

# Hanbyul Joo

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## EDUCATION

- Carnegie Mellon University** 2018  
Ph.D. in Robotics Institute, School of Computer Science  
Advisor: Prof. Yaser Sheikh  
Thesis: [Sensing, Measuring, and Modeling Social Signals in Nonverbal Communication](#)  
Thesis Committee: Yaser Sheikh (CMU), Takeo Kanade (CMU), Louis-Philippe Morency (CMU), David Forsyth (UIUC), Mina Cikara (Harvard)
- KAIST** 2009  
M.S. in Electrical Engineering  
Advisor: Prof. In So Kweon  
Thesis: Graph-based Boundary Matching for Deformable Objects
- KAIST** 2007  
B.S. in Computer Science

## RESEARCH INTEREST

The goal of my research is to endow machines and robots with the ability to perceive and understand human behaviors in 3D. Ultimately, I dream to build an AI system that can behave like humans in new environments and can interact with humans using a broad channel of nonverbal signals (kinesic signals or body languages). I pursue this direction by creating new tools in computer vision, machine learning, and computer graphics.

## PUBLICATIONS

- "FrankMocap: A Fast Monocular 3D Hand and Body Motion Capture by Regression and Integration"  
Yu Rong, Takaaki Shiratori, Hanbyul Joo  
International Conference on Computer Vision (ICCV) Workshop, 2021.
- "Exemplar Fine-Tuning for 3D Human Model Fitting Towards In-the-Wild 3D Human Pose Estimation"  
Hanbyul Joo, Natalia Neverova, Andrea Vedaldi  
International Conference on 3D Vision 2021 (3DV), 2021 (Oral).
- "Body2Hands: Learning to Infer 3D Hands from Conversational Gesture Body Dynamics"  
Evonne Ng, Shiry Ginosar, Trevor Darrell, Hanbyul Joo  
IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2021.
- "3D Multi-bodies: Fitting Sets of Plausible 3D Human Models to Ambiguous Image Data"  
Benjamin Biggs, Seb Ehrhardt, Hanbyul Joo, Ben Graham, Andrea Vedaldi, David Novotny  
Conference on Neural Information Processing Systems (NeurIPS), 2020 (Spotlight).
- "Perceiving 3D Human-Object Spatial Arrangements from a Single Image in the Wild"  
Jason Y. Zhang\*, Sam Pepose\*, Hanbyul Joo, Deva Ramanan, Jitendra Malik, Angjoo Kanazawa  
European Conference on Computer Vision (ECCV), 2020.
- "PIFuHD: Multi-Level Pixel-Aligned Implicit Function for High-Resolution 3D Human Digitization"  
Shunsuke Saito, Tomas Simon, Jason Saragih, Hanbyul Joo  
IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2020 (Oral).
- "You2Me: Inferring Body Pose in Egocentric Video via First and Second Person Interactions"  
Evonne Ng, Donglai Xiang, Hanbyul Joo, Kristen Grauman  
IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2020 (Oral).

