Exercise 4. Surface Quality and Smoothing

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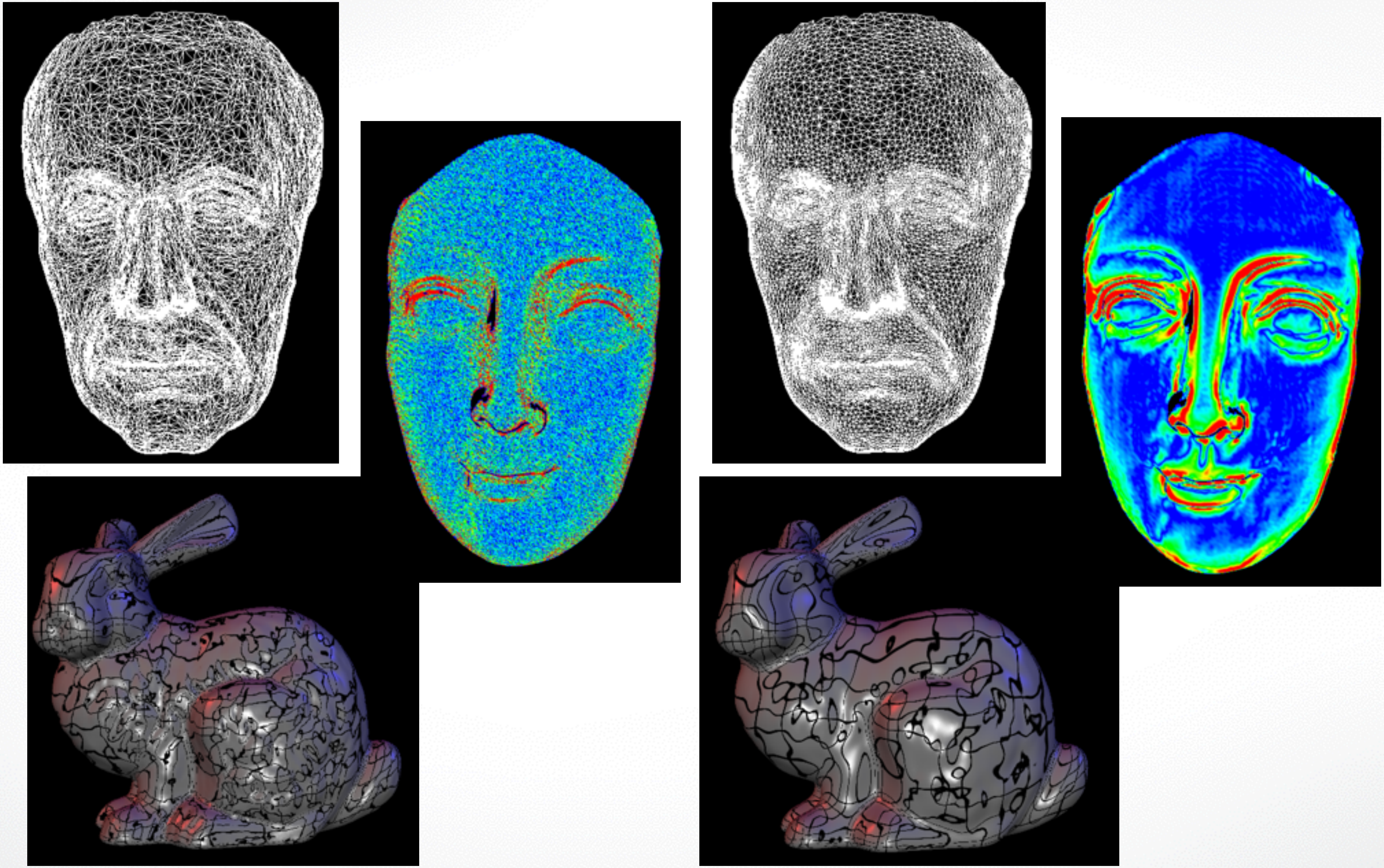
Surface Smoothing

- Spectral analysis
- **Diffusion flow**
    - **Uniform Laplace operator**
    - **Laplacian-Beltrami operator**
- Energy minimization

