Exercise 4. Surface Smoothing

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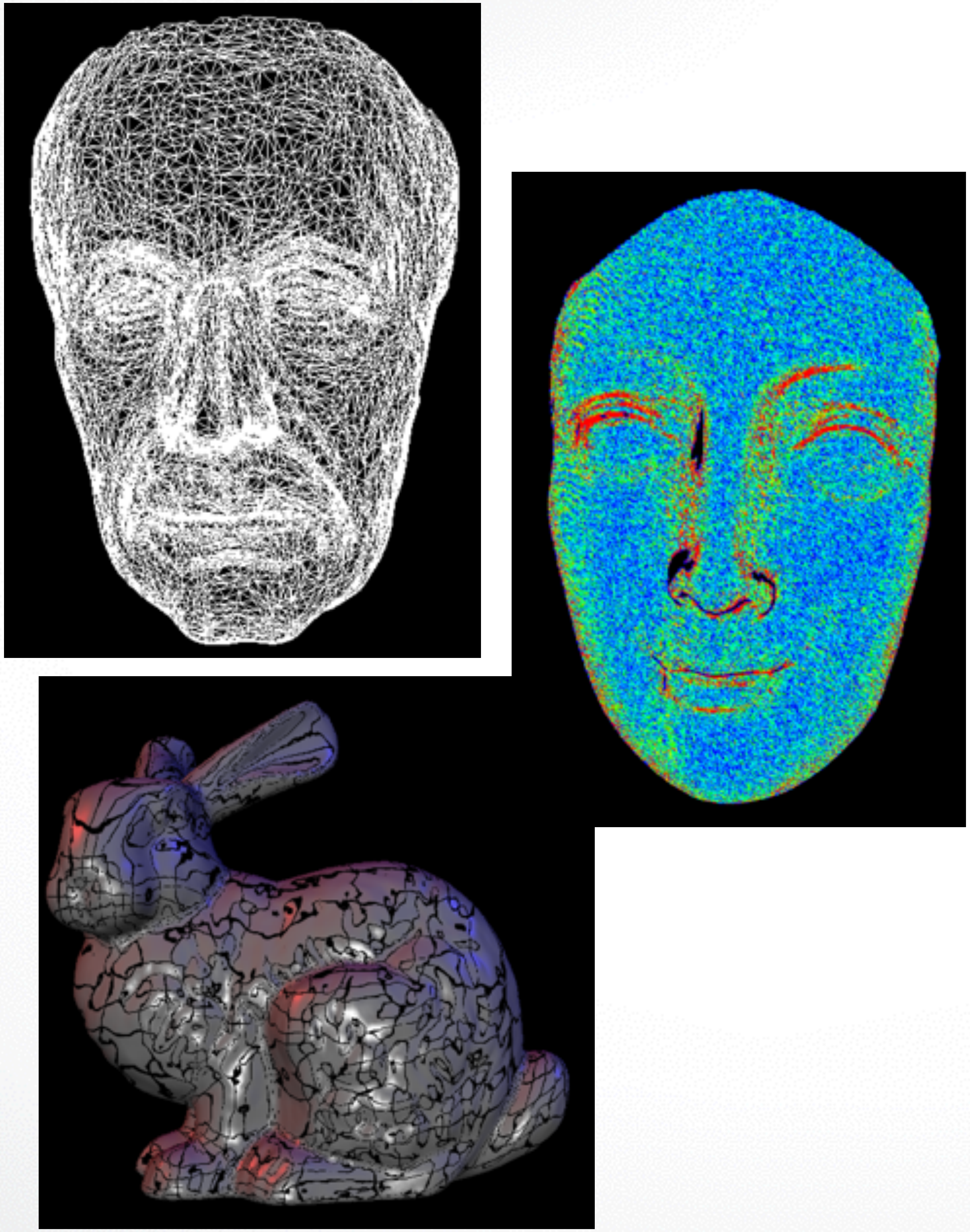
Surface Smoothing

