

# Student Project

## Neural Implicit Shape Representations for 3D Reconstruction



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### Topic

Representing 3D geometry for rendering and reconstruction has been essential in computer graphics, 3D computer vision, and robotics. Desired features for 3D geometry reconstruction are high quality and completion from partial and noisy 3D input data.

Learning-based approaches for 3D reconstruction have gained popularity because they are able to encode rich prior information about the space of 3D shapes. One example of this is implicit neural representations, which are also suitable for generative shape modeling. These methods feed fully connected neural networks with continuous spatial coordinates to produce implicit functions. The reconstructed shape is rendered via iso-surface extraction such as Marching Cubes.

### Assignment

The main objective of this project is to understand, explore advantages and drawbacks of neural implicit shape representation methods. For this purpose, a framework that compares state-of-the-art methods should be developed.

The framework will load a single unstructured list of points, visualize it and process it.

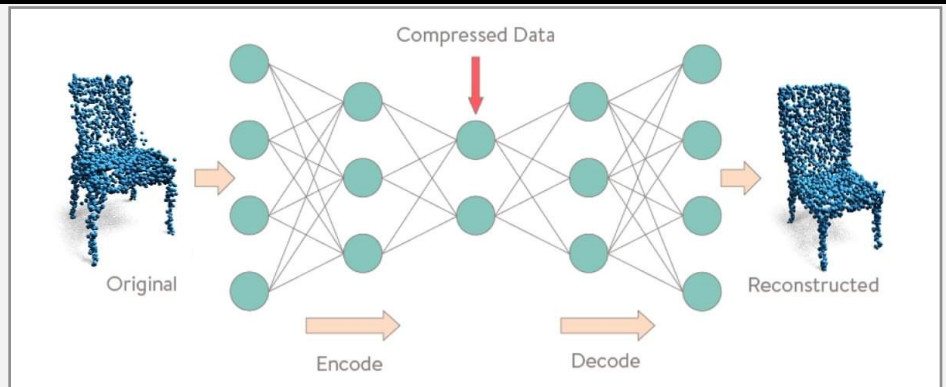
The comparison aspects are:

- Geometric details description.
- Capacity to generalize and learn a desirable shape embedding space.

### Tasks

The project is organized into the following main tasks.

- Represent training data.
- Use learned feature representation to reconstruct unseen shapes.



- Apply shape priors to complete partial shapes.
- Learn smooth and complete shape embedding space from which we can sample new shapes.

### Requirements

Interest in (3D) graphics and machine learning. Application development in C++ and Python.

### Work Load

- 50% theory
- 30% implementation
- 20% testing

### Project Type

Based on the scope of the topic and optional tasks, this project can be done as Bachelor or Master thesis. Goals are adjusted depending on the project type and number of students.

### Supervision

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### Contact

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