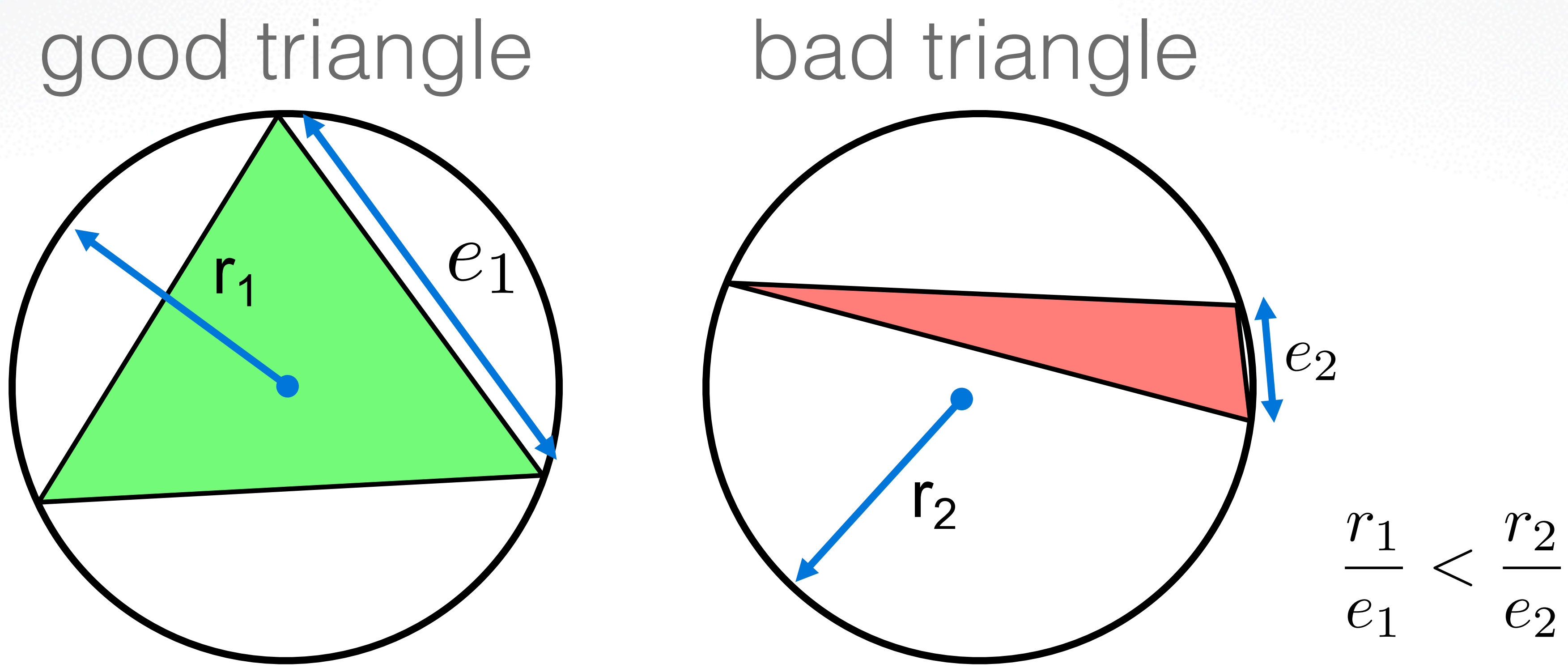
Uniform Laplacian Surface Smoothing

- Uniform Laplace operator $L_U(v) = (\frac{1}{n}\sum_i v_i) - v$
- Mesh smoothing $v' = v + \frac{1}{2} \cdot L_U(v)$
- Implement uniform Laplace operator in `QualityViewer::calc_uniform_mean_curvature()` in QualityViewer.cc
- Implement uniform Laplacian smoothing `SmoothViewer::uniform_smooth()` in SmoothViewer.cc