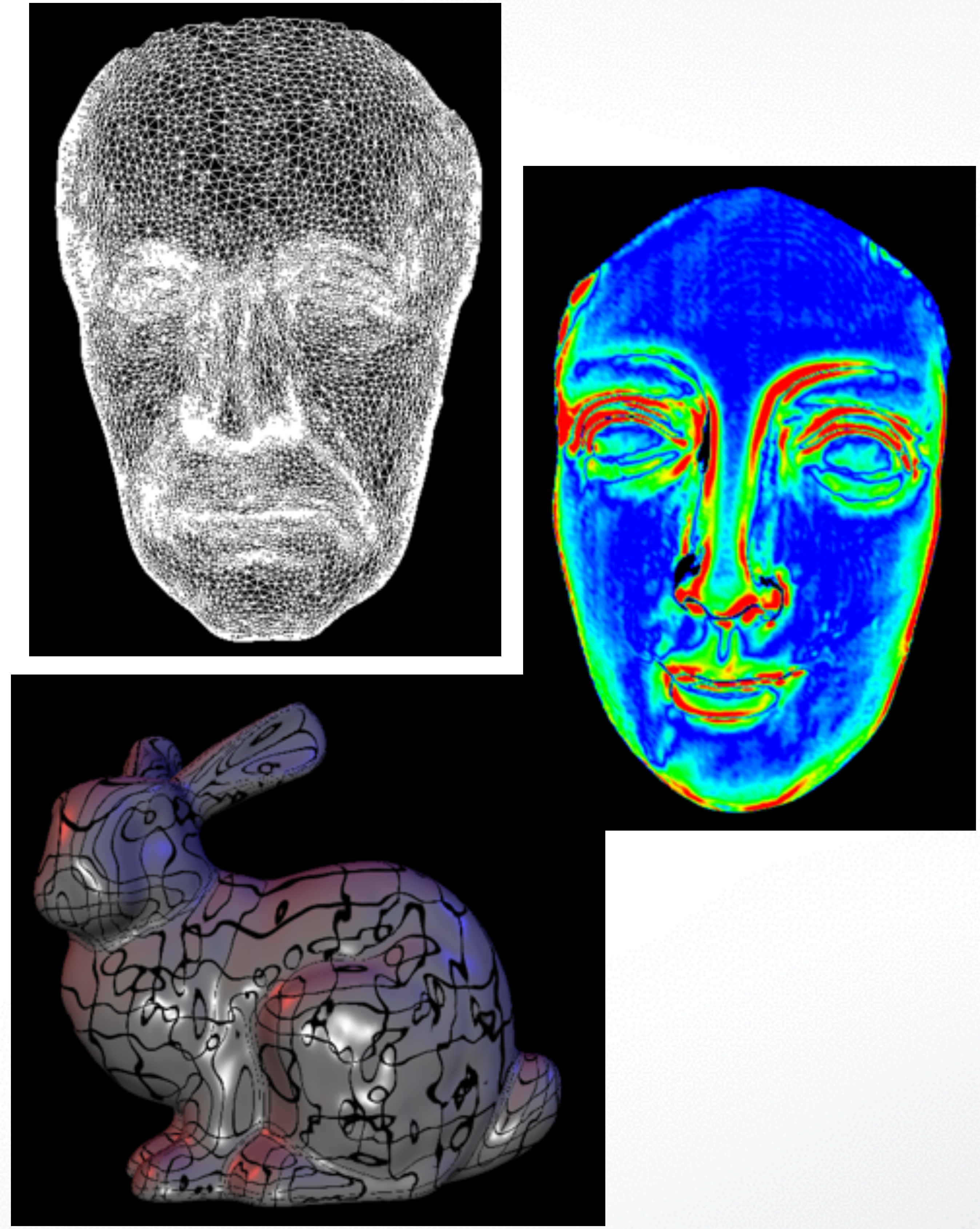
- Spectral analysis
- **Diffusion flow**
  - **Uniform Laplace operator**
  - **Laplacian-Beltrami operator**
- Energy minimization

Uniform Laplacian Surface Smoothing

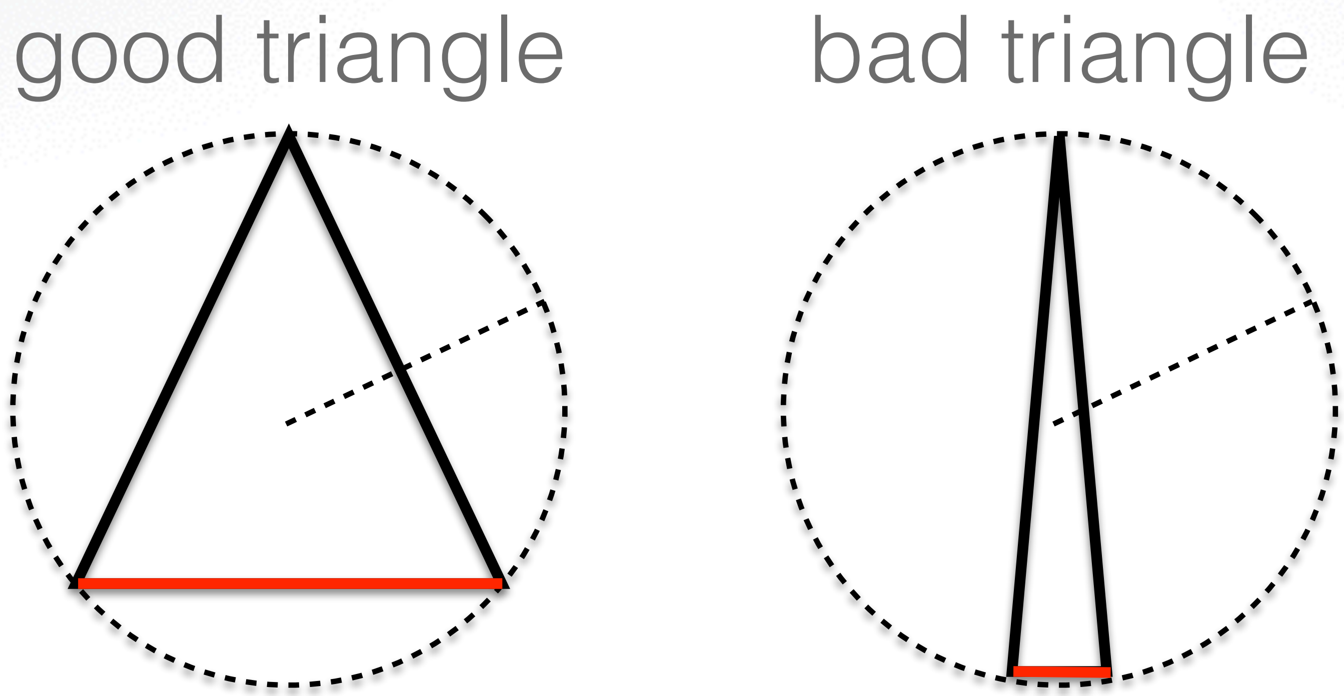
- Uniform Laplace operator $L_U(v) = (\frac{1}{n}\sum_i v_i) - v$
- Mesh smoothing $v' = v + \frac{1}{2} \cdot L_U(v)$
- Implement uniform Laplace operator in `QualityViewer::calc_uniform_mean_curvature()` in QualityViewer.cc
- Implement uniform Laplacian smoothing `SmoothViewer::uniform_smooth()` in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

