

*Spring 2015*

# CSCI 599: **Digital Geometry Processing**

## **Exercise 6. Remeshing**



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# Incremental Remeshing

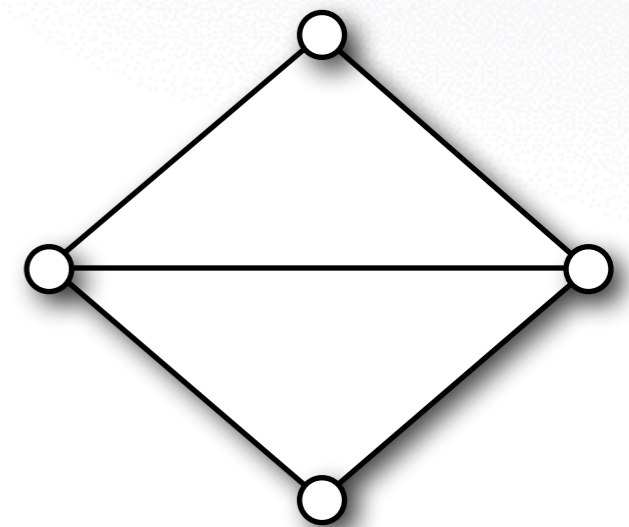
- **Split** long edges
- **Collapse** short edges
- **Flip** edges for optimal valences
- **Shift** vertices for tangential relaxation

# Split

- Split edges longer than

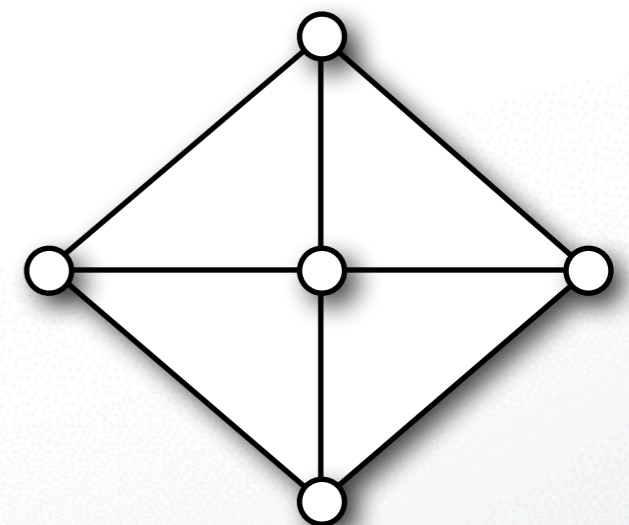
$$L_{max} = \frac{4}{3}L$$

- `split_long_edges()` in `remesh.cc`



Edge  
Split

A thick black arrow pointing downwards, indicating the process of splitting the edge.

