VECTOR PLANAR ELEMENTS: GEOMETRICAL SIMILARITY MEASUREMENT BASED ON FOURIER DESCRIPTORS

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With the rotation, translation and scaling invariance, etc. it is difficult to measure the similarity between GIS planar elements. To describe the graphics precisely, according to the number of shortest paths where vertices occur, we define the "vertex betweenness;" this measures the importance of each vertex in a graph. The higher the vertex betweenness, the more important vertex becomes. We propose a contour feature points extraction method, where Fourier descriptors are used. We normalize the first n *order factors of Fourier descriptors, on the basis of similarity between polygons, which is obtained by comparing the cosine values for every two vectors. The experiment is operated on two different data scales, 1:50 000 and 1:250 000. Combined with analysis of impact factors during similarity measurement, the experiment results show that the contour feature points extraction method can effectively measure the geometrical similarity between GIS planar elements.*

Avec la rotation, la translation, l'invariance d'échelle, etc., il est difficile de mesurer la similarité entre les éléments planaires d'un SIG. Pour décrire la représentation graphique précisément, selon le nombre de chemins les plus courts où il y a des sommets, nous définissons « l'intermédiarité des sommets », laquelle mesure l'importance de chaque sommet dans un graphique. Plus la valeur de l'intermédiarité des sommets est élevée, plus le sommet devient important. Nous proposons une méthode d'extraction des points caractéristiques du contour où les descripteurs Fourier sont utilisés. Nous normalisons les premiers facteurs d'ordre n des descripteurs Fourier en fonction de la similarité entre les polygones, laquelle est obtenue en comparant les valeurs du cosinus de toutes les paires de vecteurs consécutifs. L'expérience est effectuée sur des données à deux échelles différentes : 1/50 000 et 1/250 000. Combinés à l'analyse des facteurs d'impact durant la mesure des similarités, les résultats de l'expérience indiquent que la méthode d'extraction des points caractéristiques du contour peut effectivement mesurer la similarité géométrique entre les éléments planaires d'un SIG.

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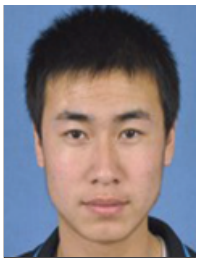

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Introduction

Geometrical similarity has been used in various fields; experts research and publish papers on it frequently. *Lai and Fu* [2010] measure the similarity of stock market behaviour in different time periods based on polygon description. *Ghosh* [2010] presents approximation algorithms to deal with art gallery visibility issues. Polygon approximation is used in gesture recognition for American Sign Language [*Geetha et al.* 2011]. For the matching algorithm of polygon habitations in GIS, *Fu et al.* [2010] and *Xu et al.* [2013] approach it using different methods. Many methods exist to calculate similarity, such as the Shape Context Descriptor [*Chen et al.* 2007], the Shape Multilevel Description Method [*An et al.* 2011], the Single Fourier Descriptor [*Lee et al.* 2003], the wavelet described method and so on. Sophisticated processing is required to overcome the challenges of the low efficiency and low accuracy associated with these methods. For example, the method of Shape Context Descriptor expresses polygons from points and is limited in its ability to describe the whole polygon. Single Fourier Descriptor, because of the infinity coefficient, is influenced by the level of detail and is sensitive to noise. As a whole, methods to calculate similarity of polygons use all points in the polygon and therefore the efficiency of these methods is low.

In this paper we have built an integrated model to calculate similarity between polygons, selecting

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