Uniform Laplacian Surface Smoothing



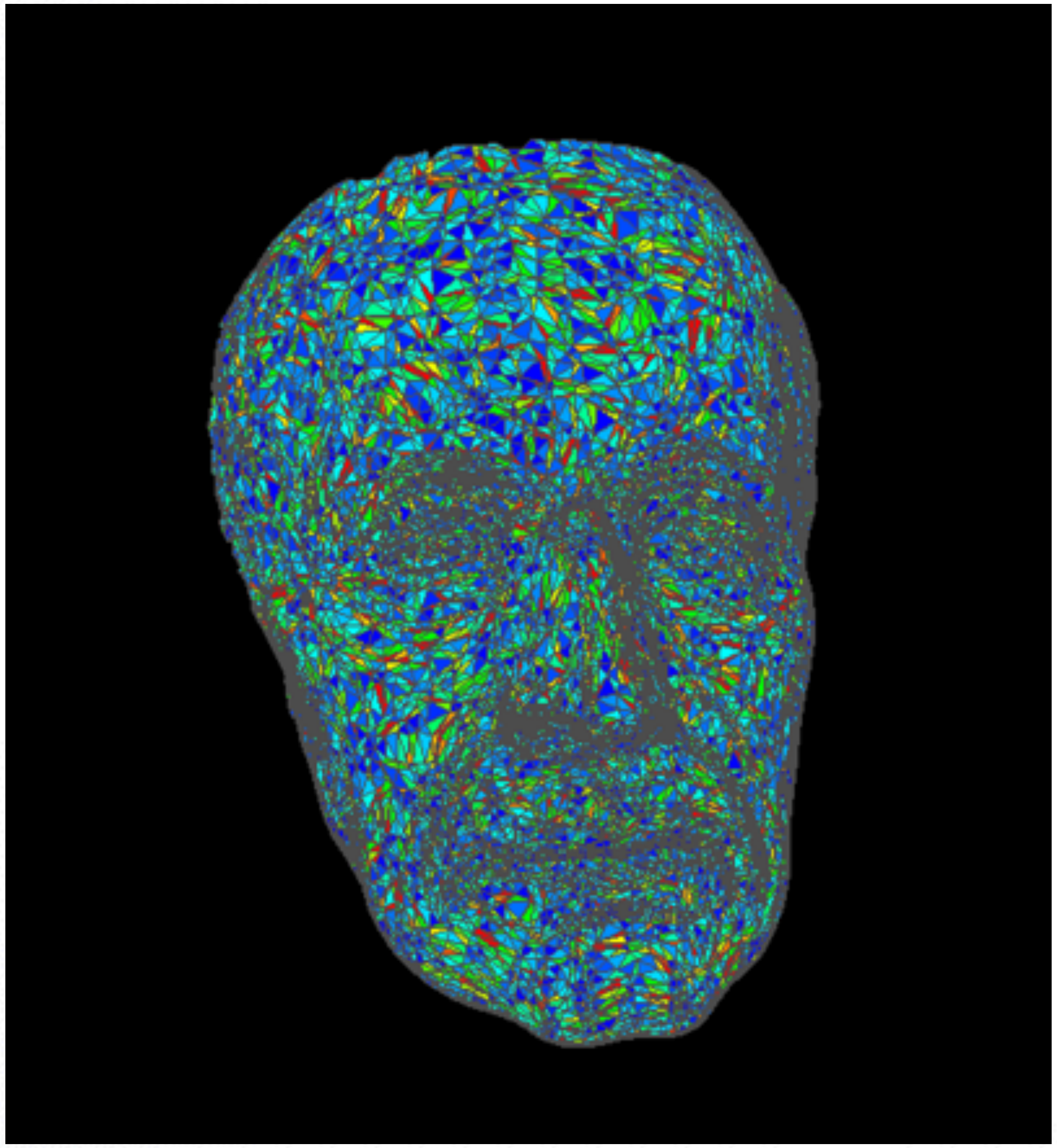


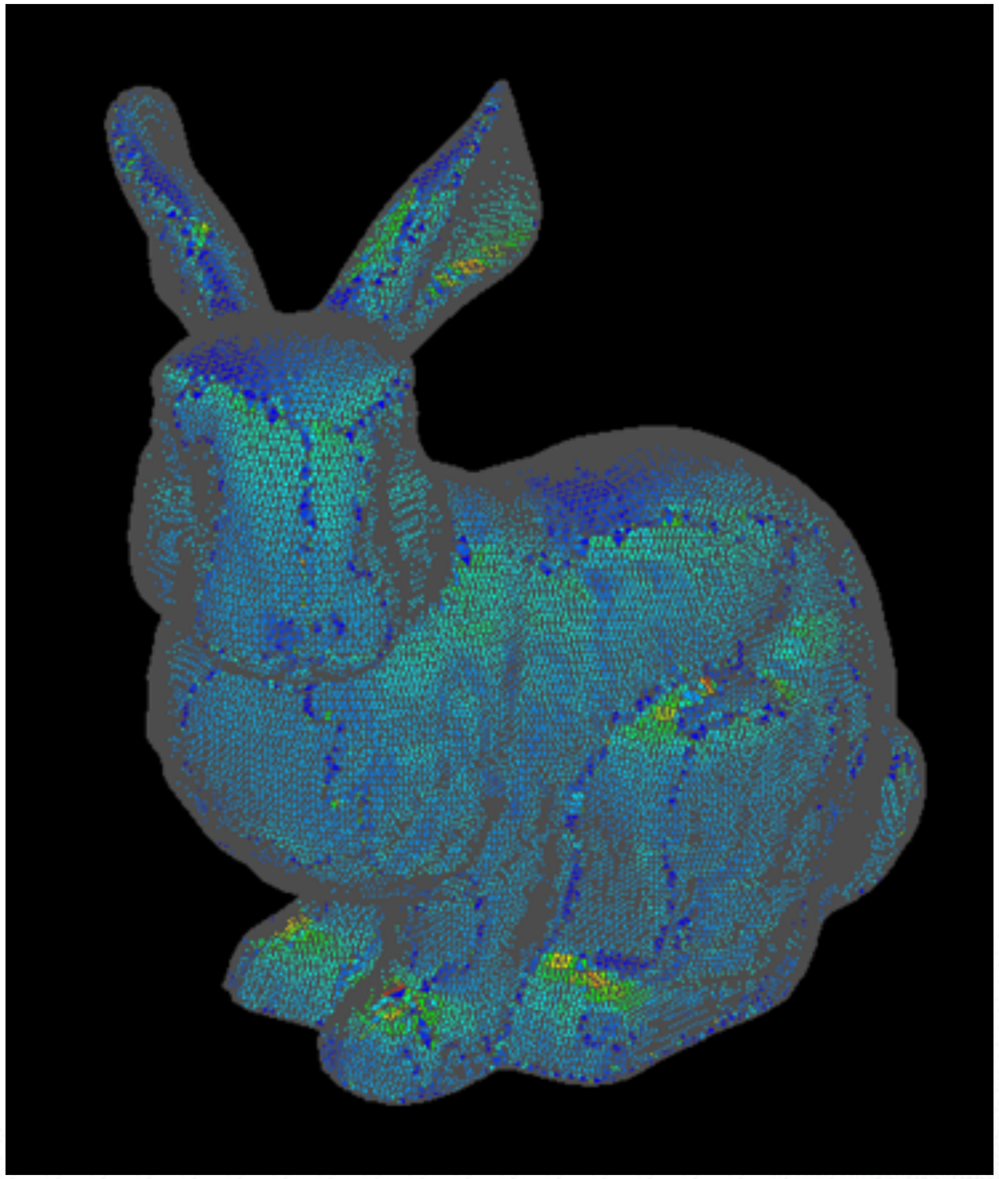
Triangle Quality



- Assess triangle quality by the circumradius to the minimum edge length
- 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