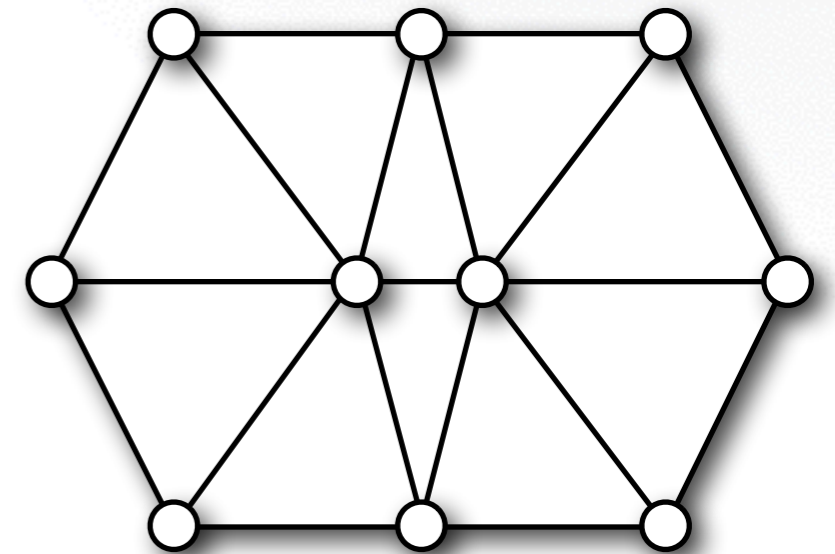


# Collapse

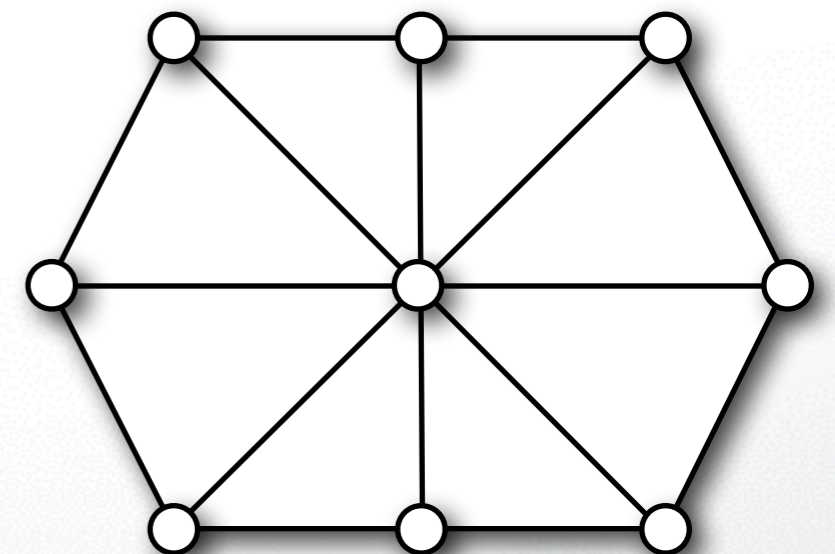

- Collapse edges shorter than

$$L_{min} = \frac{4}{5}L$$

- `collapse_short_edges()` in `remesh.cc`



Edge  
Collapse



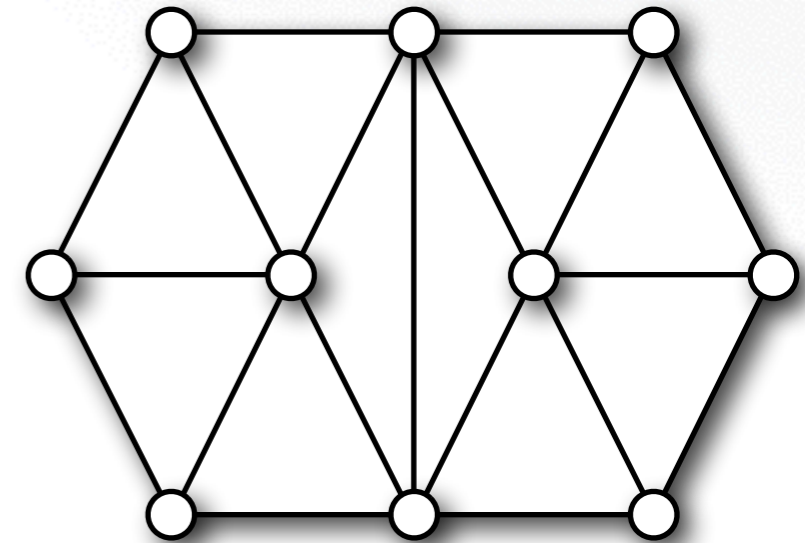
# Flip

- Optimal valence
  - 6 for interior vertices
  - 4 for boundary vertices

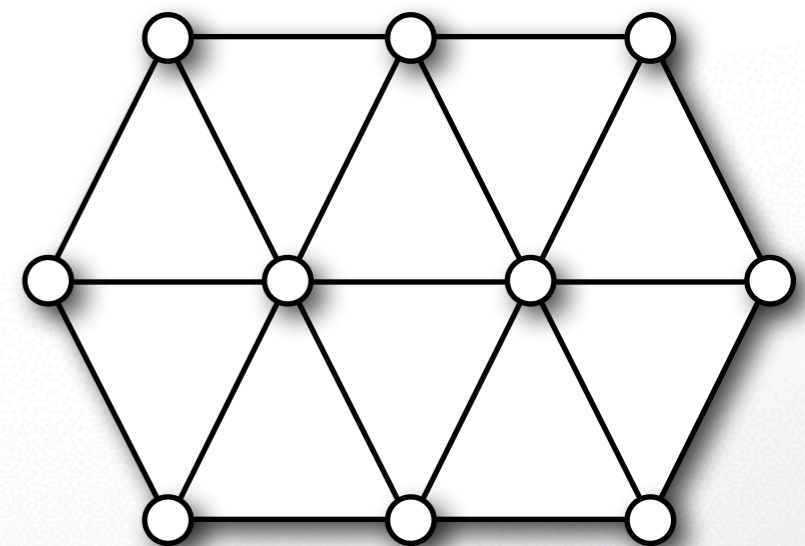
