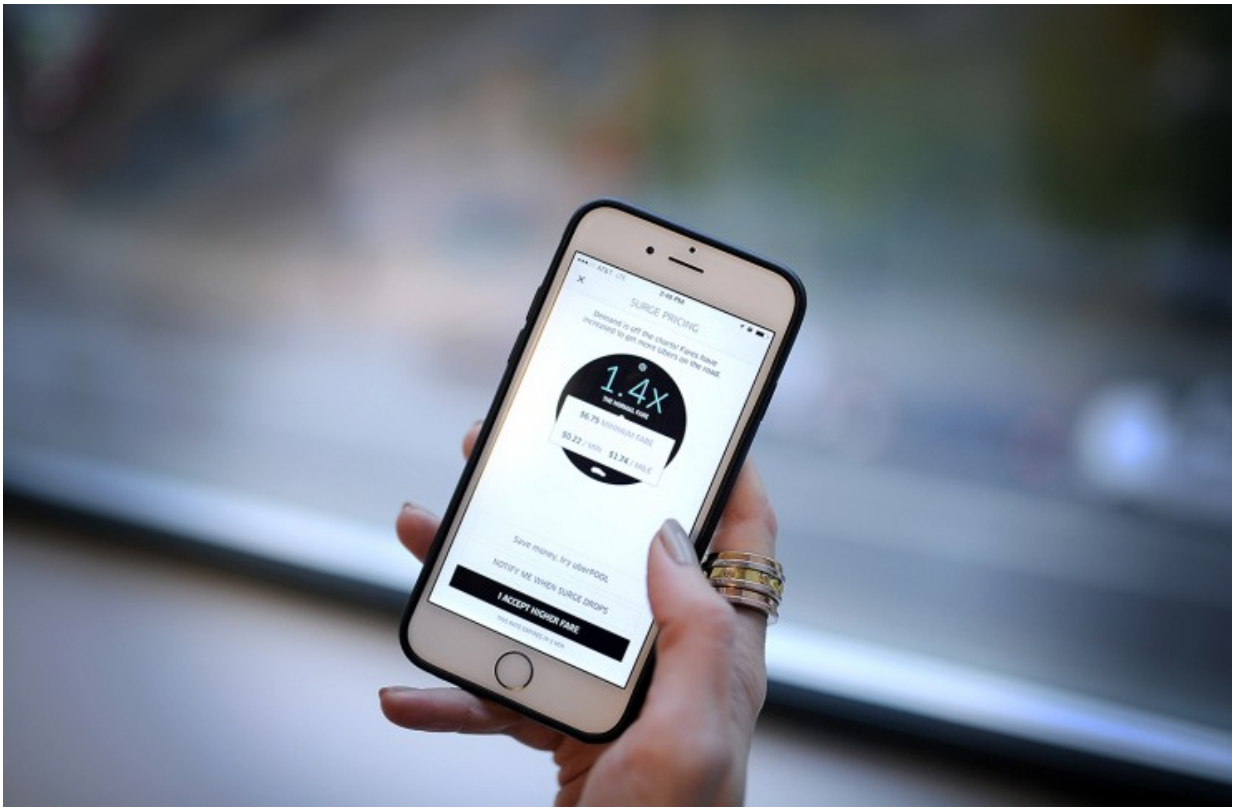
Researchers unlock details of Uber's surge pricing—and suggest ways to avoid it

October 29 2015, by Thea Singer



A research team led by Northeastern assistant professor Christo Wilson cracked open the algorithm that drives Uber's surge pricing. The team examined 'surge regions' within cities and reports findings that reveal tips on how consumers might avoid the inflated prices. Credit: Matthew Moodono/Northeastern University

You're in Manhattan's Times Square, running late for dinner at Le Cirque, on East 58th St. You open the Uber app on your smartphone, hoping a car from the now ubiquitous ride-sharing service is nearby, only to discover that you'll have to pay 1.5 times the base rate for the ride.

New research, led by Christo Wilson, assistant professor in the College of Computer and Information Science, unlocks details behind the algorithm that drives this surge pricing. Based on data from Manhattan, Wilson's team also has a fix:

Wait five minutes, or walk a few short blocks, and the surge notification may disappear.

Under the Uber hood

On Thursday, at the 2015 Internet Measurement Conference, in Tokyo, Wilson revealed that and more of Uber's secrets.

Wilson and his co-authors, Le Chen, PhD'16, and associate professor Alan Mislove, had long been troubled by Uber's "lack of transparency." Other sharing marketplaces, such as Ebay and AirBnB, openly display their products and prices online, enabling customers to make informed choices. Uber, on the other hand, operates in the dark: It releases no numbers about how many people are requesting cars or how many drivers are available, and prices vary wildly, based on time and place of customers' requests.

"You have to trust that their system is doing what they say it's doing," says Wilson, whose scholarship focuses on auditing algorithms. "But that's the question: Is it doing what they claim?"

Well, yes…and no, the researchers found.

To balance supply and demand during periods of high usage, or "surges," Wilson says, Uber uses "an opaque 'surge pricing' algorithm" that changes fares every five minutes. And it divides the cities it services into "discrete 'surge areas.'" The confluence of ricocheting prices and discretely defined areas leads, the team found, to an unusual—and unfair—scenario: "corner cases," says Wilson, "where you can walk across the street and all of a sudden the price changes."

