Implementing GWCNN – Deep Learning for Classification and Retrieval of 3D Data

Applying artificial neural networks (deep learning techniques) on 3D data is an active research topic in Computer Vision and Computer Graphics. The main challenge is aligning the input to have a uniform representation. A recent approach (GWCNN) suggests to represent 3D shapes by mapping geometric functions to a common domain, which becomes a parameter that is learned by the network.

The goal of this project is to understand and implement the GWCNN, as described in the recent paper "GWCNN: A Metric Alignment Layer for Deep Shape Analysis" (link).

The implementation will be in PyTorch or TensorFlow, and will include preprocessing of 3D data, the new architecture of the GWCNN, and analysis of the classification and retrieval results.

The architecture of the GW layer

Visualization of the uniform representation of three ants and three aliens, before (top) and after (bottom) learning the optimal common domain