen, P. C., Vlassis, N. N., Bahmani, B., Sun, W., Udaykumar, H., & Baek, S. (2022). Synthesizing controlled microstructures of porous media using generative adversarial networks and reinforcement learning. *Scientific Reports*, 12: Article No. 9034. DOI: 10.1038/s41598-022-12845-7.
35. Baru, C., Pozmantier, M., Altintas, I., Baek, S., Cohen, J., Condon, L., Fanti, G., Fernandez, R. C., Jackson, E., Lall, U., Landman, B., Li, H. H., Marin, C., Lopez, B. M., Metaxas, D., Olsen, B., Page, G., Shang, J., Turkan, Y., & Zhang, P. (2022). Enabling AI innovation via data and model sharing: an overview of the NSF Convergence Accelerator Track D. *AAAI AI Magazine*, DOI: 10.1002/aaai.12042.

34. Roy, S., Neal, C., Nguyen, Y. T., Baek, S., & Udaykumar, H. S. (2022). Meso-scale simulation of energetic materials I: a method for generating synthetic microstructures using deep feature representations. *Journal of Applied Physics*, 131(5): 055904. DOI: 10.1063/5.0065294.

33. Huang, W., Samanta, A., Chen, Y., Baek, S., Shaw, S. K., & Ding, H. (2021). Machine learning model for understanding laser superhydrophobic surface functionalization. *Journal of Manufacturing Processes*, 69: 491–502. DOI: 10.1016/j.jmapro.2021.08.007.

32. Song, S. & Baek, S. (2021). Body shape matters: Evidence from machine learning on body shape-income relationship. *PLOS ONE*, 16(7): 1–17. DOI: 10.1371/journal.pone.0254785. **Featured in PsyPost, Daily Mail, CBS The Doctors TV Show, Virginia Public Radio, and others**.

31. Roshdibenam, V., Jogerst, G. J., Butler, N. R., & Baek, S. (2021). Machine learning prediction of fall-risk in older adults using timed up & go test kinematics. *Sensors*, 21(10): 3481. DOI: 10.3390/s21103481.

30. Tong, L., Langton, R., Glykys, J., & Baek, S. (2021). ANMAF: an automated neuronal morphology analysis framework using convolutional neural networks. *Scientific Reports*, Article No. 8179. DOI: 10.1038/s41598-021-87471-w.

29. Charton, J., Baek, S., & Kim, Y. (2020). Mesh repairing using topology graphs. *Journal of Computational Design and Engineering*, 8(1): 251–267. DOI: 10.1093/jcde/qwaa076.

28. Sun, Z., Rooke, E., Charton, J., He, Y., Lu, J., & Baek, S. (2020). ZerNet: Convolutional neural networks on arbitrary surfaces via Zernike local tangent space estimation. *Computer Graphics Forum*, 39(6): 204–216. DOI: 10.1111/cgf.14012.

27. Chun, S., Roy, S., Nguyen, Y. T., Choi, J. B., Udaykumar, H. S., & Baek, S. (2020). Deep learning for synthetic microstructure generation in a materials-by-design framework for heterogeneous energetic materials. *Scientific Reports*, 10: Article No. 13307. DOI: 10.1038/s41598-020-70149-0. **Featured in Nature Research Blog.**

26. Sun, Z., He, Y., Gritsenko, A., Lendasse, A., & Baek, S. (2020). Embedded spectral descriptors: learning the point-wise correspondence metric via Siamese neural networks. *Journal of Computational Design and Engineering*, 7(1): 18–29. DOI: 10.1093/jcde/qwaa003.

25. Baek, S., He, Y., Allen, B. G., Buatti, J. M., Smith, B. J., Tong, L., Sun, Z., Li, R., Wu, J., Diehn, M., Loo, B. W., Plichta, K. A., Seyedin, S. N., Gannon, M., Cabel, K. R., Kim, Y., et al. (2019). Deep segmentation networks discover biomarkers for lung cancer survival. *Scientific Reports*, 9: Article No. 17286. DOI: 10.1038/s41598-019-53461-2.

24. Ouyang, T., He, Y., Li, H., Sun, Z., & Baek, S. (2019). Modeling and forecasting short-term power load with copula model and deep belief network. *IEEE Transactions on Emerging Topics in Computational Intelligence*, 3(2): 127–136. DOI: 10.1109/TETCI.2018.2880511.

23. Yoon, S., Baek, S., & Lee, D. (2019). 4D cardiac motion modeling using pair-wise mesh registration. *Lecture Notes in Computer Science*, 11395: 161–170. DOI: 10.1007/978-3-030-12029-0_18.

