Study uses topological data analysis to identify voting deserts

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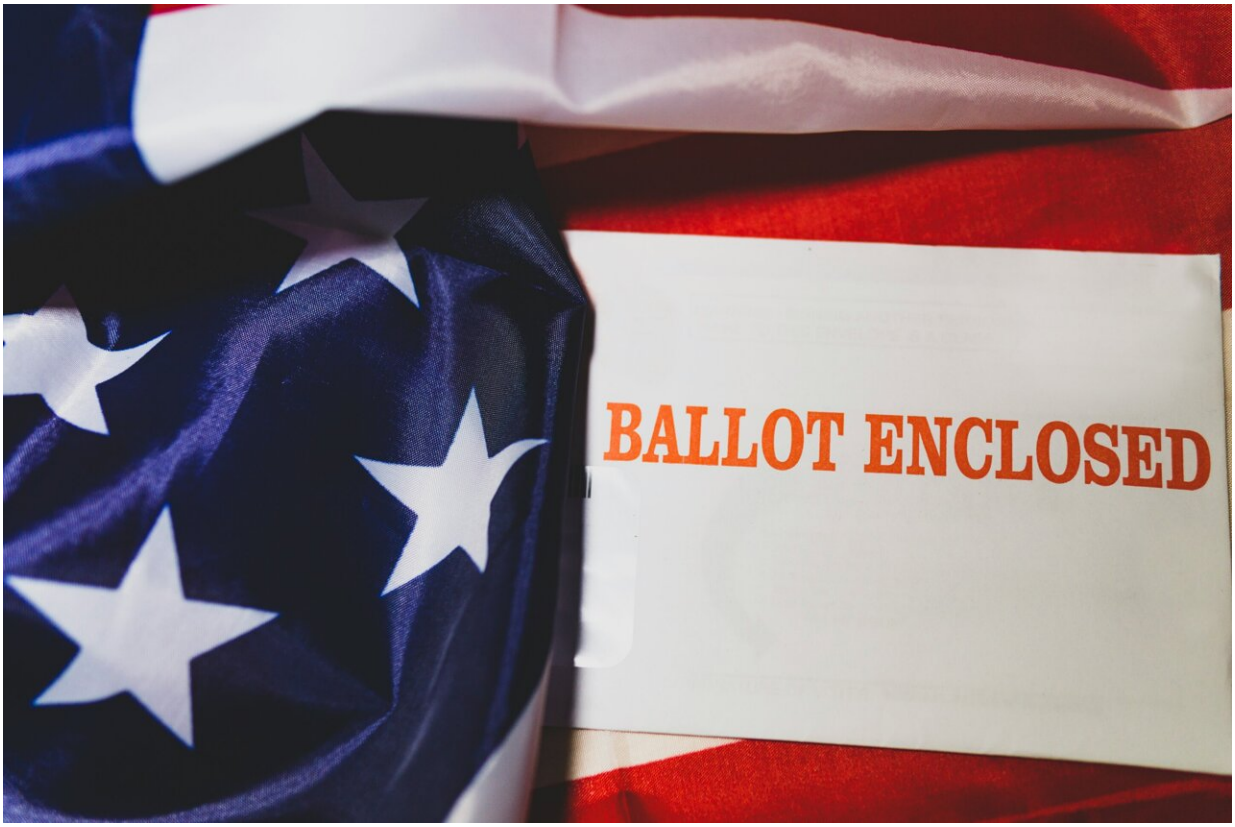

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In past years, elections in the U.S. have been marked by stories of long waiting lines at the voting polls. Add other barriers, like long commutes and inadequate transportation, and voting can become inaccessible. But

these voting deserts are difficult to quantify.

In a paper, "Persistent Homology for Resource Coverage: A Case Study of Access to Polling Sites" in *SIAM Review*, SFI External Professor Mason Porter (UCLA) and his students applied topological data analysis, which gives a set of mathematical tools that can quantify shape and structure in data, to the problem of quantifying voting deserts in LA County, Chicago, Atlanta, Jacksonville, New York City, and Salt Lake City.

Using a type of topological data analysis called persistent homology, Porter and his co-authors used estimates of average waiting times and commute times to examine where the voting deserts are located.

Applying persistent homology to a data set can reveal clusters and holes in that data, and it offers a way to measure how long those holes persist. The combination of waiting times and commute times in the data creates a pattern, with holes filling in as time passes.

The longer the hole takes to fill, the more inaccessible voting is to people in that area. "We are basically playing connect-the-dots in a more sophisticated way, trying to fill in what's there," says Porter.

Moving forward, Porter hopes to use this strategy to more accurately determine voting deserts. Finding voting deserts will hopefully be used to make voting more accessible, but it requires better-quality data than what was available to him and his students.

"This is a proof of concept," Porter said. "We had to make some very severe approximations, in terms of what data we had access to."

More information: Abigail Hickok et al, Persistent Homology for Resource Coverage: A Case Study of Access to Polling Sites, *SIAM*

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