Spectral Shape Classification: A Deep Learning Approach

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Abstract

In this paper, we propose a deep learning approach to 3D shape classification using spectral graph wavelets and the bag-of-features paradigm. In order to capture both the local and global geometry of a 3D shape, we present a three-step feature description strategy. Local descriptors are first extracted via the spectral graph wavelet transform having the Mexican hat wavelet as a generating kernel. Then, mid-level features are obtained by embedding local descriptors into the visual vocabulary space using the soft-assignment coding step of the bag-of-features model. A global descriptor is subsequently constructed by aggregating mid-level features weighted by a geodesic exponential kernel, resulting in a matrix representation that describes the frequency of appearance of nearby codewords in the vocabulary. Experimental results on two standard 3D shape benchmarks demonstrate the much better performance of the proposed approach in comparison with state-of-the-art methods.

Keywords: Deep learning; spectral graph wavelet; bag-of-features; classification.