22. Liu, T. C., Bhatt, R., Farrell, K. D., Baek, S., Liu, Y. M., Abdel-Malek, K., & Arora, J. (2018). A quantitative assessment of variations in the palm surface area as a percentage of total body surface area within the general population. *International Journal of Human Factors Modelling and Simulation*, 6(1): 81–96. DOI: 10.1504/IJHFMS.2018.091359.

21. Gritsenko, A., Akusok, A., Baek, S., Miche, Y., & Lendasse, A. (2018). Extreme Learning Machines for VISualization+R - mastering visualization with target variables. *Cognitive Computation*, 10(3): 464–477. DOI: 10.1007/s12559-017-9537-6.

20. Shi, Y., Zhang, Y., Baek, S., Backer, W. D., & Harik, R. (2018). Manufacturability analysis for additive manufacturing using a novel feature recognition technique. *Computer-Aided Design and Applications*, 15(6): 941–952. DOI: 10.1080/16864360.2018.1462574.

19. Luo, Y., Fan, Z., Baek, S., & Lu, J. (2018). Machine learning-aided exploration of relationship between strength and elastic properties in ascending thoracic aneurysm. *International Journal for Numerical Methods in Biomedical Engineering*, 34(6): e2977. DOI: 10.1002/cnm.2977.

18. Sun, Z., Harik, R., & Baek, S. (2018). Mesh segmentation via geodesic curvature flow. *Computer-Aided Design and Applications*, 15(5): 677–683. DOI: 10.1080/16864360.2018.1441235.

17. Harik, R., Shi, Y., & Baek, S. (2017). Shape Terra: mechanical feature recognition based on a persistent heat signature. *Computer-Aided Design and Applications*, 14(2): 206–218. DOI: 10.1080/16864360.2016.1223433.

16. Akusok, A., Baek, S., Miche, Y., Björk, K.-M., Nian, R., Lauren, P., & Lendasse, A. (2016). ELMVIS+: fast nonlinear visualization technique based on cosine distance and extreme learning machines. *Neurocomputing*, 205: 247–263. DOI: 10.1016/j.neucom.2016.04.039.

15. Baek, S.-Y. & Lee, K. (2016). Statistical foot-shape analysis for mass-customisation of footwear. *International Journal of Computer Aided Engineering and Technology*, 8(1/2): 80–98. DOI: 10.1504/IJCAET.2016.073265.

14. Baek, S.-Y., Kam, D.-U., & Lee, K. (2015). Differential operators on a triangular mesh and their applications. *Transactions of the Society of CAD/CAM Engineers*, 20(1): 44–54.

13. Baek, S.-Y., Lim, J., & Lee, K. (2015). Isometric shape interpolation. *Computers & Graphics*, 46(1): 257–263. DOI: 10.1016/j.cag.2014.09.025.

12. Park, J., Kim, T., Baek, S.-Y., & Lee, K. (2015). An algorithm for estimating surface normal from its boundary curves. *Journal of Computational Design and Engineering*, 2(1): 67–72. DOI: 10.1016/j.jcde.2014.11.007.

11. Baek, S.-Y. & Lee, K. (2014). An isometric shape interpolation method on mesh models. *Transactions of the Society of CAD/CAM Engineers*, 19(2): 1–10.

10. Cho, S., Baek, D., Baek, S.-Y., Lee, K., & Bang, H. (2014). 3d volume drawing on a potter's wheel. *IEEE Computer Graphics and Applications*, 34(3): 50–58. DOI: 10.1109/MCG.2014.3.

9. Choi, J.-H., Baek, S.-Y., Kim, Y., Son, T.-G., Park, S., & Lee, K. (2014). Automatic detection of inferior alveolar nerve canal from cone-beam computed tomography images for dental surgery planning. *Studies in Health Technology and Informatics*, 196(1): 61–65. DOI: 10.3233/978-1-61499-375-9-61.

8. Song, J., Cho, S., Baek, S.-Y., Lee, K., & Bang, H. (2014). GaFinC: gaze and finger control interface for 3D model manipulation in CAD application. *Computer-Aided Design*, 46(1): 239–245. DOI: 10.1016/j.cad.2013.08.039.

7. Baek, S.-Y. & Lee, K. (2013). Parametric human body modeling system for virtual garment fitting. *International Journal of Computer Aided Engineering and Technology*, 5(2/3): 242–261. DOI: 10.1504/IJCAET.2013.052932.

6. Baek, S.-Y., Wang, J. H., Song, I., Lee, K., Lee, J., & Koo, S. (2013). Automated bone landmarks prediction on the femur using anatomical deformation technique. *Computer-Aided Design*, 45(2): 505–510. DOI: 10.1016/j.cad.2012.10.033.