Uniform Laplacian Surface Smoothing

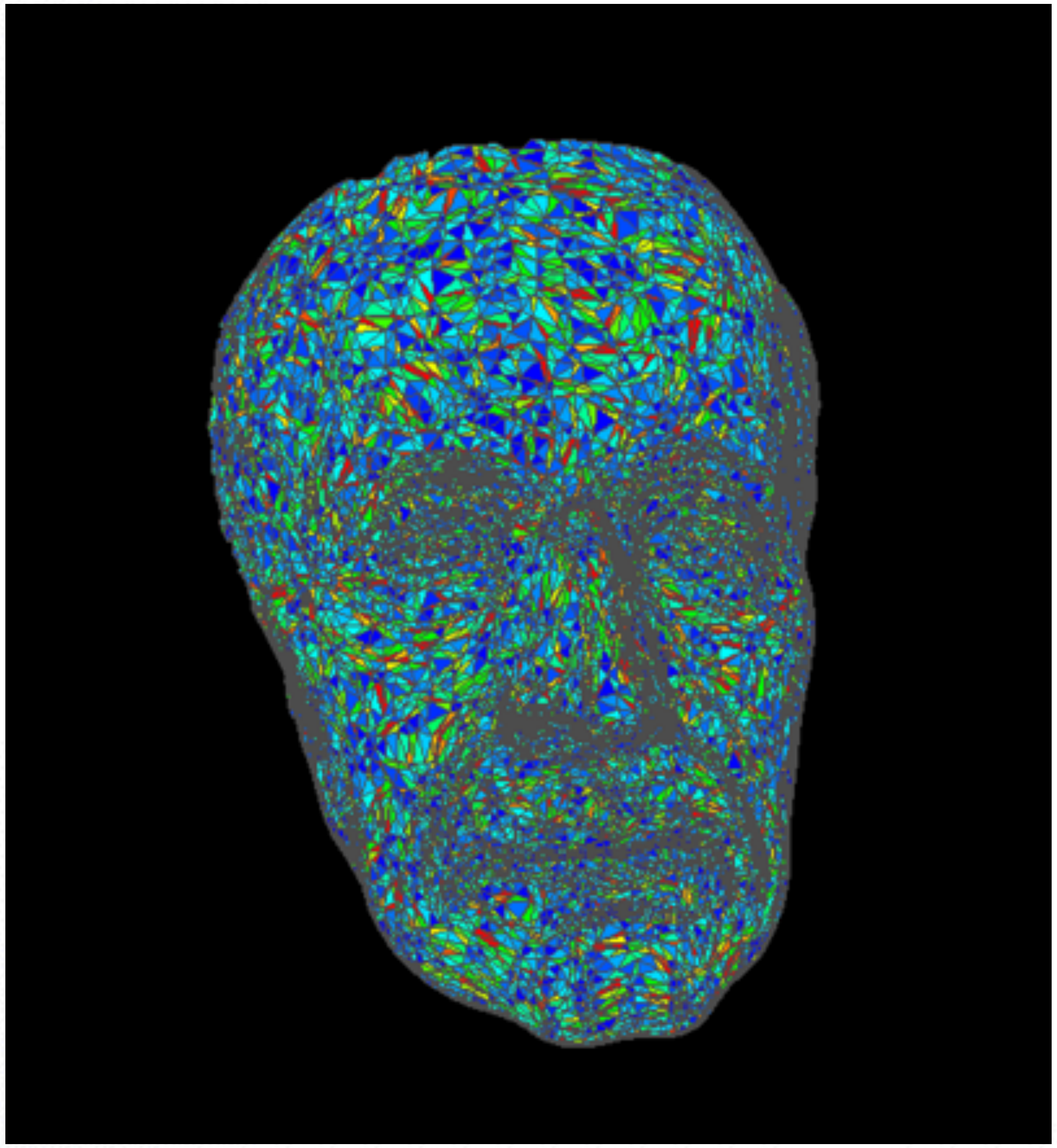


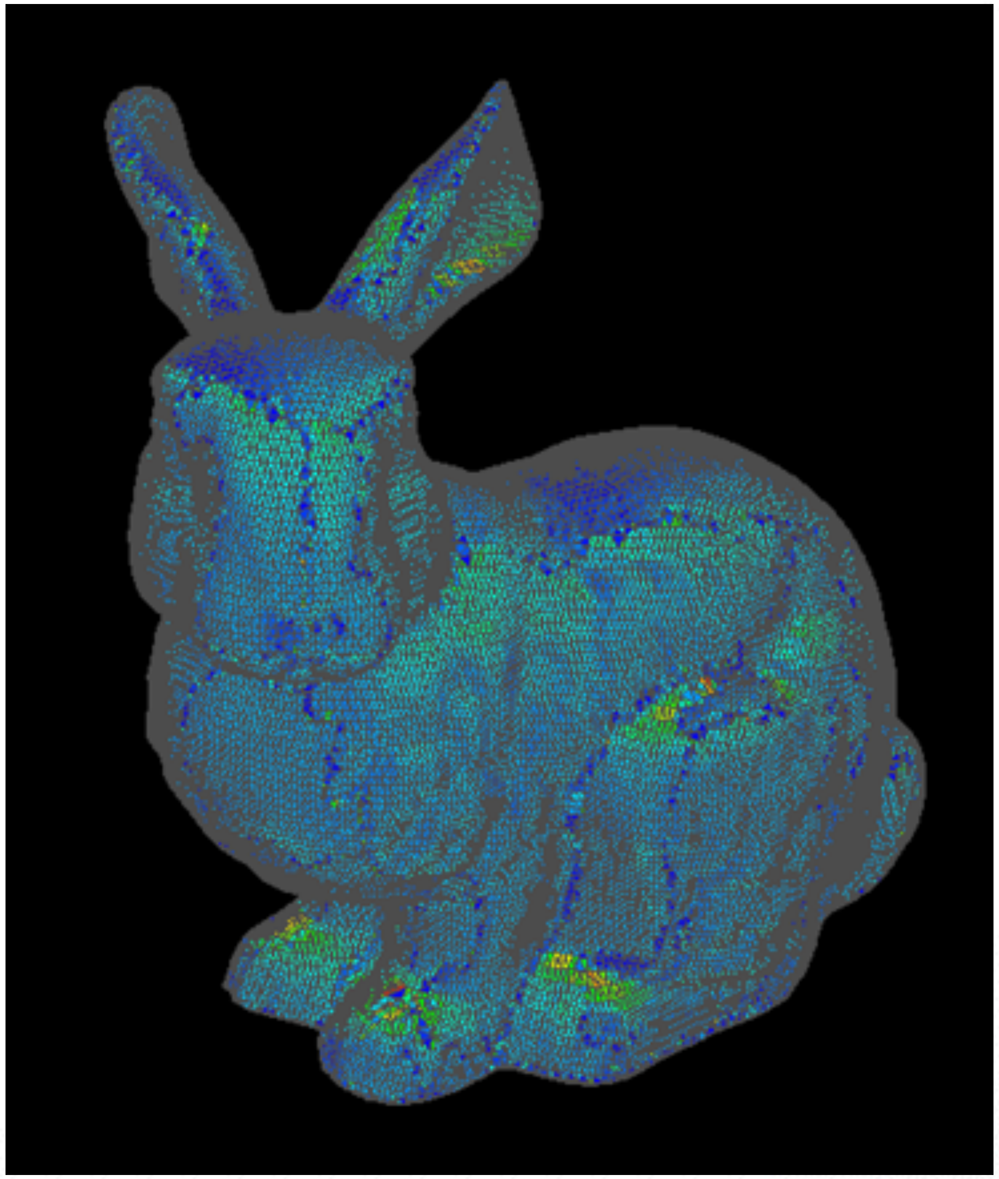
Triangle Quality



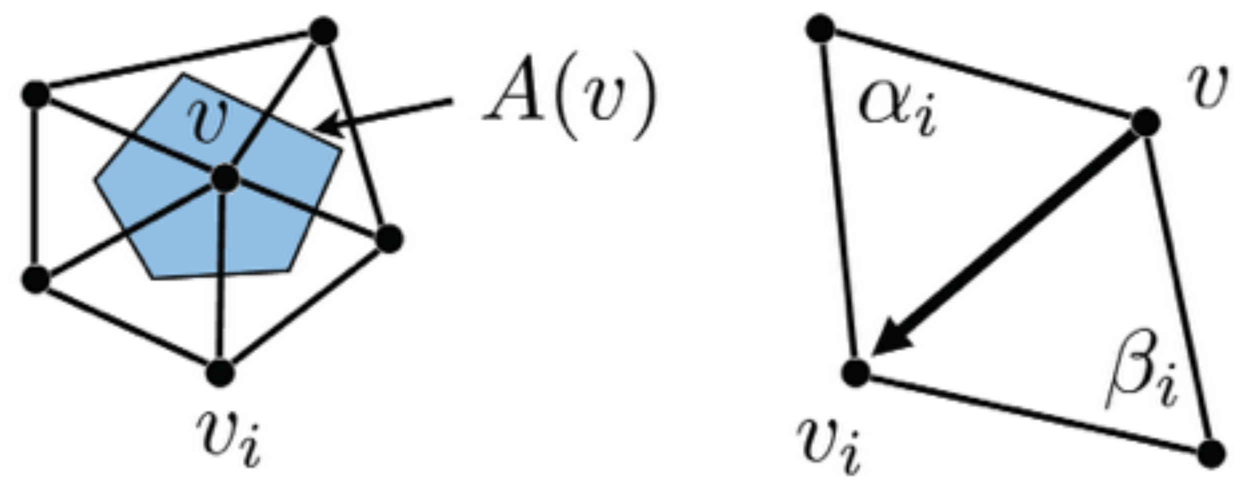
- Assess triangle quality by the circumradius to the minimum edge length ratio
- Circumradius is computed by $A = \frac{|a| \cdot |b| \cdot |c|}{4 \cdot r} = \frac{|a \times b|}{2}$
- Implement in `QualityViewer::calc_triangle_quality()` in QualityViewer.cc

