A lattice-based structural similarity index (SSIM) to measure the spatial similarity of irregular lattice maps

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Despite recent efforts in measuring the structural similarity (SSIM) index based on various types of spatial datasets such as raster or flow data, limited attention has been paid to evaluating the similarity between irregular lattice maps (e.g., choropleth maps). To fill this gap, this paper extends the SSIM index for application to irregular lattice maps to measure the similarity between two maps. We first compute a series of localized statistics (e.g., localized means, standard deviations, covariances) considering spatial heterogeneity by using a geographic kernel weighting technique with an adaptive bandwidth. Using the resulting localized statistics, we calculate the SSIM values, thereby quantifying the (dis)similarities between the two area-based maps. As an example, we compare maps of two Canadian neighbourhood deprivation indices: 1) Canadian marginalization index (CAN-Marg) and 2) Pampalon index, in the Greater Toronto Area (GTA) to evaluate how (dis)similar the two maps are using the proposed lattice-based SSIM method. Our extension of the SSIM method is a simple, but effective, analytical framework for measuring the similarity between the two polygon-based maps. To promote reproducibility and open science, we share our code via GitHub.