Using a deep neural network to improve virtual images of people created using WiFi signals

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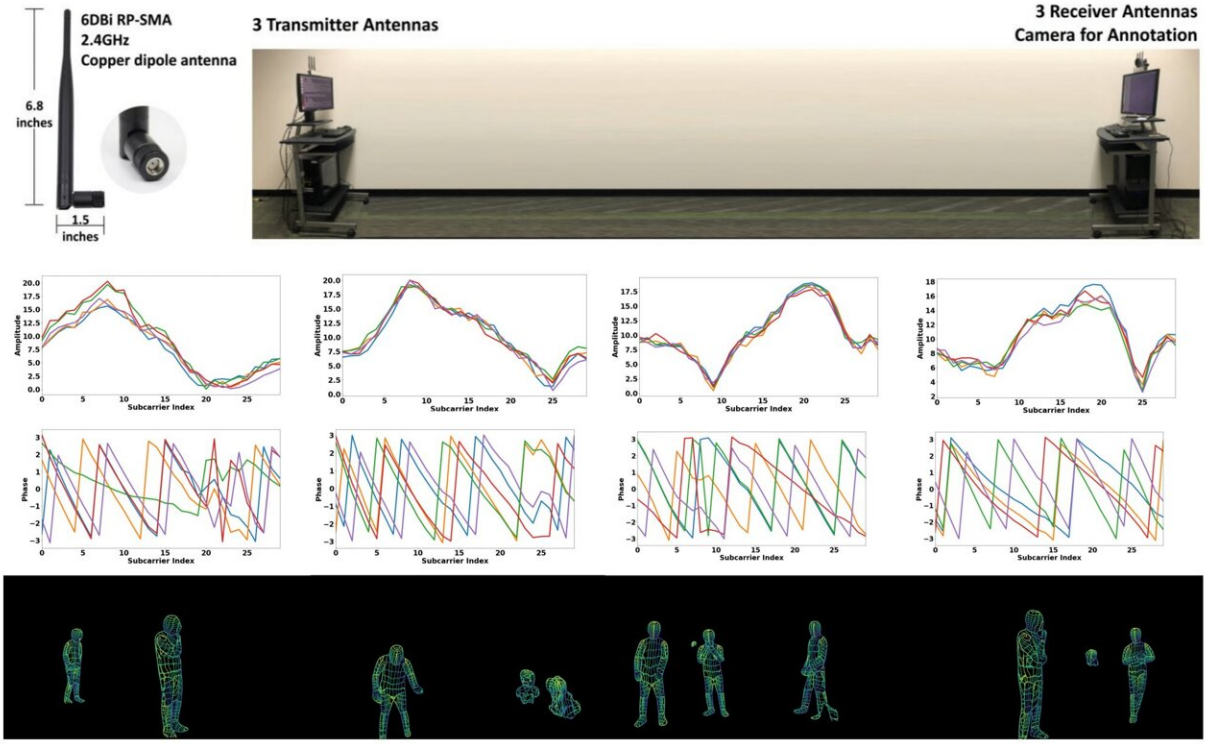

The first row illustrates the hardware setup. The second and third rows are the clips of amplitude and phase of the input WiFi signal. The fourth row contains the dense pose estimation of our algorithm from only the WiFi signal. Credit: *arXiv* (2023). DOI: 10.48550/arxiv.2301.00250

A trio of researchers at Carnegie Mellon University has taken the use of WiFi signals to identify people in a building to a new level, through the use of a deep neural network. Jiaqi Geng, Dong Huang and Fernando De la Torre suggest, in a paper they have posted to the *arXiv* preprint server, that their approach allows for creating images on par with RGB cameras.

Back in 2013, a team of engineers at MIT found that WiFi signals could be used to detect the presence of a person in a building. They noted that by mapping the signals over time, they could see where the signals were being blocked by a person's body. By continuing the process over the next few years, they found that they were able to create stick figures that showed where a person was in a given building at any given time.

The process is now known as DensePose. In this new effort, the research trio have taken this approach to a new level by introducing a neural network that helps fill in the bodies of the stick figures, providing much more lifelike images—and it can do it on the fly, allowing for real-time motion tracking of multiple people in a given area.

The work by the team involved placing three WiFi transmitters along with three aligned receivers at a scene—indoors in a room, or outside at a chosen site—along with a computer for processing and display. They note that the WiFi equipment used in their experiments cost just US $30, far less than LiDAR or radar systems.

When running, the WiFi signals are picked up by the receivers which send them to a GPU inside of a computer for processing. The processing involves using a neural network to map the amplitude and phase of the signals to coordinates onto a virtually created human body—a process known as dense human pose correspondence.

During the process, the virtual human body is broken down into 24 components where two-dimensional texture coordinates are mapped onto

them based on WiFi signals. The body parts are then put back together where they resemble a realistic human form—all in real time. The result is a virtual animation shown on the computer display that mimics the locations and actions of people in the original scene.

More information: Jiaqi Geng et al, DensePose From WiFi, *arXiv* (2023). DOI: 10.48550/arxiv.2301.00250