CSCI-GA 3033 Assignment 2

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Part 1

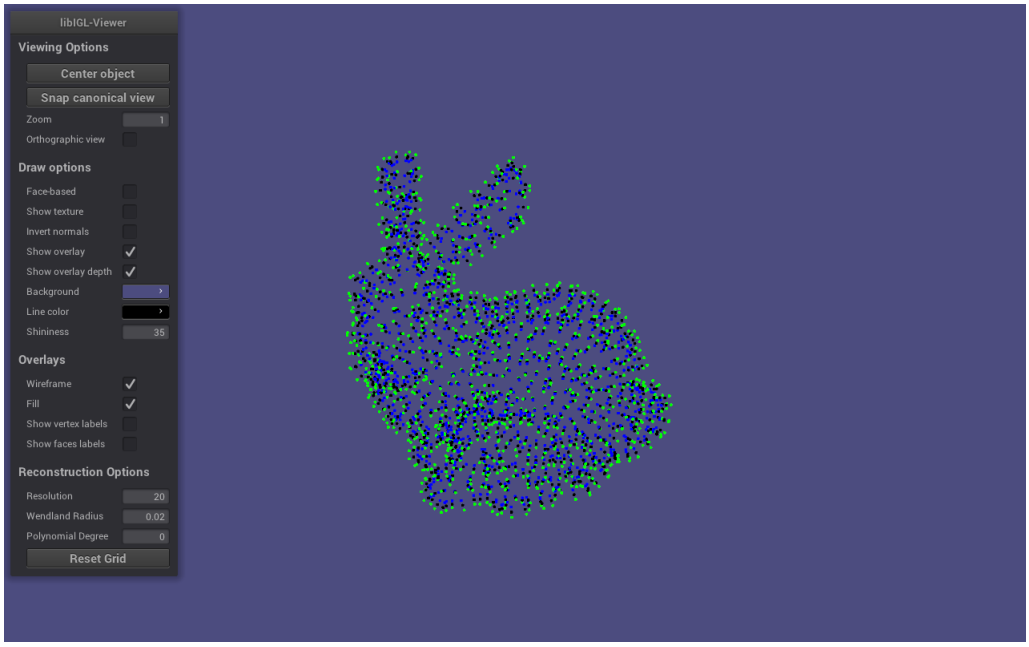

Figure 1: Constraints for the `bunny-1000.off` model

Part 2

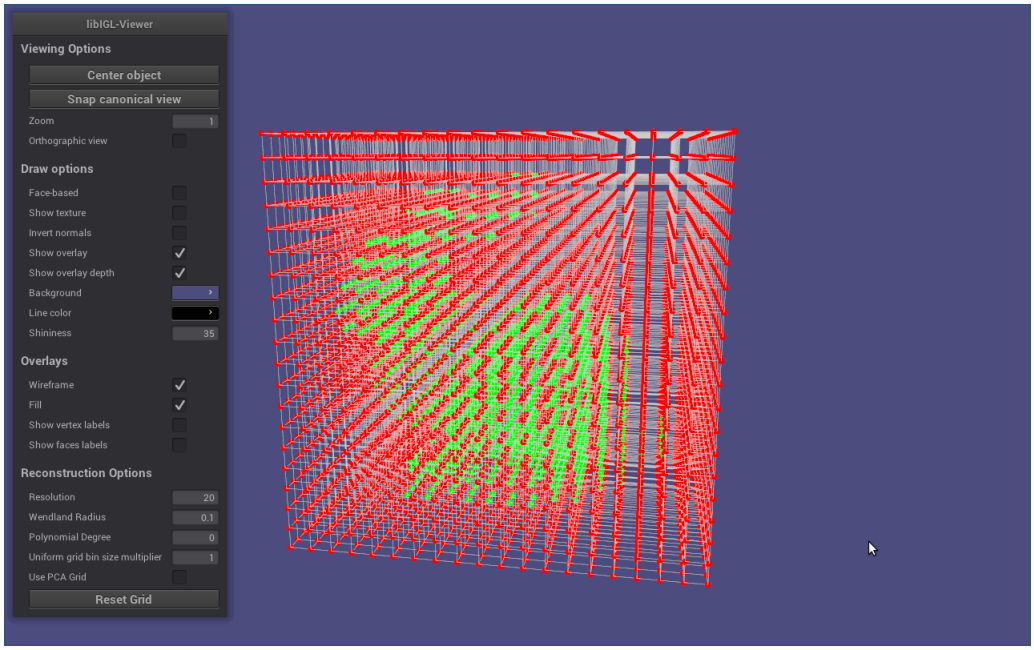

Figure 2: Grid values for the `bunny-1000.off` model

Part 3

The reconstructed models can be found in `data/reconstructed`. The number in the file name refers to one more than the interpolant degree.

