

## Emily Kim

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### EDUCATION

**Carnegie Mellon University Robotics Institute**

*Doctoral Degree*

**Harvey Mudd College**

Bachelor of Science – Joint Computer Science-Math

Pittsburgh, PA

December 2025

Claremont, CA

May 2019

### HONORS

*Uber Presidential Scholarship 2021*

### SKILLS & RESEARCH INTEREST

**Programming Languages:** Python, Java, C++, HTML, CSS, Javascript

**Research Interest:** Human Tracking and Dataset, Computer Vision, Computer Graphics, Generative AI

### GRADUATE RESEARCH

**Learning to Attack Vehicle Detection Models Trained on Satellite Images using Both the 2D Texture and 3D Mesh Deformation in the Synthetic Domain (11.2022 -)**

- Generated textured 3D meshes to train the vehicle detection models at a satellite view to run optimization experiments for attacking these models.
- Implemented an optimization model that generates data for attacking the object detection model (RetinaNet, FasterRCNN, YOLOv5) by deforming the vehicle meshes using the displacement maps and optimizing the displacement map using a differentiable renderer (PyTorch3D).
- Implemented an optimization model for attacking both the 3D mesh (optimized displacement map) and the texture map simultaneously.
- Evaluated the model performance for detecting vehicles from satellite images via adversarial attacks using 3D deformation network, detecting failure points from the model.

**Exploring the Impact of Rendering and Motion Quality on the Model Performance when Using Multi-view Human Action Recognition Synthetic Data (12.2021 - 08.2023) (accepted to WACV 2024)**

- Generated a new Human Action Recognition Dataset with real and synthetic datasets.
- Animated the raw motion capture data as skinned human meshes (SMPL) and generated a neural-based rendered synthetic dataset by modifying the motion imitation model (Liquid Warping GAN) pipeline and extending the implementation of the original code.
- Analyzed the difference between the augmentation methods in the performance of the action recognition task by running experiments comparing the performances of the models trained on synthetic datasets with different rendering pipelines and motion quality.

**Automating physical therapy exercise correctness assessment with 3D pose reconstructed from cameras and IMU sensors (05.2021 - 12.2021)**

- (1) Used 3D pose reconstruction from camera and IMU sensors instead of quantitative values and (2) used thresholding methods to define the criteria for correctness rather than using features found with the machine learning algorithm.

**Automating Error Classification for Physical Therapy using a camera and IMU sensors**

(11.2019 - 05.2021) (Published through EMBC 2021)

- Developed a classification model for tracking errors from videos captured during physical therapy sessions.
- Used OpenPose to extract 2D keypoints from videos for analysis.
- Built a Random Forest classifier to examine the performance of vision-based error detection by taking the clinicians' error annotations on exercises from each patient as labels and 2D keypoints / IMU sensor data as features.

## UNDERGRAD PROJECTS

### **Mentor Graphics, a Siemens Business Clinic Project** (09.2018 - 05.2019)

- Worked on a clinical project of automating the calculation of the silicon wafer yield using the product manufacturing information data via Decision Trees in Machine Learning.
- Worked as a Project Manager

*Skills: Machine Learning, MongoDB, Scikit-Learn, research, teamwork.*

### **Audio Generation from Dance** (01.2018 - 05.2018)

- Developed a model to create music or audio from dancing graphics, using machine learning and dilated convolutional neural networks, adapted from the method of generating the audio using WaveGAN.

### **Obama Lip Sync for Multiple Languages** (01.2018 - 05.2018)

- Adapted a training model for Obamas videos and audios to develop our own training model and do statistical analysis using the PCA to compare the speech patterns of Korean, French, Spanish to the speech patterns of English (Obama).

### **Engineering Project for Nippon Antenna** (10.2016 - 12.2016)

- Proposed solutions for improved a sound quantity and comfort problem in Nippon Antennas Bluetooth neck speaker for advanced user compatibility with six different design alternatives and made suggestions for the currently existing product for better user experience and marketability.

## WORK EXPERIENCES

### **Learning Based Image Synthesis course TA (Teaching Assistant)** *January 24, 2023 - May 10, 2023* *Carnegie Mellon University Robotics Institute* *Pittsburgh, PA*

- Worked as a teaching assistant for Learning Based Image Synthesis at Robotics Institute, dealing with image modifications, GANs, diffusion models, and style transfer.

### **Teaching Assistant for Computer Vision** *August 28, 2022 - December 19, 2022* *Carnegie Mellon University Robotics Institute* *Pittsburgh, PA*

- Worked as a teaching assistant for a fundamental Computer Vision course at Robotics Institute.

### **Research Mentor** *June 03, 2022 - August 27, 2022* *Lumiere Education* *Remote*

- Mentored two high school students to embark on their first research. Encouraged students to independently study the materials for their projects and provided guidance to think critically about previous readings and research questions while also running experiments. The two areas of research that the students studied were: (1) Use machine learning (random forest regression) to predict the trends of different types of cryptocurrencies along with trends of NASDAQ prices and the inflation rates. (2) Use machine learning (random forest classification) to classify the exercises using the data collected from the IMU sensors embedded in smartphones and/or smart watches.

### **Supply Chain Program Management Intern - SKU Rationalization Project** *May 2018 - August 2018* *Juniper Networks, Inc.* *Sunnyvale, CA*

- Embarked the SKU Rationalization process based on previous and forecasted revenue/cost and established a SKU Rationalization model for future planning. Provided suggestions for change in product list and data organization within the Supply Chain Operations Department. Skills: Data organization, statistical and business analysis.
- **Internet Day 2018:** Led an event for students from underrepresented families to teach them about the Internet and college level education.

### **Tutoring & Grading** *January 2016 - May 2019* *Harvey Mudd College* *Claremont, CA*

- Tutored for Harvey Mudd Homework Hotline and Harvey Mudd Upward Bound Program. Grading and tutoring for Intro CS, Data Structures and Program Development, Computer Science for Insight, Computability and Logic and Physics Mechanics, Electricity & Magnetism class.

## CLUB & VOLUNTEER ACTIVITIES

### **Korean Student Association (KSA), Claremont, CA**

- Served as the President of the 5 Claremont Colleges Korean Student Association.
- Hosted socials and cultural events for Korean society.

### **Korean American Scientists and Engineers Association in Harvey Mudd College, Claremont, CA**

- Served as a volunteer for educational events such as the National Mathematics and Science Competition (NMSC).