- Minimize valence excess

$$\sum_{i=1}^4 (\text{valence}(v_i) - \text{opt\_valence}(v_i))^2$$

- `equalize_valences()` in `remesh.cc`



Edge  
Flip

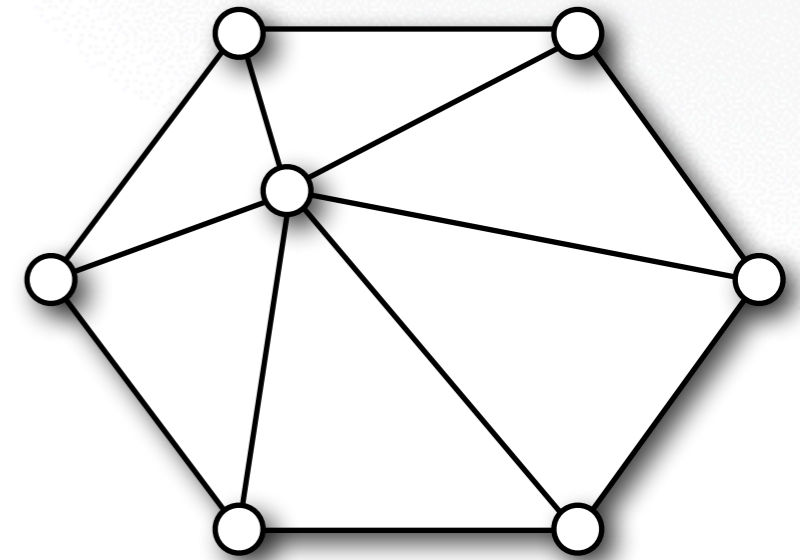


# Shift

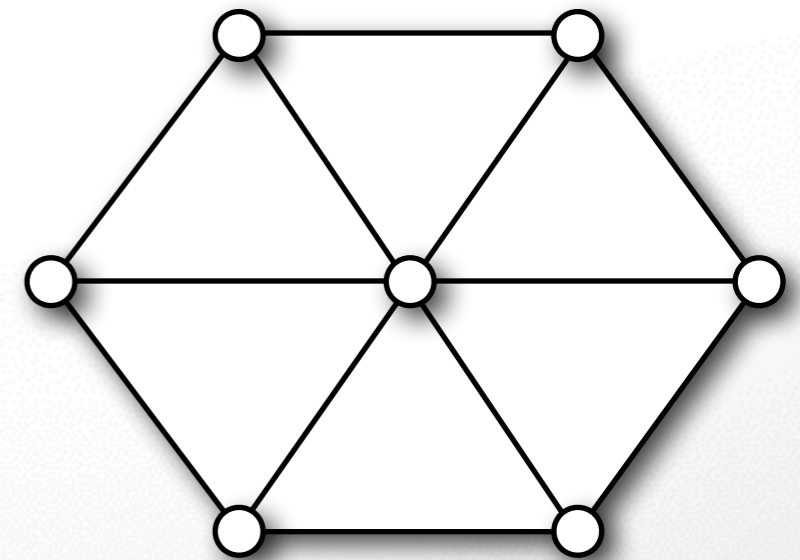

- Uniform Laplacian smoothing

$$\mathbf{c}_i = \frac{1}{\text{valence}(v_i)} \sum_{j \in N(v_i)} \mathbf{p}_j$$

