UC SANTA BARBARA

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Counting People With WiFi

Researchers in UC Santa Barbara professor Yasamin Mostofi's lab are proving that wireless signals can do more than provide Internet access. They have demonstrated that a WiFi signal can be used to count the number of people in a given space, leading to diverse applications, from energy efficiency to search-and-rescue.

"Our approach can estimate the number of people walking in an area, based on only the received power measurements of a WiFi link," said Mostofi, a professor of electrical and computer engineering. This approach does not require people to carry WiFi-enabled telecommunications devices for them to be counted, Mostofi emphasized.

To accomplish this feat of people-counting, the researchers put two WiFi cards at opposite ends of a target area, a roughly 70-square-meter space. Using only the received power measurements of the link between the two cards, their approach can estimate the number of people walking in that area. So far, they have successfully tested with up to and including nine people in both indoor and outdoor settings. The findings of Mostofi's research group are scheduled for publication in the Institute of Electrical and Electronics Engineers Journal on Selected Areas in Communications' special issue on location-awareness for radios and networks.

"This is about counting walking people, which is very challenging," said Mostofi. "Counting this many people in such a small area with only WiFi power measurements of one link is a hard problem, and the main motivation for this work."

This people-counting method relies in large part on the changes of the received wireless signal, according to the researchers. The presence of people attenuates the signal in the direct line of sight between the WiFi cards if a person crosses the line of sight, and human bodies also scatter the signal — resulting in a phenomenon called multi-path fading — when they are not in the direct line of sight path. By developing a probabilistic mathematical framework based on these two key phenomena, the researchers have then proposed a way of estimating the number of people walking in the space.

With the near-ubiquity of WiFi in many settings, the researchers' findings have the potential for many diverse applications. For instance, the ability to estimate the number of people in a given space could be used in smart homes and buildings, so air conditioning and heating could be adjusted according to the level of occupancy. "Stores can benefit from counting the number of shoppers for better business planning," noted Mostofi.

Security and search-and-rescue operations could also take advantage of occupancy estimation. Previous work in the research lab involved imaging stationary objects/humans through walls with WiFi signals, and Mostofi plans to eventually bring the two projects together in the future.

For more information, visit the research group's project page at: http://www.ece.ucsb.edu/~ymostofi/HeadCountingWithWiFi

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