ID de Contribution: **6** Type: **Non spécifié**

Towards a Mesh-Invariant Auto-Encoder

jeudi 1 février 2024 15:30 (45 minutes)

Auto-Encoders are a kind of Neural Networks that work as a non-linear generalization of a Principal Component Analysis (PCA), and have many successful uses (uniformization of data, compression, statistical studies, even data generation), especially in the cases of images. However, applying them to meshes of surfaces in 3D is much harder, both because of a general lack of data compared to pictures, and because the space of meshes is not a vector space unless restricted to those that have the exact same underlying graph topology.

We propose an Auto-Encoder model that is robust with respect to a change of mesh (and, more generally, continuous with respect to the Hausdorff distance), and introduce a type of metric using varifolds that allows training on data with varying topology.

This is a work by my PhD student, Thomas Besnier (CRIStAL), Mohamed Daoudi (CRIStAL), Emery Pierson (Polytechnique) and myself.

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