

# Hyung-gun Chi

SOFTWARE ENGINEER · MASTER STUDENT

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## Research Interests

My research interests lie at the intersection of Computer Vision and Robotics, focusing on 3D Geometric Deep Learning for recognizing and synthesizing 3D objects. In this area, I applied machine learning (deep learning) algorithms for Augmented/Virtual Reality and Smart Factory.

## Education

### Purdue University

West Lafayette, IN, USA

MASTER OF SCIENCE IN MECHANICAL ENGINEERING

Aug. 2018 - PRESENT

- Advisor: Karthik Ramani, Donald W. Feddersen Professor of Mechanical Engineering

### Yonsei University

Seoul, South Korea

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

Mar. 2010 - Feb. 2017

- Advisor: Soo-Hong Lee, Professor of Mechanical Engineering
- 2011-2013, 2-year military service

## Skills

**Programming** Python, Matlab, C/C++, SQL, JavaScript, HTML, CSS, PHP

**Frameworks** TensorFlow, PyTorch, Keras, ROS, OpenCV

**Software** Creo Parametric, SolidWorks, HyperWorks, GAZEBO

## Publications and Patents

### Journal Papers

- [J4][PDF] S. Kim, **H. G. Chi** and Karthik Ramani. Object synthesis by learning part geometry with surface and volumetric representations. In *Computer-Aided Design*, submitted.
- [J3][PDF] S. Kim, N. Winovich, **H. G. Chi**, G. Lin, and K. Ramani. Latent transformations neural network for object view synthesis. In *The Visual Computer*, pp. 1-15, 2019
- [J2][PDF] H. T. Hwang, **H. G. Chi**, N. K. Kang, H. B. Kong and Soo-Hong Lee. An Evaluation Methodology for 3D Deep Neural Network using Visualization in 3D Data Classification. In *Journal of Mechanical Science and Technology (JMST)*, 33(3), pp. 1333-1339, 2019
- [J1][PDF] JIN YONGZHU, **H. G. Chi** and Soo-Hong Lee. A Study on the Optimal Design of Pedestrian Robots Using Jansen Mechanism. In *CDE review*, 22(2), pp. 18-22, 2016

### Conference Proceedings

- [C5][PDF] **H. G. Chi**, S. Kim, X. Hu, B. Franz, Q. Huang, and Karthik Ramani. A Large-scale Mechanical Components Benchmark for Deep Neural Networks. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, submitted.
- [C4][PDF] S. Kim, **H. G. Chi**, A. Unmesh and Karthik Ramani. Multispectral Video Dataset for First-person View Hand Segmentation during Activity with Objects and Tools. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, submitted.
- [C3][PDF] L. Paredes, S. Chidambaram, X. Qian, **H. G. Chi** and Karthik Ramani. SleekPatch: Fabrication of a self-contained, slim hand wearable for interactions in mobile computing. In *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, submitted.
- [C2][PDF] H. Hwang, **H. G. Chi**, S. H. Lee. A Research about 3D Design Data Classification with 3D Convolutional Neural Network. In *Proceedings of the Society for Computational Design and Engineering Conference*, pp. 441-442, 2017
- [C1][PDF] M. H. Woo, S. H. Kim, **H. G. Chi**, M. W. Park, J. K. Kim and S. H. Lee. Development of Web-based, Module Structure Platform for Surgical Workflow Management. In *Proceedings of the Society for Computational Design and Engineering Conference*, pp. 439-441, 2016

### Patents

- [P1][PDF] **H. G. Chi**. "Computer Input Automation System" KR Patent (2017): 10-1745330.

## Research Experience

### A Large-scale Engineering Part Benchmark Dataset

C-design LAB, Purdue Univ.

GRADUATE ASSISTANT

Feb. 2019 - Present

- Collected massive mechanical component CAD data with a web-scraper, and expanded the data for dense data distribution using Creo Parametric and SolidWorks API. (Relevant publication: [C5])
- Developed a web-based 3D CAD search engine using a 3D Deep Neural Network and PostgreSQL database.
- Benchmarked state-of-art 3D Deep Neural Network for classification and segmentation task to evaluate the dataset.

## Hand motion prediction with RGBD-T data

C-design LAB, Purdue Univ.

GRADUATE ASSISTANT

Jul. 2019 - Present

- Proposed a novel dataset by fusing RGB-D and thermal data for action recognition. (Relevant publication: [C4])
- Developed a method which predicts hand motion by segmenting hands and objects with a 3D Deep Neural network dealing with RGBD-T data.

