Computer Vision, 3D Lab 1
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Part A: 3D Operators

1. Loss Functions

Chamfer Loss: A common metric that quantifies agreement between two pointclouds by measuring the euclidean distance between them.

Normal Loss: A metric measures the absolute normals between two pointclouds.

Edge Loss: A shape regularizer that minimizes the length of the edges in the predicted mesh.

Laplacian Loss: A shape regularizer that minimizes the L1-norm of the dot product of the Laplacian matrix and the vertices of the mesh.

2. Zero Weights, Except for Chamfer

As compared to the base setting of hyperparameter, in this setting Edge and Laplacian losses have slightly higher values than before, however Normal loss grows to much greater value, while Chamfer loss is still almost the same as expected, **Figure 1.a** and **Figure 1.b**. This results in a predicted mesh that has the same general shape, but with a very coarse surface, **Figure 2.a** and **Figure 2.b**.

3. Edge Weight = 100

Keeping the base settings of hyperparameters, while setting Edge loss weight to 100 results in making Edge and Laplacian losses to quickly converges to a slightly smaller value than in the original settings, and a Normal loss smaller than before, however it makes the Chamfer loss converge to a value greater than before, **Figure 3.a**. Although this results in small losses, the increment in Chamfer loss gave a prediction that wasn't able to converge to the target shape, **Figure 3.b**.

Part B: Data Structure

1. Verts/Faces

For the original setting, we have 2562 vertices.

2. Sphere Level =1

For this setting we have 42 vertices.

This will give strange transient convergence, and the Normal loss will converge to a higher value, **Figure 4.a**. Because of this coarse initial topology, the quality of the prediction is poor, and the predicted shape is far from the target shape, **Figure 4.b**.
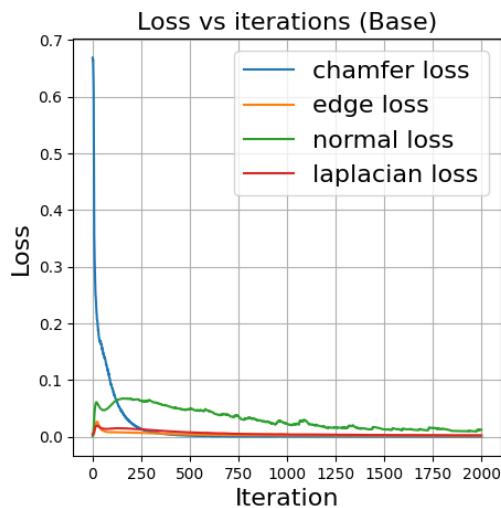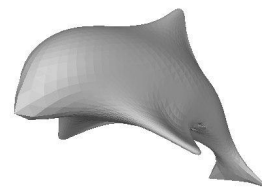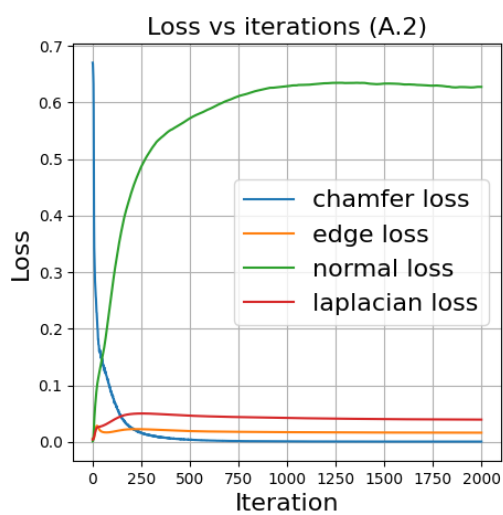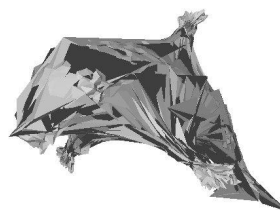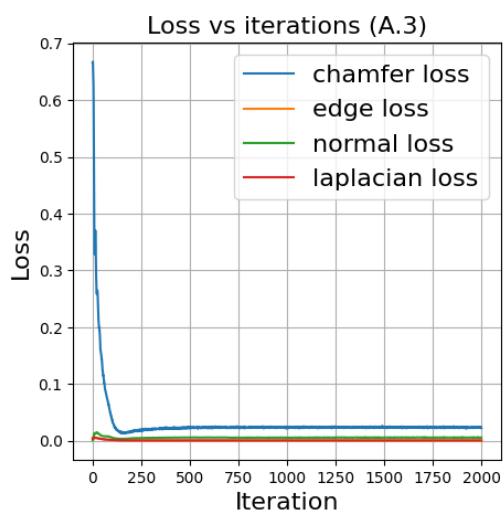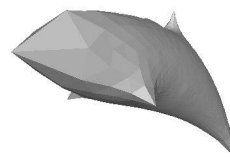

Figure 1.a.
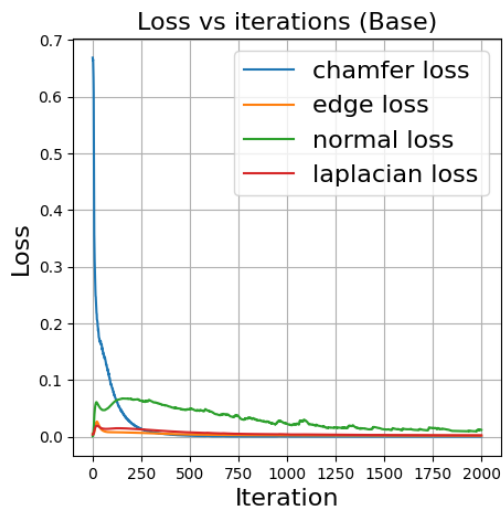

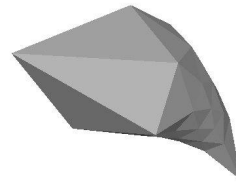**Figure 1.b**

Figure 2.a.

Figure 2.b

Figure 3.a.

Figure 3.b

Figure 4.a.

Figure 4.b