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Title: *Measuring Convexneses of Electoral Districts Using Graph Theory to Flag Potentially Gerrymandered Districts*

ABSTRACT OF RESEARCH:

Gerrymandering, the creation of unfair voting districts for political gain, has recently become a major issue because, during the past several election cycles, the number of seats received by a party did not align with the percentage of the popular vote received. Voting districts are required to be compact; however, current measures of compactness are inaccurate for reasons including differing results based on choices of coordinates or resolution, inability to adjust for the coastlines, and not addressing the fact that many sections of the country are uninhabited. This research addresses these issues by discretizing one of the most common formulas for compactness: the convex hull. By treating a district not as a geometric figure but as a graph of small regions, such as census tracts, with an edge drawn between vertices if they are geometrically adjacent, one can improve on this traditional measure. This discretization avoids the issues caused by coastlines, resolution, and coordinates, and by computing the ratio of the population of the original district and that of its convex hull, one can avoid issues caused by empty spaces as well. Thus, this metric can act as an improved mathematical signal for potentially gerrymandered districts.