5. Lee, S., Baek, S.-Y., Son, J., Kim, D., & Lee, K. (2012). Changes in medio-lateral knee joint reaction force of patients with over-pronation during gait due to insole parameters - a case study. *Transactions of the Society of CAD/CAM Engineers*, 17(3): 149–155.

4. Baek, S.-Y. & Lee, K. (2012). Parametric human body shape modeling framework for human-centered product design. *Computer-Aided Design*, 44(1): 56–67. DOI: 10.1016/j.cad.2010.12.006. **Top 25 Hottest Articles Published in Computer-Aided Design in 2012**.

3. Lee, J., Baek, S.-Y., & Lee, K. (2010). 3d generic vertebra model for computer aided diagnosis. *Transactions of the Society of CAD/CAM Engineers*, 15(4): 297–305. **Best Paper of the Year**.

2. Choi, J.-H., Park, S.-W., Baek, S.-Y., & Lee, K. (2010). Evaluation of handheld products by computing user hand fatigue. *Simulation Modeling Practice and Theory*, 18(2): 230–239. DOI: 10.1016/j.simpat.2009.10.009.

1. Jang, T., Baek, S.-Y., & Lee, K. (2009). Synthesis of human body shape for given body sizes using 3d body scan data. *Transactions of the Society of CAD/CAM Engineers*, 14(6): 364–373. **Best Paper of the Year**.

Rigorously Peer-reviewed Conferences

8. Chun, S., Ghalehjegh, N. H., Choi, J. B., Schwarz, C. W., Gaspar, J. G., McGehee, D. V., & Baek, S. S. (2019). NADS-Net: a nimble architecture for driver and seat belt detection via convolutional neural networks. In *International Conference on Computer Vision (ICCV) - Autonomous Driving Workshop*. Seoul, Korea. **(Oral Presentation, Acceptance rate: 30.91%)**.

7. Ghalehjegh, N. H., Vahidzadeh, M., & Baek, S. (2019). Multi-scale embedded CNN for music tagging (MsE-CNN). In *International Conference on Machine Learning (ICML) Workshop*. Long Beach, California.

6. Yoon, S., Baek, S., & Lee, D. (2018). 4D cardiac motion modeling using pair-wise mesh registration. In *21st International Conference on Medical Image Computing & Computer Assisted Intervention (MICCAI) Workshop*. Granada, Spain.

5. Gritsenko, A., Akusok, A., Miche, Y., Bjork, K.-M., Baek, S., & Lendasse, A. (2016). Combined nonlinear visualization and classification: ELMVIS++C. In *2016 International Joint Conference on Neural Networks (IJCNN 2016)*. Vancouver, Canada. **(Acceptance rate: 58.33%)**.

4. Baek, S.-Y., Lim, J., & Lee, K. (2014). Isometric shape interpolation. In *Shape Modeling International (SMI 2014)*. Hong Kong. **(Acceptance rate: 36%)**.

3. Song, J., Cho, S., Baek, S.-Y., Lee, K., & Bang, H. (2013). GaFinC: Gaze and finger control interface for 3D model manipulation in CAD application. In *SIAM Conference on Geometric & Physical Modeling (GD/SPM13)*. Denver, CO, USA. **(Acceptance rate: 26.8%)**.

2. Baek, S.-Y., Wang, J. H., Song, I., Lee, K., & Koo, S. (2012). Automated bone landmarks prediction on the femur using anatomical deformation technique. In *Symposium on Solid and Physical Modeling (SPM 2012)*. Dijon, France. **(Acceptance rate: 44%)**.

1. Baek, S.-Y., Kim, B.-Y., & Lee, K. (2009). 3D face model reconstruction from single 2D frontal image. In *8th ACM SIGGRAPH International Conference on Virtual Reality Continuum and Its Applications in Industry (VRCAI '09)*. Tokyo, Japan. **(Acceptance rate: 41%)**.

Conference Proceedings & Presentations

64. Basener, B. & Baek, S. (2023). Understanding deep learning using topological dynamical systems, index theory, and homology. In *2023 Joint Mathematics Meetings (JMM 2023)*. Boston, Massachusetts. **To appear**.

63. Takezawa, Y., Langton, R., Baule, S. M., Zimmerman, M. B., Baek, S., & Glykys, J. (2022). Cation-chloride cotransporters' role in neuronal swelling during oxygen-glucose deprivation in the neonatal neocortex. In *The Society for Neuroscience 2022 Annual Meeting*. San Diego, California. **To appear**.

62. Moghadasi, N., Nguyen, P. C., & Baek, S. (2022). A deep learning approach for topology optimization to enhance structural design. In *ASME International Mechanical Engineering Congress & Exposition (IMECE)*. Columbus, Ohio. **To appear**.