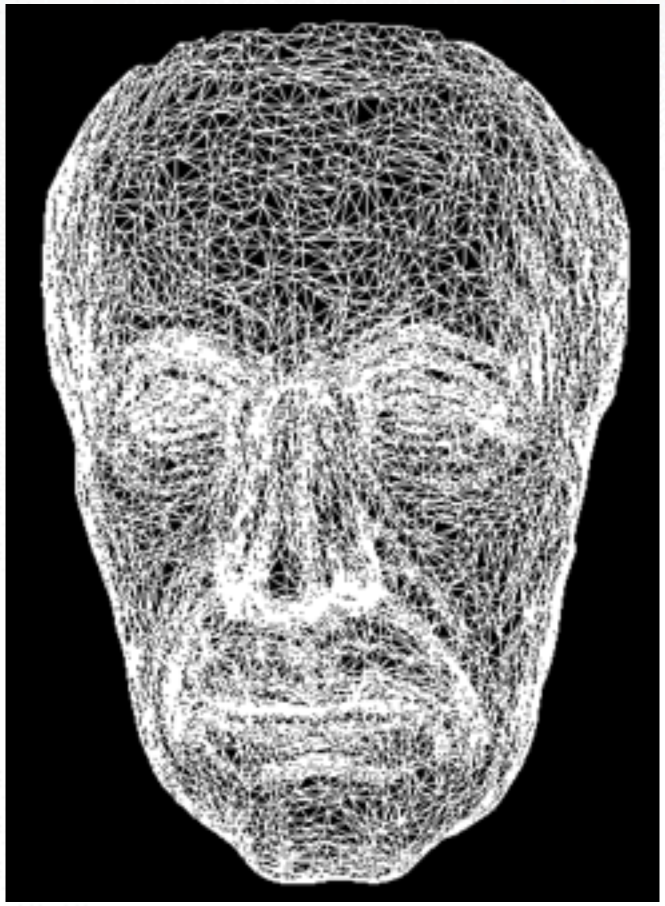
Laplace-Beltrami curvature and smoothing

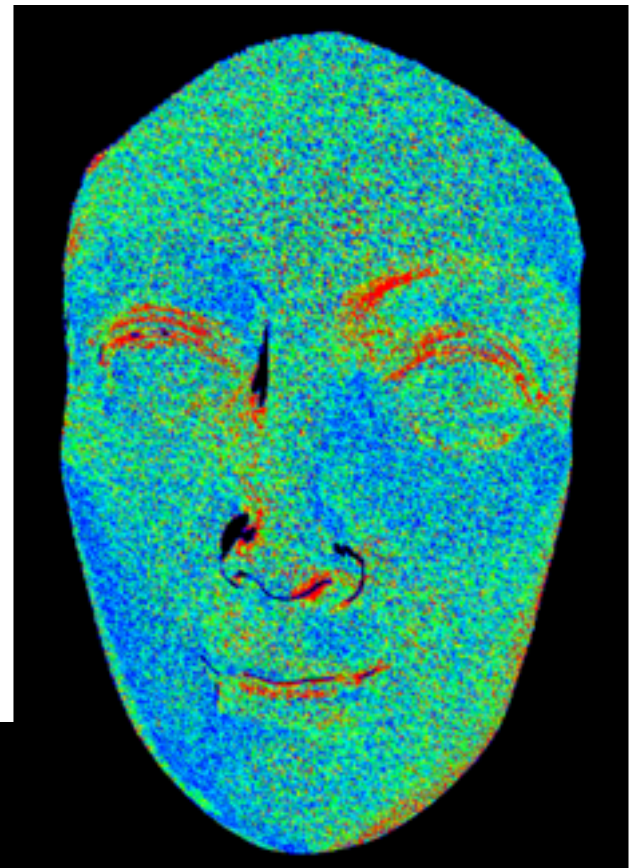
- Laplace-Beltrami Operator

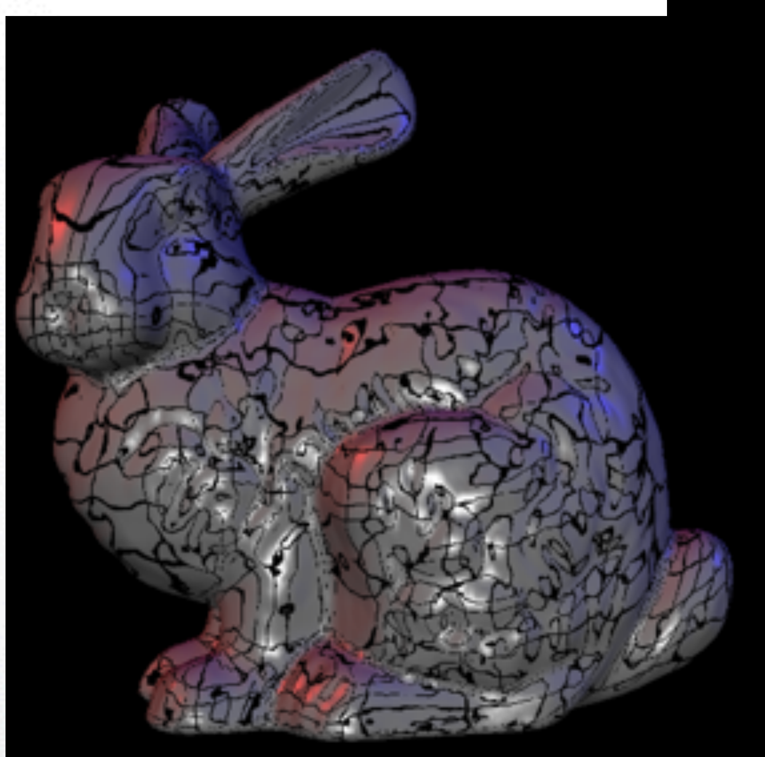
$$L_B(v) = \frac{1}{2A} \sum_i ((\cot \alpha_i + \cot \beta_i)(v_i - v))$$

