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Image processing in macroseismology: use of the image moments analysis for the comparison of isoseismal maps

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Whether a synthetic macroseismic field approximates an empirical one or not is a difficult question to reslove, especially when the obtained fields are shown in the form of maps. The simplest and most subjective method is just to visually compare the maps. However, this method is not acceptable for any serious evaluation, so we applied image processing in order to get numerical measure of similarity.
Seven input images were chosen as representatives of the isoseismal shapes which typicaly occure on macroseismic intensity earthquake maps. Since similarities and differences between them are difficult to assess in an objective way, image moments method is applied for their comparison.
Image moments are numerical descriptors invariant to translation, rotation, scale change and some types of image distortion and as such are one of the most useful tools used in image processing and pattern recognition. Many types of imege moments are defined, providing different capabilities of description, complexity of computation and sensitivity to noise. In this work, Zernike moments were used because of their relatively simple and fast computing as well as robustness to noise.
First, input images in the form of typical isoseismal shapes were prepared and the first eight orders of Zernike moments calculated by using circumscribed circle algorithm. Thus obtained coordinates of every image in 20D space were compared with the other images in the set by using Euclidean distance as the unit of dissimilarity. Results show that Zernike moments can be used for objective comparison and evaluation of similarity of isoseismals.