61. Nguyen, P. C., Kim, Y., Choi, Y., & Baek, S. (2022). Multiscale homogenization for structure-property linkage modeling in design for additive manufacturing of cellular structure. In *ASME International Mechanical Engineering Congress & Exposition (IMECE)*. Columbus, Ohio. **To appear**.

60. Choi, J., Nguyen, P., Nguyen, Y.-T., Udaykumar, H., & Baek, S. (2022). Physics-aware AI-directed framework for microstructural design of shocked materials. In *The USACM Thematic Conference on Uncertainty Quantification for Machine Learning Integrated Physics Modeling (MLIP)*. Arlington, Virginia. **Best Poster Award**.

59. Choi, J. B., Nguyen, P. C., Nguyen, Y.-T., Udaykumar, H., & Baek, S. (2022). A novel AI-assisted framework for microstructural design of shocked materials. In *22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter (SHOCK22)*. Anaheim, California.

58. Nguyen, P. C. H., Choi, J. B., Nguyen, Y.-T., Udaykumar, H., & Baek, S. (2022). Establishing the structure-property-performance linkage of pressed energetic materials using physics-aware recurrent convolutional neural networks (PARC). In *22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter (SHOCK22)*. Anaheim, California.

57. Walters, D., Herrin, J., Sewell, T., Baek, S., & Udaykumar, H. (2022). Learning continuum strength models for meso-scale simulations of HMX from molecular dynamics using deep neural networks. In *22nd Biennial Conference of the APS Topical Group on Shock Compression of Condensed Matter (SHOCK22)*. Anaheim, California.

56. Udaykumar, H., Baek, S., Nguyen, Y. T., Nguyen, P., & Sen, O. (2022). Bridging meso- and macro-scales using machine learning for simulations of shocked heterogenous energetic materials. In *19th U.S. National Congress on Theoretical and Applied Mechanics*. Austin, Texas.

55. Nguyen, P., Choi, J., Nguyen, Y.-T., Baek, S., & Udaykumar, H. (2022). Exploring the structure-property-performance linkage of energetic materials via physics-aware recurrent convolutions. In *The Mach Conference*. Baltimore, Maryland.

54. Baek, S., Udaykumar, H., Sun, W., & Nguyen, P. (2022). Synthesizing realistic images of material microstructures using convolutional neural networks. In *The 150th Annual Meeting & Exhibition of the Minerals, Metals & Materials Society (TMS2022)*. Anaheim, California.

53. Brown, C. R., Juno, J. L., Howes, G. G., Haggerty, C. C., Baek, S. S., & Batabyal, A. (2021). Analysis of instabilities in quasi-perpendicular magnetized collisionless shocks using the field-particle correlation technique. In *The 63th Annual Meeting of the APS Division of Plasma Physics*.

52. Udaykumar, H. S., Baek, S., Nguyen, Y. T., Chun, S., & Seshadri, P. K. (2020). Artificial intelligence techniques for materials-by-design of energetic materials. In *The 32nd Joint Army Navy NASA Air Force (JANNAF) Energetics Systems Hazards (ESHS) Meeting*.

51. Jogerst, G., Roshdibenam, V., Butler, N., Xu, Y., & Baek, S. (2020). The use of machine learning to predict fall risk in older adults. In *North American Primary Care Research Group (NAPCRG) 48th Annual Meeting*. San Francisco, California.

50. Baek, S. (2020). Learning geometric data via generative neural networks. In *IISE Annual Conference & Expo 2020*. New Orleans, Louisiana.

49. Shull, J. R., Kim, H., Roshdibenam, V., Fethke, N., & Baek, S. (2020). Ergonomic assessment via deep convolutional neural networks. In *IISE Annual Conference & Expo 2020*. New Orleans, Louisiana.

48. Duquette, E., Rahmati, N., Duquette, K., Tong, L., Baek, S., Staley, K., & Glykys, J. (2019). Cotransport of water and chloride through co-cotransporters during neocortical seizures. In *Gordon Research Conference--Spatio-Temporal Control of GABAergic Signaling and Its Breakdown in Brain Disorders*. Newry, Maine.

47. Moon, B., Choi, J. B., Lee, H. D., & Baek, S. (2019). Asphalt pavement crack detection based on deep learning. In *International Conference on Smart Cities*. Seoul, Korea.

46. Sun, Z., Baek, S., Yaddanapudi, S., & St-Aubin, J. (2019). Synthetic CT generation using unpaired images in a CycleGAN with identity loss. In *2019 Annual Meeting of the American Association of Physicists in Medicine (AAPM 2019)*. San Antonio, Texas.

45. Baek, S. & Song, S. (2018). Shape Matters: Evidences from machine learning on body shape-income relationship. In *88th Southern Economic Association Annual Meetings (SEA 2018)*. Washington, D.C.