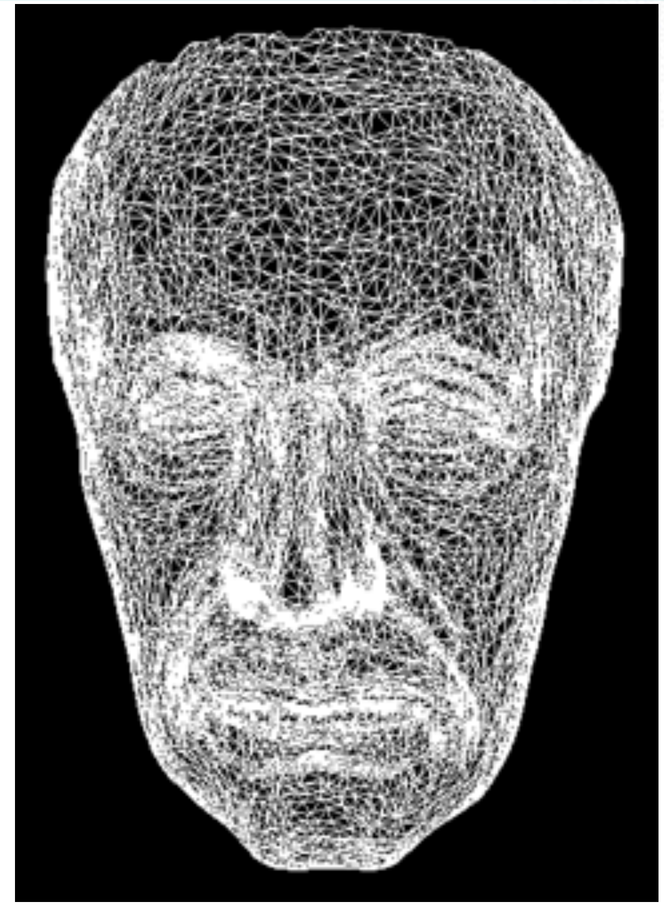
- Compute mean curvature using Laplace-Beltrami weights in `QualityViewer::calc_mean_curvature()` in QualityViewer.cc
- Implement smoothing in `SmoothViewer::smooth()` in SmoothViewer.cc

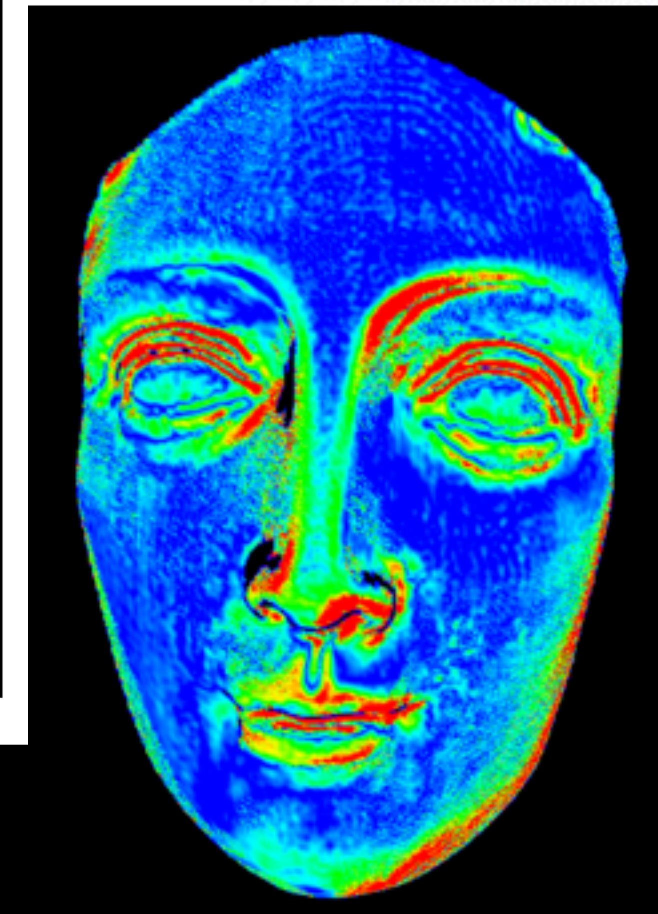
Laplace-Beltrami curvature and smoothing

