



# deepHand: Deep Learning the Finger and Hand Articulations

**deepHand is an improved natural user interface that uses a single camera and convolutional neural networks to robustly track hand position and finger joint angles, allowing for more intuitive gestures with less hardware.**

As virtual and augmented reality devices continue to become more commonplace, gesture-based natural user interfaces (NUI) seem to be the future. NUIs can provide an immersive and natural computing experience, especially when compared to traditional input devices such as mice and keyboards. Although NUIs are an improvement from traditional input devices, they are still limited by their hand-tracking capabilities as well as by their extensive hardware requirements.

Researchers at Purdue University have developed a greatly improved NUI known as deepHand. deepHand determines hand position robustly using a single camera, even when the hand may be partially hidden from view. Unlike current hand-tracking software, deepHand identifies and tracks the finger joint angles instead of the position of the finger joints themselves, which allows the system to be considerably more robust and invariant to changes in camera orientation. It continuously tracks objects even when they are covered or slightly removed from view through the use of convolutional neural networks (CNNs). CNNs are based on biological visual cortexes and work by layering and overlapping images; in deepHand it tracks the joint angles. deepHand allows more intuitive hand gestures while using less hardware, opening the door for immersive human-computer interactions.

## Advantages:

- Natural gesture based inputs
- Uses a single camera
- Permits hand-tracking under occlusion

Potential Applications:

## Technology ID

2016-RAMA-67373

## Category

Artificial Intelligence & Machine Learning/Computer Vision & Image Recognition  
Robotics & Automation/Perception & Sensing  
Education & EdTech/Immersive & XR Learning Environments

## Authors

Joon Hee Choi  
Chiho Choi  
Karthik Ramani  
Ayan Sinha

## Further information

Matt Halladay  
[MRHalladay@prf.org](mailto:MRHalladay@prf.org)

Erinn Frank  
[EEFrank@prf.org](mailto:EEFrank@prf.org)

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- Gaming and animation
- Immersive human-computer interaction
- Healthcare
- Education

**TRL: 6**

**Intellectual Property:**

Provisional-Patent, 2015-12-15, United States

Utility Patent, 2016-12-15, United States

DIV-Patent, 2019-06-10, United States

CON-Patent, 2019-12-09, United States

CON-Gov. Funding, 2020-11-30, United States

CON-Patent, 2022-06-13, United States

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