44. Baek, S. & Song, S. (2018). Shape Matters: Evidences from machine learning on body shape-income relationship. In *28th Annual Meeting of Midwest Econometrics Group (MEG 2018)*. Madison, Wisconsin.

43. Baek, S. & Song, S. (2018). Economic models with non-Euclidean data. In *2018 Joint Statistical Meetings (JSM 2018)*. Vancouver, Canada.

42. Baek, S., Sun, Z., Yaddanapudi, S., Kim, Y., Gross, B., Hawkes, K., McCune, K., Yuan, T., & Xia, J. (2018). Applying machine learning for automated liver segmentation on radiotherapy planning CT. In *2018 Annual Meeting of the American Association of Physicists in Medicine (AAPM 2018)*. Nashville, Tennessee.

41. He, Y., Fei, F., Wang, W., Song, X., Sun, Z., & Baek, S. (2018). Predicting manufactured shapes of a projection micro-stereolithography process via convolutional encoder-decoder networks. In *ASME 2018 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2018)*. Quebec, Canada.

40. Baek, S., Sun, Z., & Lu, J. (2018). Wall stress estimation in cerebral aneurysm via geometric convolutional neural network. In *The 8th World Congress of Biomechanics (WCB 2018)*. Dublin, Ireland.

39. Luo, Y., Fan, Z., Baek, S., & Lu, J. (2018). Machine-learning investigation of relationship between strength and response features in ascending thoracic aneurysm tissue. In *The 8th World Congress of Biomechanics (WCB 2018)*. Dublin, Ireland.

38. Baek, S. & Song, S. (2018). Estimation of economic models with non-Euclidean data. In *New Frontiers in Econometrics*. Stamford, Connecticut.

37. Gritsenko, A., Sun, Z., Baek, S., Miche, Y., Hu, R., & Lendasse, A. (2017). Deformable surface registration with extreme learning machines. In *International Conference on Extreme Learning Machines (ELM2017)*. Yantai, China.

36. Nolte, Z., Riley, M., Harik, R., & Baek, S. (2017). Mosquito Popper: a multiplayer online game for 3d body scan data segmentation. In *14th Annual International CAD Conference (CAD'17)*. Okayama, Japan.

35. Shi, Y., Zhang, Y., Baek, S., & Harik, R. (2017). Validation of feature recognition on manufacturability analysis for additive manufacturing. In *14th Annual International CAD Conference (CAD'17)*. Okayama, Japan.

34. Sun, Z., Baek, S., & Harik, R. (2017). Mesh segmentation via geodesic curvature flow. In *14th Annual International CAD Conference (CAD'17)*. Okayama, Japan.

33. Baek, S., Lee, H., Bhatt, R., Farrell, K., Arora, J. S., & Abdel-Malek, K. (2017). Parametric modeling of Korean construction workers for the safer construction environment. In *International Conference on Maintenance and Rehabilitation of Constructed Infrastructure Facilities (2017 MAIREINFRA)*. Seoul, Korea. **Best Paper Award**.

32. Luo, Y., Baek, S., & Lu, J. (2017). Classifying stress strain curves obtained at rupture and non-rupture sites in ascending thoractic aneurysm tissue using machine learning. In *5th International Conference on Computational and Mathematical Biomedical Engineering (CMBE2017)*.

31. Akusok, A., Eirola, E., Miche, Y., Oliver, I., Björk, K.-M., Gritsenko, A., Baek, S., & Lendasse, A. (2016). Incremental ELMVIS for unsupervised learning. In *International Conference on Extreme Learning Machines (ELM2016)*. Marina Bay Sands, Singapore.

30. Gritsenko, A., Akusok, A., Baek, S., & Lendasse, A. (2016). ELMVIS++R – Mastering visualization with target variables. In *International Conference on Extreme Learning Machines (ELM2016)*. Marina Bay Sands, Singapore.

29. Baek, S., Sun, Z., & Mate, S. S. (2016). Development of full-resolution anthropometric human models based on nonlinear statistical shape analysis. In *7th International Conference of Applied Human Factors and Ergonomics*. Orlando, Florida.

28. Harik, R., Baek, S.-Y., Bruchem, B.-J. V., & Tooren, M. V. (2015). SHAPE TERRA: Industrial feature recognition based on persistent heat signature. In *12th Annual International CAD Conference (CAD'15)*. London, The United Kingdom.

27. Harik, R., Baek, S.-Y., Bruchem, B.-J. V., & Tooren, M. V. (2015). Shape Terra: A feature recognition tool using persistent heat signature. In *2015 Annual Conference of the Society of CAD/CAM Engineers*. Pyeongchang, Korea.

