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Integration of Textural Information in the Context of 3D Mesh Classification

3D data exists in diverse forms, including volumetric grids, point clouds, and meshes. The adoption of deep learning frameworks for processing 3D data depends on the chosen representation, as each form offers unique advantages and limitations related to computational efficiency, data sparsity, and the ability to capture geometric and other detailed features.
A 3D mesh is a digital representation of a 3D object, comprising:

- **Vertices:** Points in 3D space defining the structure.
- **Edges:** Lines connecting pairs of vertices.
- **Faces:** Flat surfaces, typically triangles or quadrilaterals, enclosing the mesh.

This representation enhances the ability to model surfaces in detail while addressing ambiguities that are often present in point cloud representations. Meshes are well-suited for 3D tasks because they offer a detailed geometric structure while maintaining a relatively low memory footprint. Additionally, they can incorporate texture information through texture mapping, which can provide crucial support for tasks like semantic segmentation.

In this thesis, we aim to explore various strategies for integrating textural and geometric information to enhance the semantic segmentation of 3D textured meshes. These strategies may involve:

- **Architectural Design:** For example, transformer-based models.
- **Training Procedures:** Such as self-supervised learning , auxiliary supervision.
- **Knowledge Distillation:** Leveraging pre-trained models for efficient learning.
- **Other Areas of Interest:** Based on project requirements or your expertise.

A significant portion of this thesis focuses on implementing methodologies, whether novel or adapted from existing approaches. The datasets required for this work will be provided; however, some preprocessing may be necessary depending on the project's needs. The results will primarily be evaluated using these datasets, though additional datasets are available and can be utilized as supplementary resources.

Note:
It is mandatory to have an advanced understanding of deep learning (e.g., completion of *Image Analysis 1 and 2*) and proficiency in Python, including PyTorch and other fundamental computer vision libraries.

This thesis will be supervised by Mohammadreza Heidarianbaei, M.Sc.

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