## Part Geometry Net (PGNet)

C-design LAB, Purdue Univ.

GRADUATE ASSISTANT

Oct. 2018 - Aug. 2019

- Built a Generative Adversarial Network which generates 3D objects given a discrete category condition and continuous instance-level attributes by fusing the various types of geometric information.
- Introduced a part identifier module which learns part geometry to preserve part properties of 3D objects. (Relevant publication: [J4])

## Latent Transformation Neural Network (LTNN)

C-design LAB, Purdue Univ.

GRADUATE ASSISTANT

Aug. 2018 - April. 2019

- Developed a fully-convolutional conditional generative network which is capable of view synthesis using a light-weight neural network suited for real-time applications. Introduced the conditional transformation unit which is designed to learn the latent space transformations corresponding to specified target views. (Relevant publication: [J3])

## Visual Programming Language for Mobile Robots and IoT Nodes

C-design LAB, Purdue Univ.

GRADUATE ASSISTANT

Aug. 2018 - Feb. 2019

- Proposed a web-based visual and spatial programming language that allows novice users and small industries to program mobile robots and IoT Nodes to execute planned tasks.
- Developed a virtual world using Robotic Operating System(ROS) and GAZEBO which simulates interaction between mobile robots and IoT devices.

## ControllAR

C-design LAB, Purdue Univ.

GRADUATE ASSISTANT

Aug. 2018 - Dec. 2018

- Proposed a parametrizing interface, simple and accessible fabrication workflow, and a pressure sensor using a soft piezoresistive elastomer material. Also, developed embedded system using Arduino and analyzed signals from different sensors and materials. (Relevant publication: [C3])

## 3D Deep Neural Network evaluation method

Knowledge-Based Design LAB, Yonsie Univ.

UNDERGRADUATE RESEARCH ASSISTANT

Feb. 2016 - Jul. 2017

- Proposed an evaluation method for 3D Deep Neural Networks by visualizing the impact of each voxel of each 3D objects and also a web-based 3D CAD search engine using a 3D Deep Neural Network for demonstration. (Relevant publication: [J2][C2])

## Web-based Surgical Workflow Management Platform

Knowledge-Based Design LAB, Yonsie Univ.

UNDERGRADUATE RESEARCH ASSISTANT

Feb. 2016 - Aug. 2016

- Developed a web-based interface and database for integrated surgical information, to optimize surgical procedures and reduce the medical loss caused by communication errors and lack of information. (Relevant publication: [C1])

## Working Experience

### Python Developer

Seoul, South Korea

FINANCIAL INSIGHT

Jan. 2018 - Jul. 2018

- Worked as a Python developer in an early-stage startup company. Developed a web-scraper and database for collecting financial data of the Korean stock market.

### Python Developer and CEO

Seoul, South Korea

NEIL LAB CORPORATION

Sep. 2016 - Dec. 2017

- Developed an office automation system using Python specifically for automating tasks such as sending an e-mail or issuing receipts, and designed a back-end system and database for customer web-service which automatically scrap and integrate customer's financial and personal data. (Relevant patent: [P1])
- Founded and led a startup company as a CEO for a year and also worked as a Python developer. The company was funded \$ 30,000 by the Seongnam Industry Promotion Agency.

### Mechanic and Squad leader

Inje, South Korea

REPUBLIC OF KOREA ARMY

Apr. 2011 - Jan. 2013

- Maintained military weapons and equipment including firearms and vehicles.
- Led a squad as a squad leader; honored as a distinguished soldier.

## Extracurricular Activity

### Habitat for Humanity Korea Campus Chapter

South Korea

MEMBER & PRESIDENT

Mar. 2010 - Aug. 2016

- Constructed new houses for the homeless and renovated old houses, served more than 500 hours.
- Led and managed a volunteer group for a year; received the first honor from 2014 Yonsei Club Evaluation.

## Korea Food for the Hungry International - campus volunteer group

MEMBER

South Korea

Apr. 2013 – Nov. 2013

- Mentored preschool children and elementary school students at the Seoul Children's Center

## Honors & Awards

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| 2016 | <b>KISTI (Korea Institute of Science and Technology Information) President's Award,</b><br>Edison Challenge – Computer Aided Design Section                  | Seoul, South Korea   |
| 2016 | <b>CDE (Korea Society for Computational Design and Engineering) President's Award,</b><br>CDE Challenge – Computational Design and Engineering Tools Section | Daejeon, South Korea |