26. Jang, S., Woo, S., Kam, D.-U., Baek, S.-Y., & Lee, K. (2014). Automatic generation of LEGO layout from 3d model. In *2014 Autumn Conference of the Korean Society of Mechanical Engineers*. Gwangju, Korea.

25. Kim, D.-W., Baek, S.-Y., & Lee, K. (2014). Local parameterization of meshes using geodesics. In *2014 Autumn Conference of the Korean Society of Mechanical Engineers*. Gwangju, Korea.

24. Lee, J., Lim, J., Baek, S.-Y., & Lee, K. (2014). Extraction of a margin line for dental CAD. In *2014 Autumn Conference of the Korean Society of Mechanical Engineers*. Gwangju, Korea.

23. Woo, S., Baek, S.-Y., & Lee, K. (2014). Optimization method for rapid rigid-registration between X-ray and digitally reconstructed radiography. In *2014 Autumn Conference of the Korean Society of Mechanical Engineers*. Gwangju, Korea.

22. Baek, S.-Y., Kam, D.-U., & Lee, K. (2014). Differential operators on a triangular mesh and their applications. In *2014 Summer Conference of the Society of CAD/CAM Engineers*. Muju, Korea. **Best Paper Award**.

21. Kim, D.-W., Lee, J., Baek, S.-Y., & Lee, K. (2014). Algorithm for generating high-precision point cloud using quaternary coded structured light and phase. In *2014 Summer Conference of the Society of CAD/CAM Engineers*. Muju, Korea.

20. Woo, S., Lee, J.-H., Baek, S.-Y., & Lee, K. (2014). Automatic generation of high-quality digitally reconstructed radiography for registration between 2D X-ray image and 3D CT image. In *2014 Summer Conference of the Society of CAD/CAM Engineers*. Muju, Korea.

19. Lee, J.-H., Woo, S., Baek, S.-Y., Lee, K., Dong, Y., & Lee, S. (2014). A C-arm calibration method for 2D-3D registration. In *2014 Annual Conference of the Korean Society of Medical Robot*. Seoul, Korea.

18. Lim, J., Baek, S.-Y., Lee, J., & Lee, K. (2014). Automatic determination of the insertion axis of a dental crown that minimizes undercut area. In *10th International Symposium on Tools and Methods for Competitive Engineering (TMCE 2014)*. Budapest, Hungary.

17. Baek, S.-Y. & Lee, K. (2014). An isometric shape interpolation method on mesh models. In *2014 Annual Conference of the Society of CAD/CAM Engineers*. Pyeongchang, Korea. **Best Paper Award**.

16. Choi, J.-H., Baek, S.-Y., Kim, Y., Son, T.-G., Park, S., & Lee, K. (2014). Automatic detection of inferior alveolar nerve canal from cone-beam computed tomography images for dental surgery planning. In *NEXTMED/MMVR21*. Manhattan Beach, CA, USA.

15. Lim, J., Baek, S.-Y., Lee, J., & Lee, K. (2014). Automatic algorithm for finding insertion axis of dental prosthesis. In *2014 Annual Conference of the Society of CAD/CAM Engineers*. Pyeongchang, Korea.

14. Park, J.-S., Kim, T., Baek, S.-Y., & Lee, K. (2014). An algorithm for estimating surface normal from its boundary curves. In *2014 Annual Conference of the Society of CAD/CAM Engineers*. Pyeongchang, Korea. **Best Student Paper Award**.

13. Park, H., Lee, D., Yang, S., Lee, S., Baek, S.-Y., & Lee, K. (2012). KineCAD: A novel gesture-based CAD system using kinect. In *2012 Asian Conference on Design and Digital Engineering (ACDDE 2012)*. Hokkaido, Japan.

12. Lee, S., Baek, S.-Y., Son, J., Kim, D., & Lee, K. (2012). Changes in medio-lateral knee joint reactions of flatfoot patients due to insole conditions. In *18th Congress of the European Society of Biomechanics*. Lisbon, Portugal.

11. Baek, S.-Y., Son, J., & Lee, K. (2012). Statistical analysis of foot shape for designing mass-customized footwear. In *9th International Symposium on Tools and Methods for Competitive Engineering (TMCE 2012)*. Karsluhe, Germany.

10. Son, J., Baek, S.-Y., & Lee, K. (2012). Automatic measurement of dimensions of 3D foot scan data. In *Asian Workshop on 3D Body Scanning Technologies*. Tokyo, Japan.

9. Baek, S.-Y., Son, J., & Lee, K. (2012). Knowledge-based design framework for user-tailored insoles. In *2012 Annual Conference of the Society of CAD/CAM Engineers*. Pyeongchang, Korea. **Session Keynote**.

