

Visual Intelligence Laboratory

The lab conducts research in geometric data analysis at the intersection of computational geometry, vision, and artificial intelligence (AI), which is applied to a wide range of multidisciplinary problems, in which shapes play an important role in understanding scientific phenomena. The lab's previous and ongoing research topics include computational design and engineering, physics simulation using AI, cancer morphology analysis, socioeconomic bias associated with physical appearance, and ergonomic assessment using computer vision.

Key Research:

Geometric Data Analysis: Developing mathematical foundations and scalable algorithms to expand convolutional neural networks to different geometric domains, benefiting many scientific studies, including computer-aided design and manufacturing, computer graphics, 3D sensing systems on autonomous vehicles, the brain mapping problem in neuroscience, and computational mechanics.

- Investigating the mechanisms of particle energization in collisionless heliospheric shocks.
- Integrating multi-scale modeling and experiments to develop a meso-informed predictive capability for explosives safety and performance.
- Machine learning mesoscale structure-property-performance relationships of energetic materials for multi-scale modeling of shock-induced detonation.

Who We Work With

- U.S. Air Force (Air Force Office of Scientific Research)
- U.S. Department of Transportation
- National Science Foundation
- National Institutes of Health
- Hyundai Motor Company
- Many others

Lab Expertise



Professor Stephen Baek

- Assistant Professor, Industrial and Systems Engineering
- PhD: Mechanical and Aerospace Engineering, Seoul National University
- Other Affiliations: Electrical and Computer Engineering, Radiation Oncology, Applied Mathematical and Computational Sciences

RESEARCH HIGHLIGHTS

Human Performance Analysis: Developing virtual reality technologies for interactive simulation among subjects within different simulation environments in order to study the road user behaviors for enhancing road safety.

- Vehicle driver state detection via deep learning.
- A study on user experience in autonomous driving scenarios.
- Developing connected simulation to study interactions between drivers, pedestrians, and bicyclists.

Medical Image Analysis: Characterizing shapes and textures of diseases in medical images and correlating them with other clinical parameters in order to detect disease and predict clinical outcomes ore accurately.

- Lung cancer outcome prediction.
- Interstitial lung disease quantification.

LEARN MORE



SCHEDULE A VISIT

by contacting Stephen Baek at stephen-baek@uiowa.edu or 319-384-0810



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on our website www.stephenbaek.com/lab