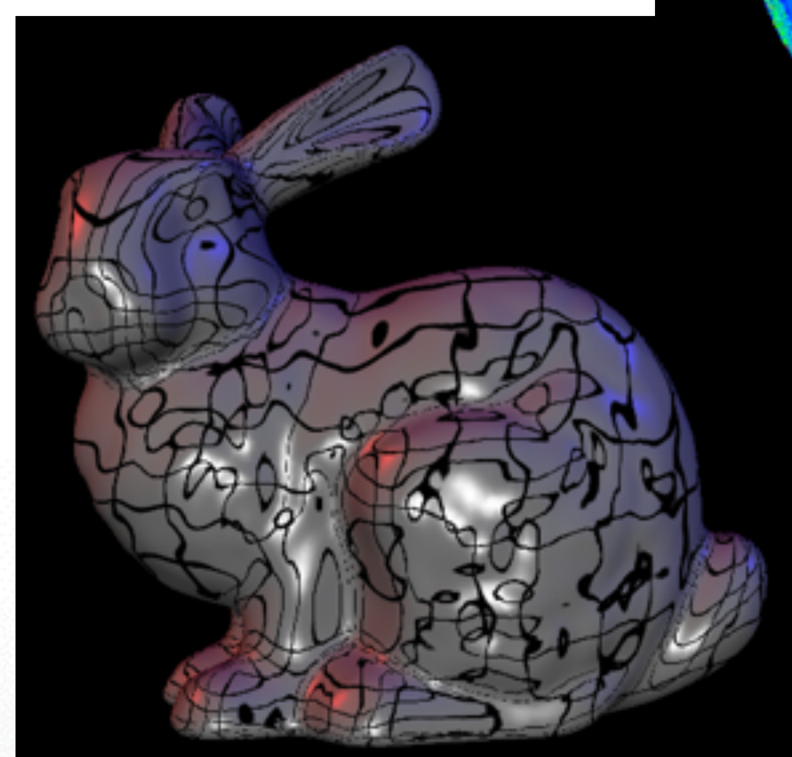








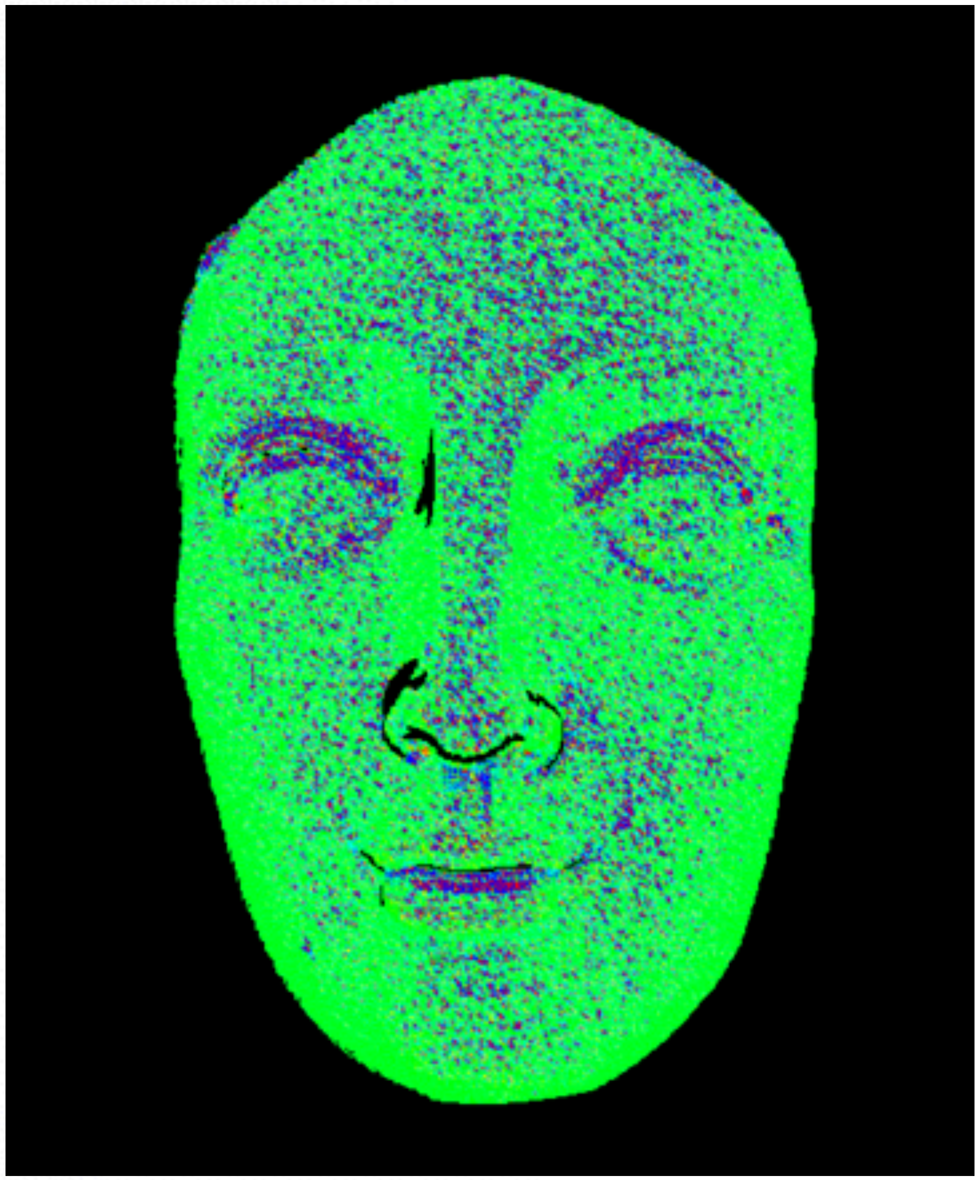


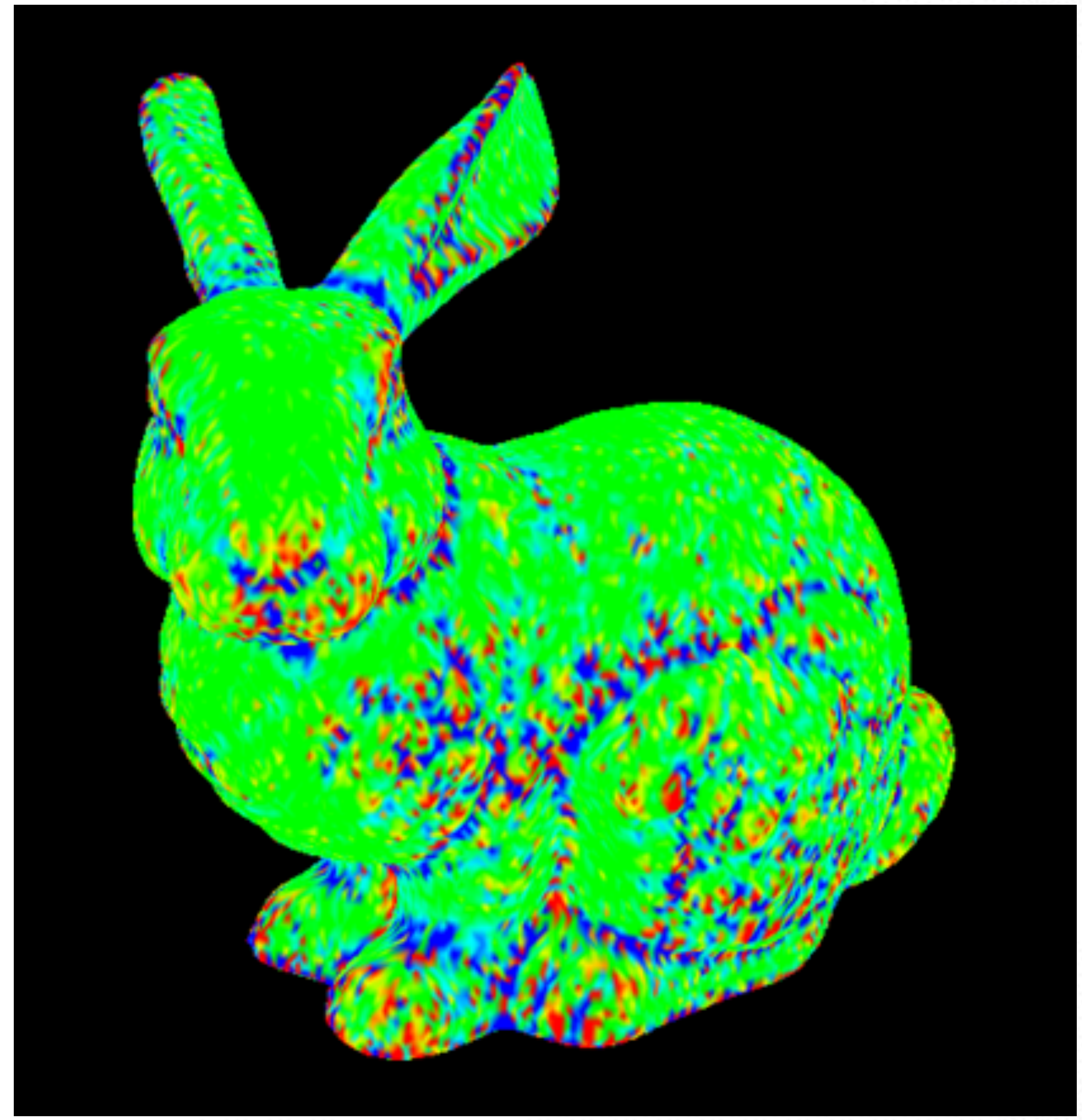


Gaussian Curvature

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

Gaussian Curvature





Submission

- Deadline: **Mar 12, 2014 11:59pm**
- Upload a .zip compressed file named "Exercise4-YourName.zip" to
  - http://www.dropitto.me/usc-cs599dgp
  - password: `ididit`
- Include a "read.txt" file describing how you solve each exercise and the encountered problems

Contact

- Office Hours: Wednesday 11:30 - 13:30 SAL 219
- email: smirnov@usc.edu, peilun.hsieh@usc.edu
- Highly recommended to post your question on Piazza:

https://piazza.com/usc/spring2014/cs599dgp http://cs599.hao-li.com

Thanks!