8. Lee, S., Baek, S.-Y., Son, J., Kim, D., & Lee, K. (2012). Changes in medio-lateral knee joint reaction force of patients with over-pronation during gait due to insole parameters. In *2012 Annual Conference of the Society of CAD/CAM Engineers*. Pyeongchang, Korea.

7. Son, J., Baek, S.-Y., & Lee, K. (2012). An algorithm for automatic measurement of dimensions of 3D foot scan data. In *2012 Annual Conference of the Society of CAD/CAM Engineers*. Pyeongchang, Korea.

6. Baek, S.-Y., Lee, J., & Lee, K. (2011). Deformation of raw 3D scan surfaces via multi-resolution RBF networks. In *Asian Workshop on 3D Body Scanning Technologies*. Tokyo, Japan.

5. Jo, J., Baek, S.-Y., Lee, K., Song, I.-s., & Koo, S. (2011). Statistical deformation of femur geometry. In *2011 Spring Conference of the Korean Society of Mechanical Engineers*. Pohang, Korea.

4. Lee, J., Baek, S.-Y., & Lee, K. (2011). 3D generic vertebra model for computer aided diagnosis. In *2011 Annual Conference of the Society of CAD/CAM Engineers*. Pyeongchang, Korea.

3. Baek, S.-Y. & Lee, K. (2010). Interactive parametric modeling of human body shape. In *2010 Asian Conference on Design and Digital Engineering (ACDDE 2010)*. Jeju, Korea.

2. Baek, S.-Y. & Lee, K. (2010). Parametric human body modeling system for virtual garment fitting. In *8th International Symposium on Tools and Methods of Competitive Engineering (TMCE 2010)*. Ancona, Italy.

1. Jang, T., Baek, S.-Y., & Lee, K. (2009). Synthesis of human body shape for given body parameters using 3D body scan data. In *2009 Annual Conference of the Society of CAD/CAM Engineers*. Pyeongchang, Korea.

Invited Talks

External

18. Navigating the Space of Disease Shapes through the Lenses of Geometric Data Analysis. *Morehouse School of Medicine*, Atlanta, Georgia, April 2022.

17. Navigating the Space of Shapes through the Lenses of Geometric Data Analysis. *Yonsei University College of Medicine*, Seoul, Korea, June 2021.

16. Navigating the Space of Shapes through the Lenses of Geometric Data Analysis. *Lunit, Inc.*, Seoul, Korea, June 2021.

15. Navigating the Space of Shapes through the Lenses of Geometric Data Analysis. *Kyungpook National University*, Daegu, Korea, June 2021.

14. Learning Geometric Data via Generative Neural Networks. *IISE Annual Conference & Expo 2020*, New Orleans, Louisiana, June 2020.

13. What does AI see? Deep segmentation networks discover biomarkers for lung cancer survival, *NCI Webinar*, The National Cancer Institute, The National Institutes of Health, December 2019.

12. Deep Learning in Autonomous Vehicles, Aisin Technical Center of America, Northville, MI, December 2019.

11. Driver360: A Four-Dimensional Scanning System to Better Understand Drivers. *SaferSim Webinar*, `https://www.youtube.com/watch?v=OEjo_vc2JC8&t=22s`

10. Navigating the Space of Shapes through the Lens of Deep Learning. *Graduate Seminar*, Department of Mechanical Engineering, Chung-Ang University, Seoul, South Korea, December 2018.

9. Digital Human Modeling for Prediction and Prevention of Musculoskeletal Injury. *Greater Iowa Asphalt Conference*, Asphalt Paving Association of Iowa, Des Moines, IA, March 2018.

8. Deep Learning on Non-Euclidean Data. *Midwest Conference on Careers for Frontier Science and the 4th Generation Industrial Revolution Technology*, Korean-American Scientists and Engineers Association, Schaumburg, IL, November 2017.

7. Teaching Computers How to Design. Korea Institute of Science and Technology, Seoul, Korea, August 2017.
6. Digital Human Models for Human-Centered Infrastructure, Korea Institute of Construction Technology, Goyang, Korea, August 2017.
5. Teaching Computers How to Design, Department of Mechanical Engineering, Kyungpook National University, Daegu, Korea, August 2017.
4. Design from Big Data. *Graduate Seminar*, Department of Mechanical Engineering, University of Wisconsin at Madison, WI, January 2016.
3. Understanding Digital Shapes. *Korean-American Scientists and Engineers Association (KSEA) Iowa City Chapter Meeting*, Iowa City, IA, September 2015.
2. Understanding Human Body Shapes. *Graduate Seminar*, School of Mechatronics, Gwangju Institute of Science and Technology (GIST), Gwangju, Korea, December 2014.
1. Knowledge-Based Design Framework for User-Tailored Insoles. *2012 Annual Conference of the Society of CAD/CAM Engineers*, Pyeongchang, Korea, August 2012.