Triangle Quality





Laplace-Beltrami curvature and smoothing



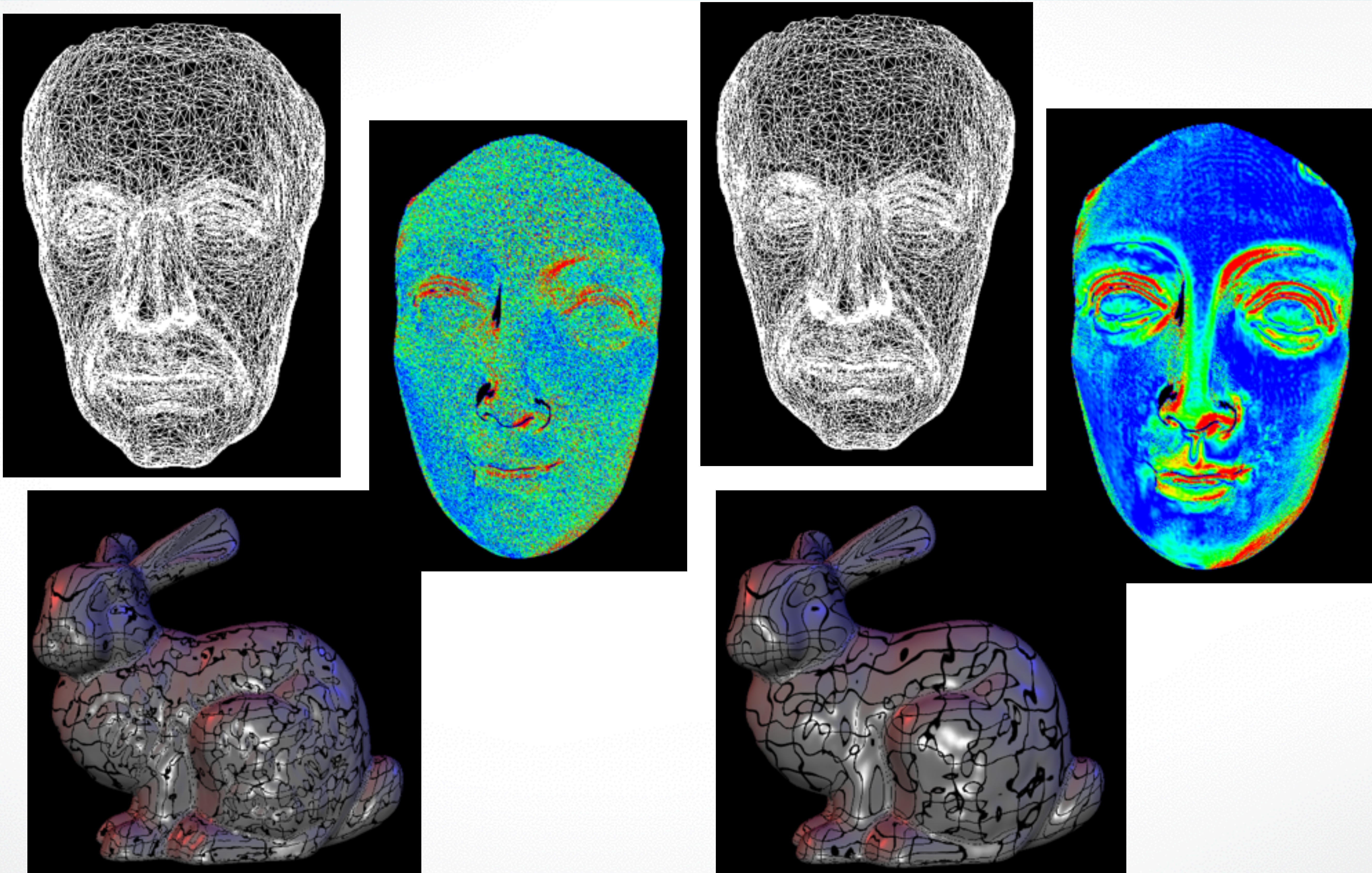
- Laplace-Beltrami Operator

$$L_B(v) = \frac{1}{2A}\sum_i((\cot\alpha_i + \cot\beta_i)(v_i - v))$$

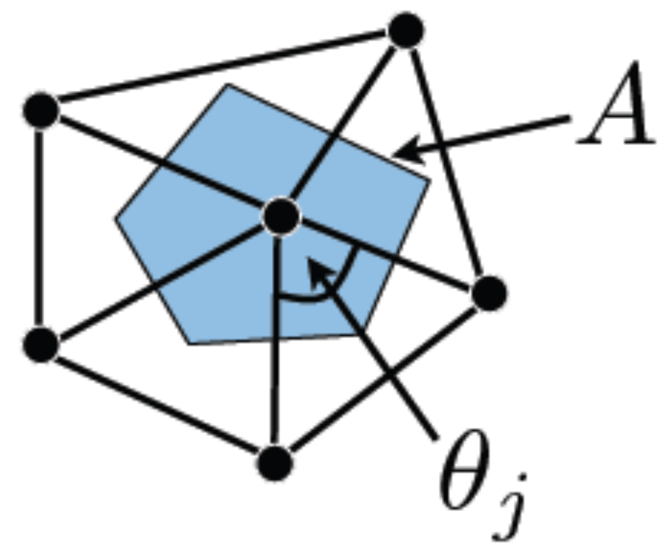
- Compute mean curvature using Laplace-Beltrami weights in `QualityViewer::calc_mean_curvature()` in QualityViewer.cc