Times Square, their data show, is one of those corner cases. "For example," they write in the paper, "20 percent of the time in Times

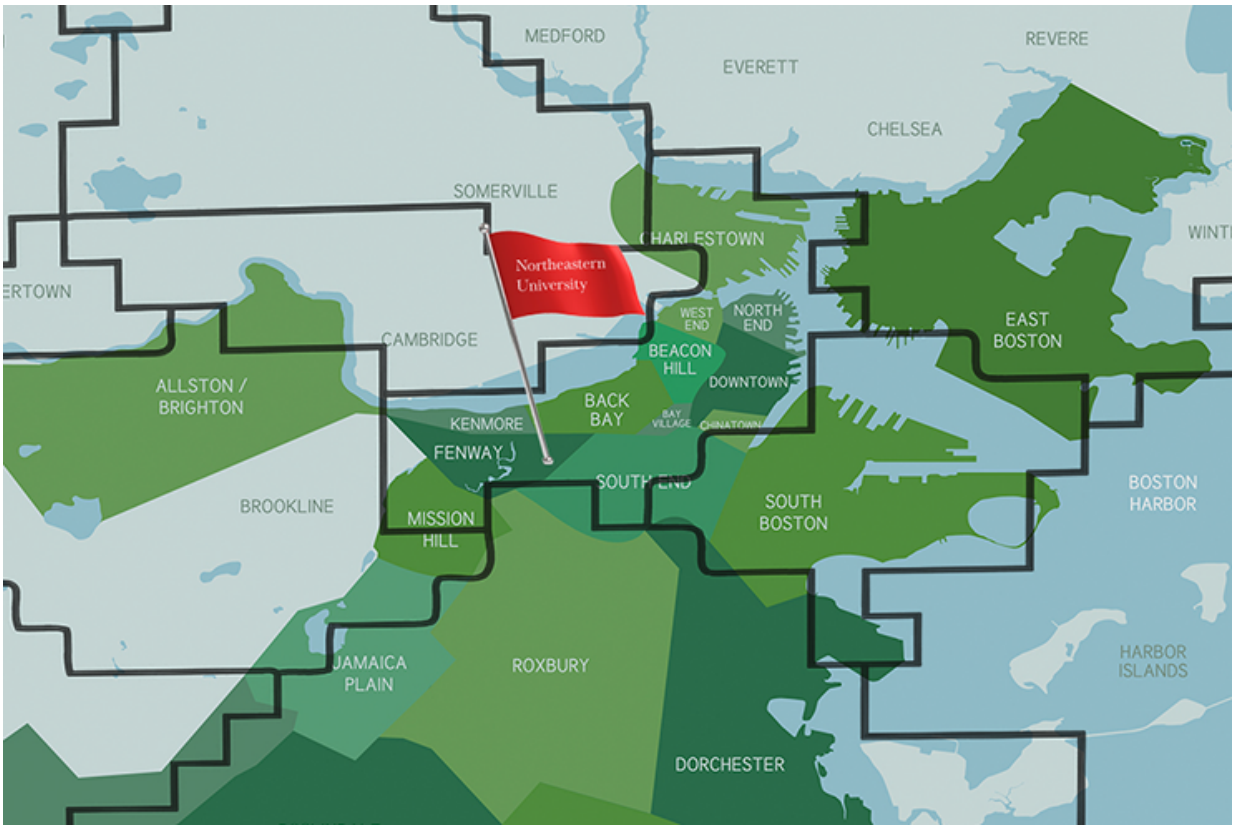
Square, customers can save 50 percent or more by being in an adjacent surge area."

What exactly are surge areas? They are manually demarcated sections of a particular city, each with its own independent price based on intensity of demand at a particular point in time. The maps of the surge areas look like funky jigsaw puzzles: uneven pieces with mostly sharp edges locked together. Boston, for instance, has nine surge areas. Manhattan: 16. London: 19. Still, says Wilson, how Uber divided up the cities is not clear.

Becoming Uber

To conduct the research, Wilson and his colleagues did more than look under Uber's hood; they essentially crawled inside its computer systems.

Using servers in a closet on the Northeastern campus, they programmed and ran Uber apps "pretending" to be people at 43 different GPS locations throughout San Francisco and Manhattan over a four-week period. The researchers chose San Francisco and Manhattan for several reasons, including their having, respectively, the second and third largest number of Uber drivers in the U.S. and large differences in access to public transportation.



The data they collected included the surge price—that is, the number by which the base price was multiplied during surges—and estimated wait time for each "ride" as well as the location of the "request." Crunching the data, they tracked supply and demand, how those dynamics changed over time and distance, and the way surge prices varied by location.

"We did a lot of correlation analysis looking at how many cars were getting booked over time and how many cars were available, and you do see high correlation between supply and demand and the surge," says Wilson. "So the system is definitely responding to supply and demand changes."

Still, there is room for manipulation, on the part of both drivers and customers.

The data wasn't conclusive regarding drivers. But Uber driver forums, Wilson reports, contained conversations about "collusion"—drivers in a specific area uniting to go offline to artificially reduce supply and thus lead to a price surge. "The drivers talk about this, but we don't have any evidence that this actually works," says Wilson.

For customers, however, the findings were explicit. "If you're a

customer, it can pay to wait or walk," says Wilson. He notes, however, that you can't know where to walk to or how far if you don't have a detailed surge-area map in hand—and Uber is unlikely to ever provide one.

However, Wilson and his team will. "Sitting on my computer is all the research we're doing in this vein," he says. "We have a website for it, and eventually we'll have a page about the paper that's accessible to the public. We are developing surge maps, and will put all of them there there, too."

Provided by Northeastern University