Internal

24. Navigating the Space of Shapes through the Lenses of Geometric Data Analysis. *Graduate Seminar*, Department of Mechanical and Aerospace Engineering, University of Virginia, Charlottesville, Virginia, April 2022.
23. Navigating the Space of Shapes through the Lenses of Geometric Data Analysis. *Department of Engineering Systems and Environment Colloquium*, University of Virginia, Charlottesville, Virginia, April 2022.
22. Zernike CNN: Convolutional Neural Networks on Arbitrary Surfaces. *Graduate Seminar*, Applied Mathematical and Computational Sciences, University of Iowa, Iowa City, IA, April 2020.
21. What is AI and why is it useful?, Department Radiology, University of Iowa, Iowa City, IA, December 2019.
20. How does your phone recognize your face (and many others)? *Tau Beta Pi Engineering Honors Society*, College of Engineering, University of Iowa, Iowa City, IA, April 2019.
19. How does your phone recognize your face (and many others)? *Sonia Kovalevsky Math Day*, Department of Mathematics, University of Iowa, Iowa City, IA, April 2019.
18. Navigating the Space of Shapes through the Lens of Deep Learning. *Graduate Seminar*, Department of Industrial and Manufacturing Systems Engineering, Iowa State University, Ames, IA, March 2019.
17. Navigating the Space of Shapes through the Lens of Deep Learning. *College of Nursing Research Forum*, University of Iowa, Iowa City, IA, March 2019.
16. Navigating the Space of Shapes through the Lens of Deep Learning. *Informatics Day*, University of Iowa Informatics Initiative (UI3), University of Iowa, Iowa City, IA, February 2019.
15. Navigating the Space of Shapes through the Lens of Deep Learning. *AMCS Seminar*, Interdisciplinary Graduate Program in Applied Mathematical and Computational Sciences, University of Iowa, Iowa City, IA, February 2019.

14. Navigating the Space of Shapes through the Lens of Deep Learning. *Radiology Insight Lecture Series*, Department of Radiology, University of Iowa Hospitals and Clinics, University of Iowa, Iowa City, IA, January 2019.
13. Navigating the Space of Shapes through the Lens of Deep Learning. *Translational Research Seminar*, Department of Radiation Oncology, University of Iowa Hospitals and Clinics, University of Iowa, Iowa City, IA, October 2018.
12. Visual Intelligence Laboratory. *Department of Mechanical and Industrial Engineering Advisory Board Meeting*, University of Iowa, Iowa City, IA, April 2018.
11. Deep Learning on Non-Euclidean Data. *Translational Research Seminar*, Department of Radiation Oncology, University of Iowa Hospitals and Clinics, University of Iowa, Iowa City, IA, November 2017.
10. Teaching Computers How to Design. *Mechanical Engineering Graduate Seminar*, Department of Mechanical and Industrial Engineering, University of Iowa, Iowa City, IA, October 2017.
9. Teaching Design to Computers. *Industrial Engineering Graduate Seminar*, Department of Mechanical and Industrial Engineering, University of Iowa, Iowa City, IA, March 2017.
8. Solving Computational Geometry Problems with Games, EPX Video Game and Animation Studio, University of Iowa, Iowa City, IA, February 2017.
7. Inside IDEA lab, *Public Digital Arts Showcase*, Public Digital Arts (PDA) Cluster, University of Iowa, Iowa City, IA, October 2016.
6. MetaCAD: CAD beyond CAD. *Informatics Symposium*, University of Iowa Informatics Initiative (UI3), Iowa City, IA, April 2016.
5. MetaCAD: CAD beyond CAD. *ECE Graduate Seminar*, Department of Electrical and Computer Engineering, University of Iowa, Iowa City, IA, January 2016.
4. Solving Industrial Engineering Problems using Global Brain. *Industrial Engineering Graduate Seminar*, Department of Mechanical and Industrial Engineering, University of Iowa, Iowa City, IA, October 2015.
3. Technology and Art. *Department of Mechanical and Industrial Engineering Advisory Board Meeting*, University of Iowa, Iowa City, IA, October 2015.
2. MetaCAD: CAD beyond CAD. *Mechanical Engineering Graduate Seminar*, Department of Mechanical and Industrial Engineering, University of Iowa, Iowa City, IA, September 2015.
1. Understanding Human Body Shapes. *Mechanical Engineering Graduate Seminar*, Department of Mechanical and Industrial Engineering, University of Iowa, Iowa City, IA, January 2015.

Patents

Registered

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