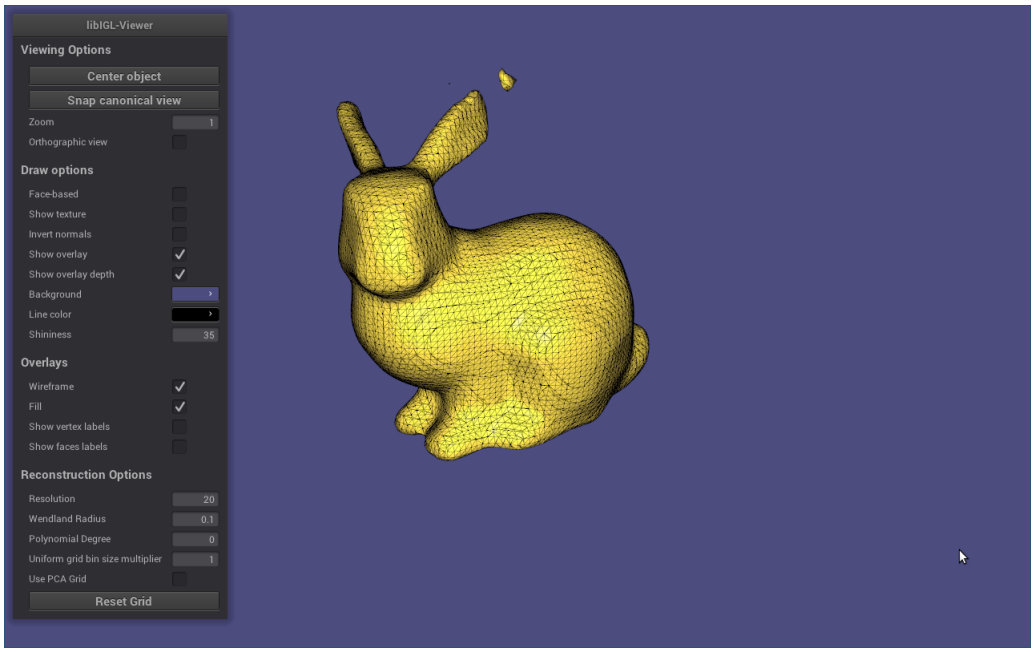

Figure 3: Reconstructed `bunny-1000.off` model

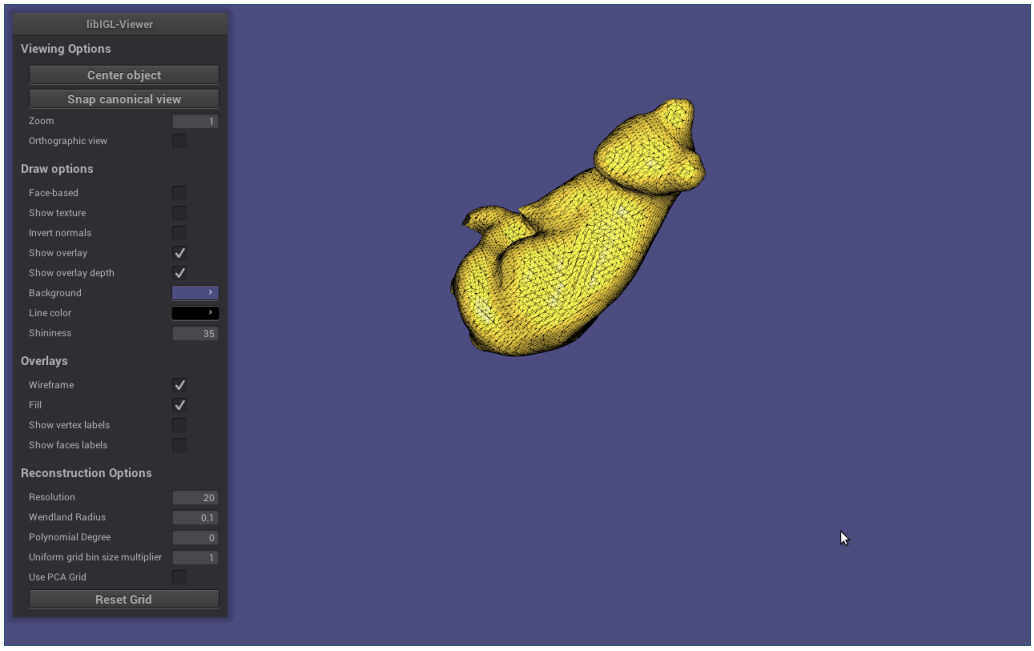

Figure 4: Reconstructed `cat.off` model

Theory Question

Proof. Let S be the (manifold) implicit surface defined by $f(\mathbf{x}) = 0$, and p be a point on S ($f(p) = 0$).

Since we assume S is manifold, there must exist linearly independent vectors v_1 and v_2 tangent to S at p. We can then define the normal as $\bar{n} = v_1 \times v_2$.