- "Single-Network Whole-Body Pose Estimation"  
Gines Hidalgo, Yaadhav Raaj, Haroon Idrees, Donglai Xiang, **Hanbyul Joo**, Tomas Simon, Yaser Sheikh  
International Conference on Computer Vision (**ICCV**), 2019.
- "Towards Social Artificial Intelligence: Nonverbal Social Signal Prediction in A Triadic Interaction"  
**Hanbyul Joo**, Tomas Simon, Mina Cikara, Yaser Sheikh  
IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**), 2019 (**Oral**).
- "Monocular Total Capture: Posing Face, Body and Hands in the Wild"  
Donglai Xiang, **Hanbyul Joo**, Yaser Sheikh  
IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**), 2019 (**Oral**).
- "Total Capture: A 3D Deformation Model for Tracking Faces, Hands, and Bodies"  
**Hanbyul Joo**, Tomas Simon, and Yaser Sheikh  
IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**), 2018 (**Oral**).  
[**Best Student Paper Award**]
- "Panoptic Studio: A Massively Multiview System for Social Interaction Capture"  
**Hanbyul Joo**, Tomas Simon, Xulong Li, Hao Liu, Lei Tan, Lin Gui, Sean Banerjee, Timothy Godisart, Bart Nabbe, Iain Matthews, Takeo Kanade, Shohei Nobuhara, and Yaser Sheikh  
Transactions on Pattern Analysis and Machine Intelligence (**TPAMI**), 2017.
- "Hand Keypoint Detection in Single Images using Multiview Bootstrapping"  
Tomas Simon, **Hanbyul Joo**, Iain Matthews, and Yaser Sheikh  
IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**), 2017.
- "Panoptic Studio: A Massively Multiview System for Social Motion Capture"  
**Hanbyul Joo**, Hao Liu, Lei Tan, Lin Gui, Bart Nabbe, Iain Matthews, Takeo Kanade, Shohei Nobuhara and Yaser Sheikh  
International Conference on Computer Vision (**ICCV**), 2015 (**Oral**).
- "MAP Visibility Estimation for Large-Scale Dynamic 3D Reconstruction"  
**Hanbyul Joo**, Hyun Soo Park, and Yaser Sheikh  
IEEE Conference on Computer Vision and Pattern Recognition (**CVPR**), 2014 (**Oral**).
- "Graph-based Shape Matching for Deformable Objects"  
**Hanbyul Joo**, Yekeun Jeong, Olivier Duchenne, and InSo Kweon  
IEEE International Conference on Image Processing (**ICIP**), 2011.
- "Graph-Based Robust Shape Matching for Robotic Application"  
**Hanbyul Joo**, Yekeun Jeong, Olivier Duchenne, Seong-Young Ko, and InSo Kweon  
IEEE International Conference on Robotics and Automation (**ICRA**), 2009.
- "Statistical Background Subtraction Based on the Exact Per-pixel Distributions"  
Youngbae Hwang, **Hanbyul Joo**, Junsik Kim, and InSo Kweon  
International Association of Pattern Recognition workshop on Machine Vision Applications (**MVA**), 2007.

## WORK EXPERIENCES

- Facebook AI Research (Meta AI), USA**  
Research Scientist *Jan. 2019 – Jan. 2022*
- Oculus Research Pittsburgh, USA**  
Research Intern *May. 2017 – Oct. 2017*  
Worked on a *3D Human Body, Face, and Hand Tracking and Modeling* project
- Disney Research Zurich, Switzerland**  
Research Intern *June. 2015 – Oct. 2015*  
Mentor: Thabo Beeler and Derek Bradley  
Worked on a *3D Face Capture* project

**Electronics and Telecommunications Research Institute (ETRI), South Korea**

Researcher

Feb. 2009 – Jul.2012

Worked on *full 3D reconstruction technology for broadcasting communication fusion* project

Developed a real-time markerless motion capture system using 20 broadcast cameras

Developed a system for automatic rigging and animation of 3D virtual avatar

## TUTORIAL ORGANIZATION

"Visual Recognition for Images, Video, and 3D"

Ross Girshick, Alexander Kirillov, Yuxin Wu, Christoph Feichtenhofer, Haoqi Fan, Yanghao Li, **Hanbyul Joo**, Justin Johnson, Xinlei Chen, Georgia Gkioxari, Nikhila Ravi, Piotr Dollár, Wan-Yen Lo, Saining Xie

In Conjunction with **ECCV 2020**.

"DIY A Multiview Camera System: Panoptic Studio Teardown "

**Hanbyul Joo**, Tomas Simon, Hyun Soo Park, Shohei Nobuhara, Yaser Sheikh

In Conjunction with **CVPR 2017**.

## AWARDS & SCHOLARSHIPS

**CVPR Best Student Paper Award**

2018

Out of 979 accepted papers (out of 3309 submissions)

**Samsung Scholarship**

2012 - 2017

Tuition and stipend for Ph.D. study (\$50K/year, for 5 years)

**Governmental Scholarship for KAIST Graduate Students**

2007 - 2009

**Governmental Scholarship for KAIST Undergraduate Students**

2002 - 2006

## DATASETS & OPENSOURCE

**FrankMocap:** <https://github.com/facebookresearch/frankmocap>

A Strong and Easy-to-use Single View 3D Hand+Body Pose Estimator

**PIFuHD:** <https://github.com/facebookresearch/pifuhd>

High-Resolution 3D Human Digitization Code from A Single Image.