- Implement smoothing in `SmoothViewer::smooth()` in SmoothViewer.cc

Laplace-Beltrami curvature and smoothing

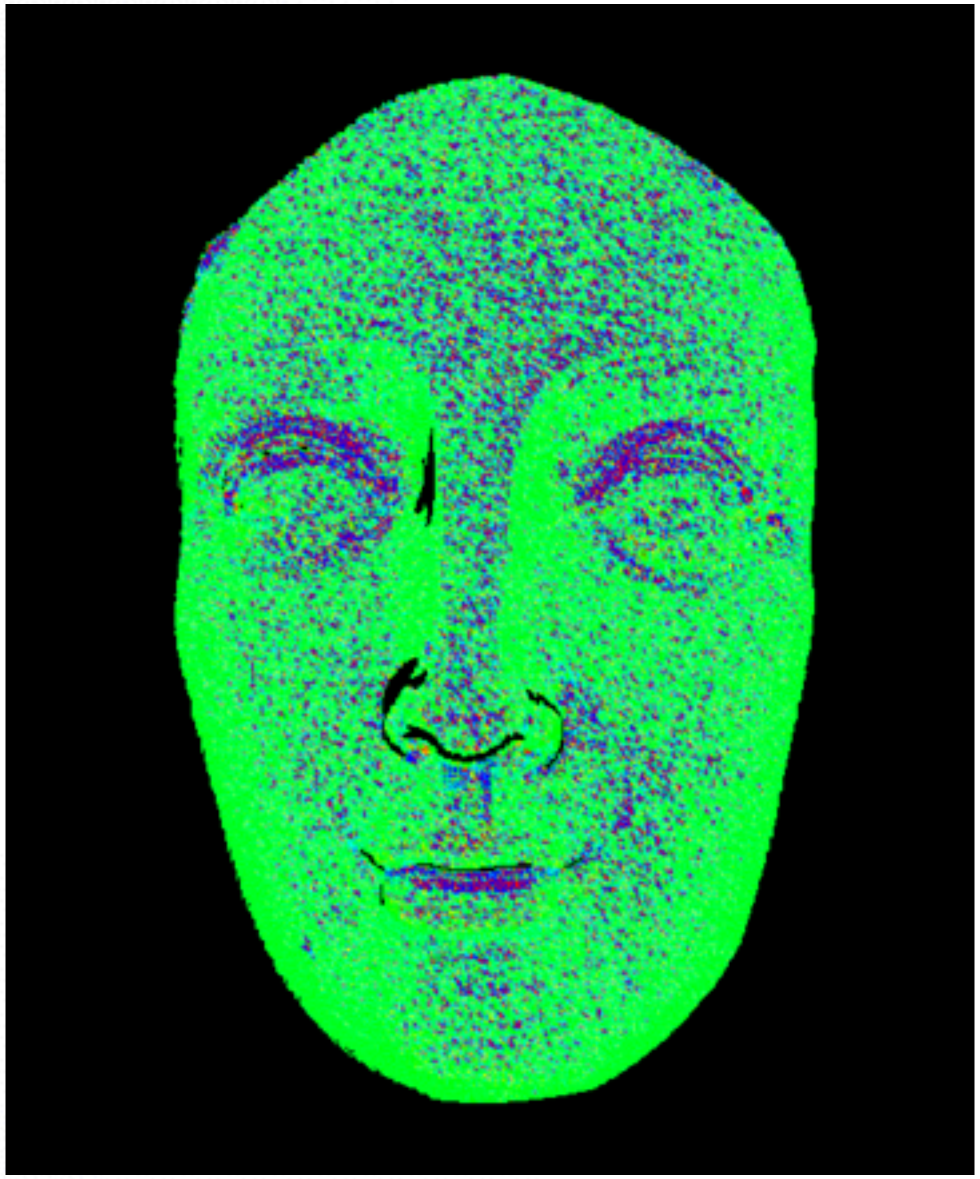