And since S is the level set of f at 0, $\nabla_v f = 0$, where $\nabla_v = v \cdot \nabla f$ is the directional derivative along the vector v tangent to S.

Thefore, $\nabla_{v_1} f = \nabla_{v_2} f = 0 \Leftrightarrow \nabla f \propto v_1 \times v_2 \Leftrightarrow \nabla f \propto \bar{n}$. □

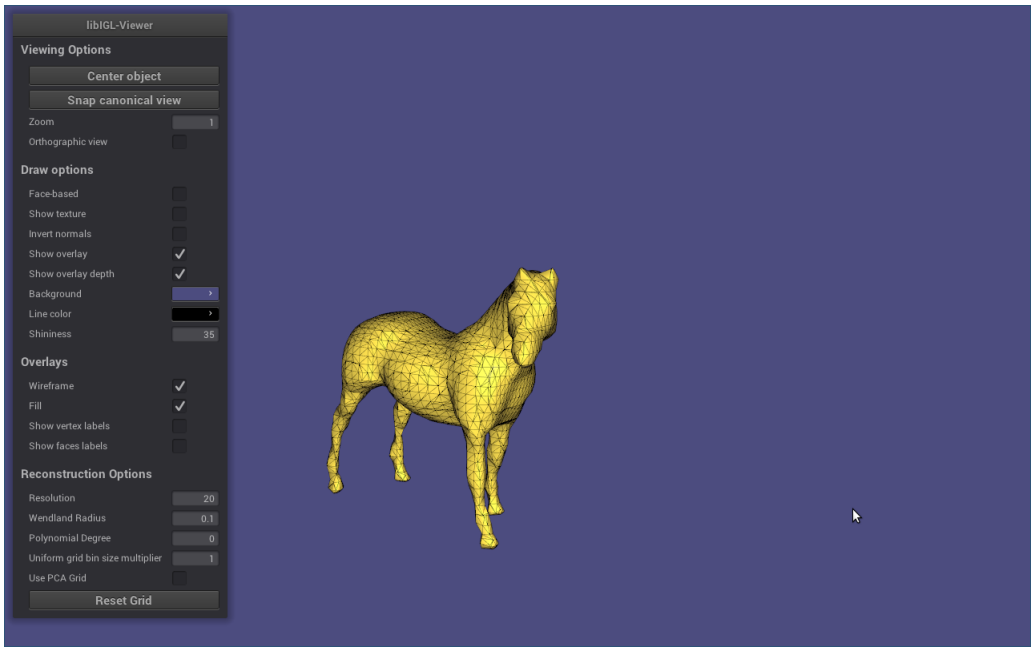

Figure 5: Reconstructed `horse.off` model

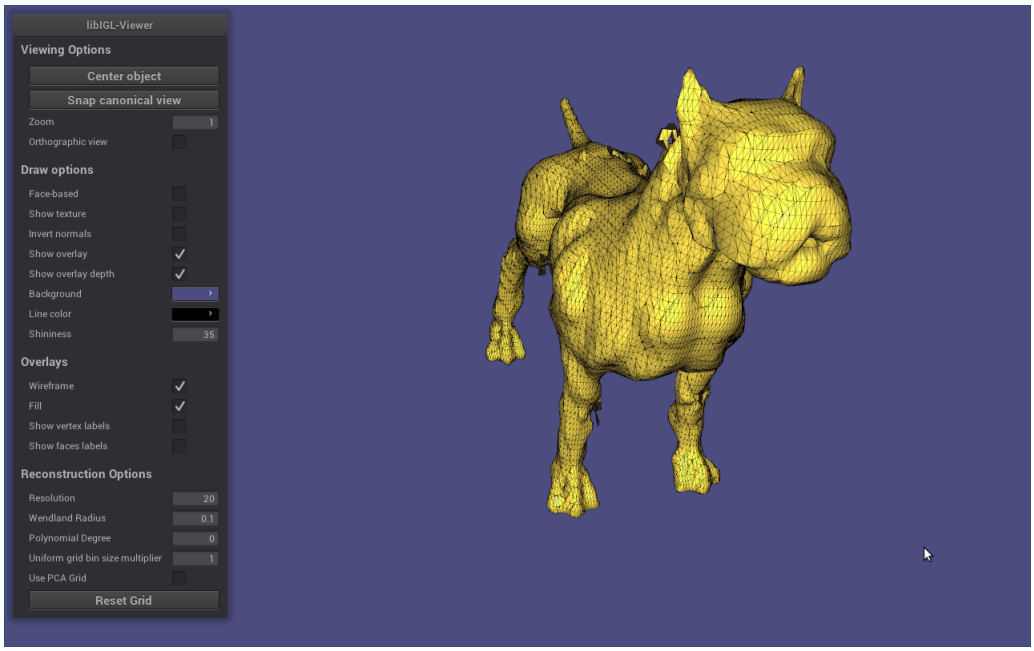

Figure 6: Reconstructed `hound.off` model

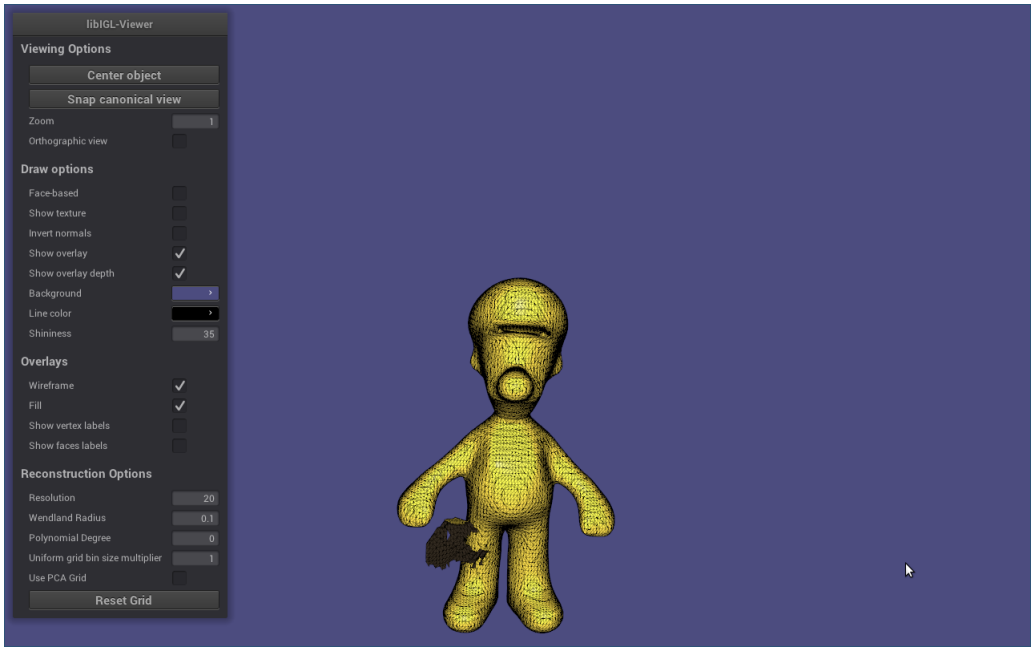

Figure 7: Reconstructed `luigi.off` model

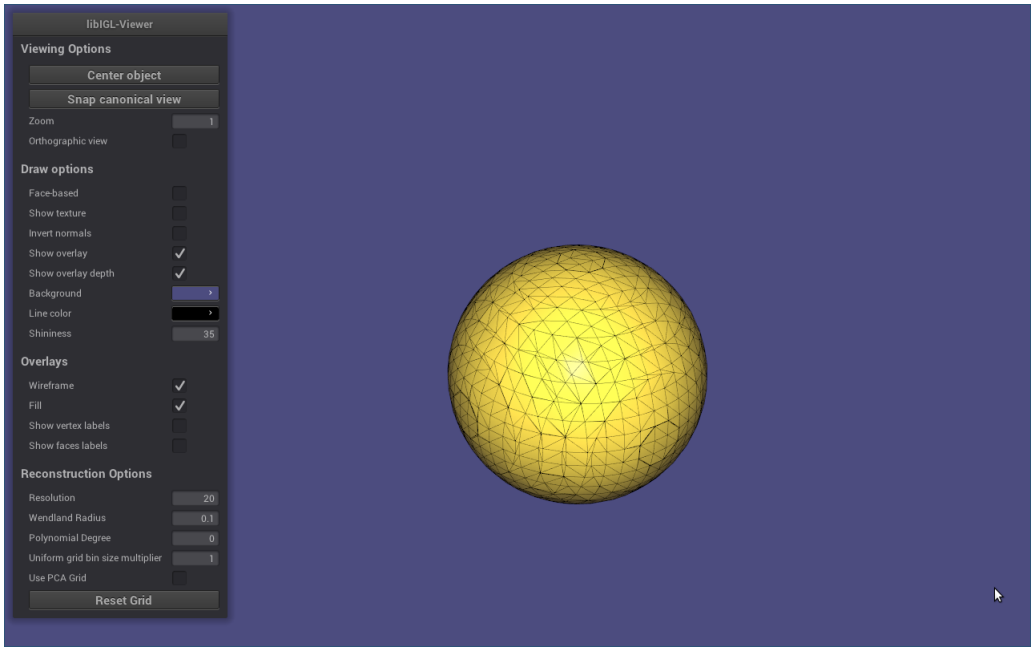

Figure 8: Reconstructed `sphere.off` model