Top 1 in Trending repository list on GitHub

3.1K stars and 331 forks (as of Sep 2020)

**Panoptic Studio Dataset:** <http://domedb.perception.cs.cmu.edu>

A dataset of 3D hands, bodies, and face motion for social groups captured by the Panoptic Studio

**OpenPose:** <https://github.com/CMU-Perceptual-Computing-Lab/openpose>

The first real-time multi-person system to jointly detect body, hand, and facial keypoints on single images

Top 1 in Trending repository list on GitHub

18.7K stars and 5.7K forks (as of Sep 2020)

## TALKS

**A Computational Approach to Sensing, Measuring, and Modeling Humans in 3D**

ai.x 2020 conference (hosted by SK Telecom, Korea)	Aug 2020
SNU AI Summer School, Korea	Aug 2020
360 Perception and Interaction Workshop in ICCV 2019 (hosted by Min Sun)	Oct 2019
Facebook AI Video Summit	June 2019
Google Research	Aug 2018
Microsoft Research	June 2018
UC Berkeley, BAIR (hosted by Prof. Jitendra Malik)	May 2018
UT Austin, School of Computer Science (hosted by Prof. Kristen Grauman)	April 2018
Carnegie Mellon University, School of Computer Science (hosted by Prof. Chris Atkeson)	April 2018
MIT, CSAIL, (hosted by Prof. Antonio Torralba)	April 2018
MIT, Media Lab	Nov 2017

### **Towards Social Artificial Intelligence: Nonverbal Social Signal Prediction in A Triadic Interaction**

CVPR Oral Talk	June 2019
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### **Total Capture: A 3D Deformation Model for Tracking Faces, Hands, and Bodies**

GAMES Webinar (hosted by Prof. Yebin Liu)	Oct 2018
CVPR Oral Talk	June 2018

### **The Panoptic Studio: A Massively Multiview System for Social Interaction Capture**

UC Berkeley, Computer Vision Group (hosted by Prof. Alexei A. Efros)	Dec 2016
Stanford, Computer Vision and Geometry Lab (hosted by Prof. Silvio Savarese)	Dec 2016
Adobe Research, San Jose	Dec 2016
ACM International Conference on Multimodal Interaction (ICMI), ASSP4MI workshop	Nov 2016
Carnegie Mellon University, VASC Seminar	Dec 2015
ICCV Oral Talk	Dec 2015
ETH Zurich, Computer Vision and Geometry lab (hosted by Prof. Marc Pollefeys)	Oct 2015
Seoul National University (hosted by Prof. Kyoung Mu Lee)	June 2015
ETRI, CG Team	May 2015
KAIST (hosted by Prof. In So Kweon)	May 2015

### **MAP Visibility Estimation for Large-Scale Dynamic 3D Reconstruction**

Carnegie Mellon University, Civil & Environmental Engineering	Feb. 2015
Carnegie Mellon University, People Image Analysis Consortium	Nov. 2014
Autodesk, Reality Computing Meetup, Pittsburgh	Nov. 2014
Conference on Computer Vision and Pattern Recognition (CVPR), Oral Talk	Jun. 2014
Carnegie Mellon University, VASC Seminar	Jun. 2014

## **SELECTED PRESS COVERAGE**

**FOSSBYTES**, Facebook's New "PiFuHD" Tech Can Construct 3D Models From Photos, *Jun. 2020*

**IT Media (Japanese)**, High-definition 3D model creation from one portrait with AI Developed such as Facebook, *Jun. 2020*