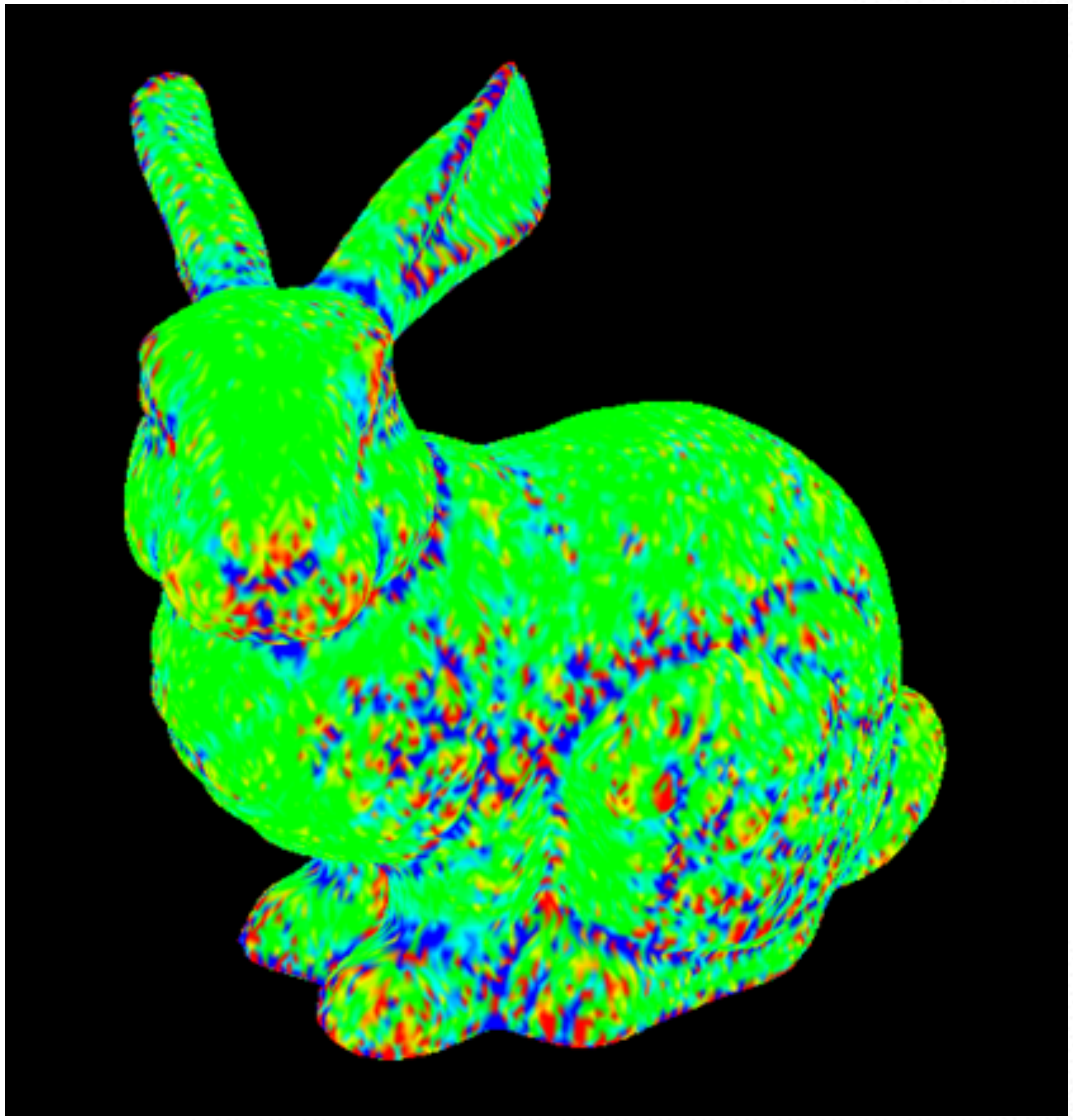
Gaussian Curvature



- Gaussian curvature $G = (2\pi - \sum_j \theta_j) / A$
- `QualityViewer::calc_gauss_curvature()` in QualityViewer.cc

