Is your phone's wifi giving away where you walk? Researchers secretly track pedestrian using wireless signals

- Used more than two million points picked Wi-Fi from about 2,000 people
- Routes were created using the Wi-Fi connections that were accessed
- Wi-Fi traces also show when people arrive at certain places
- Method can be used to build better infrastructure for public places

By Stacy Liberatore For Dailymail.com

Your smartphone is leaving a trail of breadcrumbs when you walk around town and researchers can use this digital path to observe choices you make about activities and destinations.

Using Wi-Fi traces that register when a device makes a connection with a hotspot, researchers were able to map out the daily routes of students and staff on a college campus.

This technique allowed them to determine which restaurants people preferred and why – without using video recordings or handing out surveys on campus.

Scroll down for video
Using Wi-Fi traces that register when a device makes a connection with a hotspot, researchers were able to map out the daily routes of students and staff on a college campus. With this information, they determined which restaurants people preferred and why, and could even see when people arrive on campus (pictured).

HOW DOES THIS TECHNIQUE WORK?

Researchers gathered more than two million points picked up by the campus's 789 Wi-Fi over a 10 day period from about 2,000 students and staff.

And paired the information with data about the campus grounds, purchases made at the 21 eateries in the vicinity and class schedules.

Routes were created using the Wi-Fi connections that were accessed and other information like school timetables and sales figures from multiple restaurants on the campus.

Once the data was combined, researchers were able to understand what factors influenced student's decisions on what to eat.

'This thesis develops models of activity and destination choices in pedestrian facilities from WiFi traces. We adapt the activity-based travel demand analysis of urban mobility to pedestrians and to digital footprints,' reads the published paper.

'We are interested in understanding the sequence of activities and destinations of a pedestrian using discrete choice models and localization data from communication antennas.'

'We have statistics and numbers on people who drive and take the train, but pedestrian behavior is often a mystery,' said Antonin Danalet, a researcher in the Transport and Mobility Laboratory at the Swiss University EPFL.

'These observations would come in very handy for understanding the use of pedestrian infrastructure at music festivals, museums and hospitals, for example.'

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'Collecting Wi-Fi traces (pictured) has a big advantage, it's quite cheap compared to video tracking or surveying people on campus,' said Danalet. Routes were created using the Wi-Fi connections that were accessed and other information like school timetables and sales figures from restaurants on the campus.

For example, Danalet found that the kind of food wasn't a key factor in decision-making, but the cost, proximity to the student and overall size of the restaurant had an bigger influence on their choices.

**HOW DOES GOOGLE TRACK YOUR LOCATION?**

A code used to build Android 4.3 claimed ‘to improve location accuracy and for other purposes, Google and other apps may scan for nearby networks even when Wi-Fi is off.'

By identifying nearby Wi-Fi networks a device can determine a user's location and it can be used as an alternative to GPS.

The feature of Android 4.3 means that even if a user disables Wi-Fi to save battery or conceal their location, for example, it will stay on and run in the background.

It also indicates that any location, or 'other' information obtained during this scan will be shared with Google or other apps installed onto a device.

'Using real WiFi data collected on the EPFL campus, we estimate an activity path choice model showing a satiation effect, a schedule delay effect related to class start time, primary activity preferences, time of day preferences and pattern preferences,' states Danalet in the paper.

'We also develop a destination model for a specific activity type: eating.'

'Knowing that the individual has decided to eat, which restaurant does she choose?'

'This conditional destination choice model includes in its utility the cost of menus, available types of foods and drinks, visibility of the restaurant, distance from a previous activity episode, socioeconomic characteristics and habits.'

To test the accuracy of this system, Danalet compared it to the 'comings and goings of an actual person' – himself.
Once the data was combined, researchers were able to understand what factors influenced student's decisions on what to eat. Danalet found that the kind of food wasn't a key factor in decision-making, but the cost, proximity to the student and overall size of the restaurant had an bigger influence on their choices.

'This allowed me to correct any biases in the model,' said Danalet.

HOW DOES APPLE KNOW WHERE YOU ARE?

iPhones are able to analyse the data to figure out where you live and work, basing decisions on the frequency and timing of trips.

The function – called the Frequent Locations feature – was quietly introduced to iPhones in 2013.

Smartphones have had the ability to track their owners’ movements since they were first installed with GPS chips and mapping functions.

But this feature, which is automatically installed on any iPhone with the iOS 7 or an iOS 8 operating system, is the first to display the movements clearly on a map.

The phone records the date of every one of your journeys, your time of arrival and departure and how many times you have been to each address.

'We compared the Wi-Fi traces to the results of a survey asking students when they arrive on campus and when they leave.'

According to the Wi-Fi traces, students were declaring they arrived on campus in the morning a half hour earlier than they listed on the survey.

'Do they turn on their phone a half hour after arriving on campus, or were they trying to look good for the survey?' Danalet said.
'We have no idea. But psychologists refer to the second hypothesis as social desirability bias.'

Danalet sees this technique being used in different public spaces that have a lot of foot traffic.

'This methodology can be applied in different public spaces with pedestrians, typically train stations, hospitals airports and museums,' he said.

'It allows us to design in a better way and a new future infrastructure.'

'Typically when you guild the train station it allows you to locate properly the ticket machine or to know the impact of a new shop on different floors.'