**WIRED**, Inside the Panoptic Studio, the Dome That Could Give Robots Super-Senses, *Feb. 2018*

**BBC News**, The Dome Which Could Help Machines Understand Behavior, *Oct. 2017*

**Reuters**, 500-Camera Dome Trains Computer To Read Body Language, *Oct. 2017*

**EBS (Korean TV Channel)**, Docuprime: The Global War For Talent, *Mar. 2017*

**CMU News**, Scientists Put Human Interaction Under The Microscope, *Mar. 2017*

**The Verge**, Cracking The Elaborate Code, *Dec. 2016*

**SPIEGEL ONLINE**, The Panoptic Studio: Computer Decipher The Secrets of Body Language, *Dec. 2015*

**Wired (Italian)**, Panoptic Studio: The Latest Generation of Motion Capture, *Jul. 2015*

**Voice of America**, New Studio Yields Most Detailed Motion Capture in 3D, *Apr. 2015*

**Reuters**, Motion capture on a whole new level, *Apr. 2015*

**Discovery Channel Canada**, Daily Planet Show, Future Tech: Panoptic Studio, *Jan. 2015*

**IEEE Spectrum**, Camera-Filled Dome Recreates Full 3-D Motion Scenes, *Jul. 2014*

**Discovery News**, Amazing 3-D Flicks from Dome of 500 Cameras?, *Jul. 2014*

**NBC NEWS**, Camera-Studded Dome Tracks Your Every Move With Precision, *Jul. 2014*

**CNet**, Tomorrow Daily: New video capture tech, *Jul. 2014*

**Engadget**, Watch A Dome Full of Cameras Capture 3D Motion in Extreme Detail, *Jul. 2014*

**GIZMODO**, A Dome Packed With 480 Cameras Captures Detailed 3D Images In Motion, *Jul. 2014*

**THE Verge**, Scientists build a real Panopticon that captures your every move in 3D, *Jul.2014*

**Science Daily**, Hundreds of Videos Used To Reconstruct 3-D motion Without Markers, *Jul. 2014*

**PHYS.ORG**, Researchers Combine Hundreds of Videos To Reconstruct 3D Motion Without Markers, *Jul. 2014*

**Slate**, Freezing Memories in Time, *Jul. 2014*

**PetaPixel**, Researchers Use a 480-Camera Dome to More Accurately Capture 3D Motion, *Jul. 2014*

**Gizmag**, Camera-studded Dome Used To Reconstruct 3D Motion, *Jul. 2014*

**theENGINEER**, 3D Motion Captured Without Markers, *Jul. 2014*

**CMU News**, Carnegie Mellon Combines Hundreds of Videos To Reconstruct 3D Motion ..., *Jul. 2014*

## **PATENTS**

Motion capture apparatus and method (Patent No.: US 8805024 B2)  
**Hanbyul Joo**, Seong-Jae Lim, Ji-Hyung Lee, Bon-Ki Koo

Method for automatic rigging and shape surface transfer of 3D standard mesh model based on muscle and nurbs by using parametric control (Patent No.: US 7171060 B2)  
Seong Jae Lim, Ho Won Kim, **Hanbyul Joo**, Bon Ki Koo

3D model shape transformation method and apparatus (Patent No.: US8922547B2)  
Seong-Jae Lim, **Hanbyul Joo**, Seung-Uk Yoon, Ji-Hyung Lee, Bon-Ki Koo.

## **Student Mentorship**

**Evonne Ng**, PhD in UC Berkeley  
FAIR-BAIR program mentor (Spring 2020 - present)

Xiang Xu, PhD in Simon Fraser University  
FAIR internship mentor (Summer 2020 - present)

Yu Rong, PhD in The Chinese University of Hong Kong  
FAIR internship mentor (Spring 2020)

Shunsuke Saito, PhD in University of Southern California  
FAIR internship mentor (Summer 2019)

Donglai Xiang, MS in Carnegie Mellon University  
Mentoring for [Monocular Total Capture Project](#)

## TEACHING

**Guest Lecturer**, Carnegie Mellon University *Fall 2018*  
15-463 Computational Photography (Instructor: Ioannis (Yannis) Gkioulekas)

**Guest Lecturer**, Carnegie Mellon University *Spring 2018*  
16-720 Computer Vision (Instructor: Kris Kitani)

**Teaching Assistant**, Carnegie Mellon University *Fall 2014*  
16-720 Computer Vision (Instructor: Martial Hebert)