Gaussian Curvature

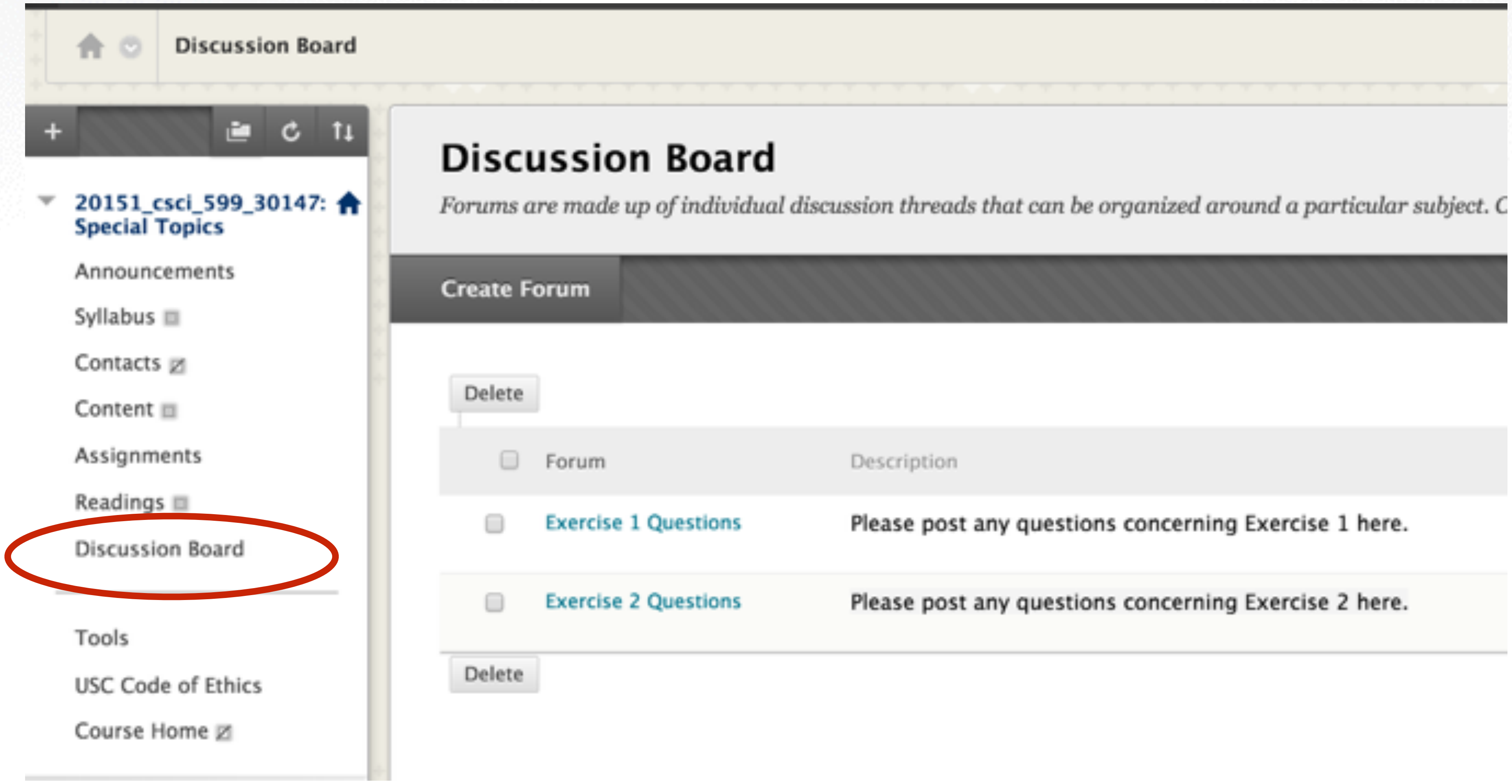




Submission

- Deadline: **Wednesay, March 11, 2015 11:59pm**
- Upload a .zip compressed file named “Exercise4-YourName.zip” to Blackboard, same as before
- Include a “read.txt” file describing how you solve each exercise and the encountered problems

Contact



- email (include “CSCI_599” in title): olszewski.kyle@gmail.com, peilun.hsieh@usc.edu
- Highly recommended to post your questions on Blackboard

http://cs599.hao-li.com

Thanks!