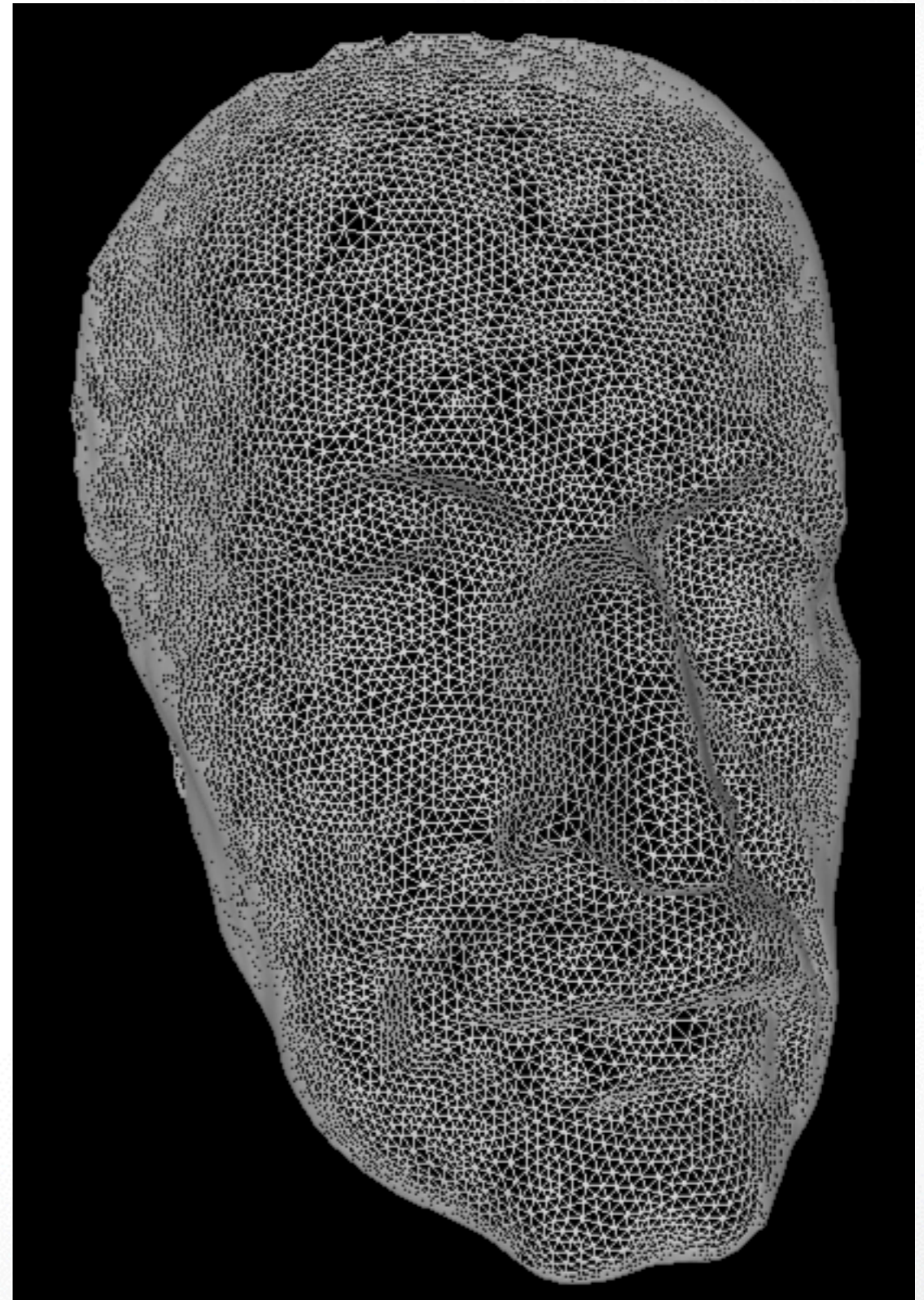
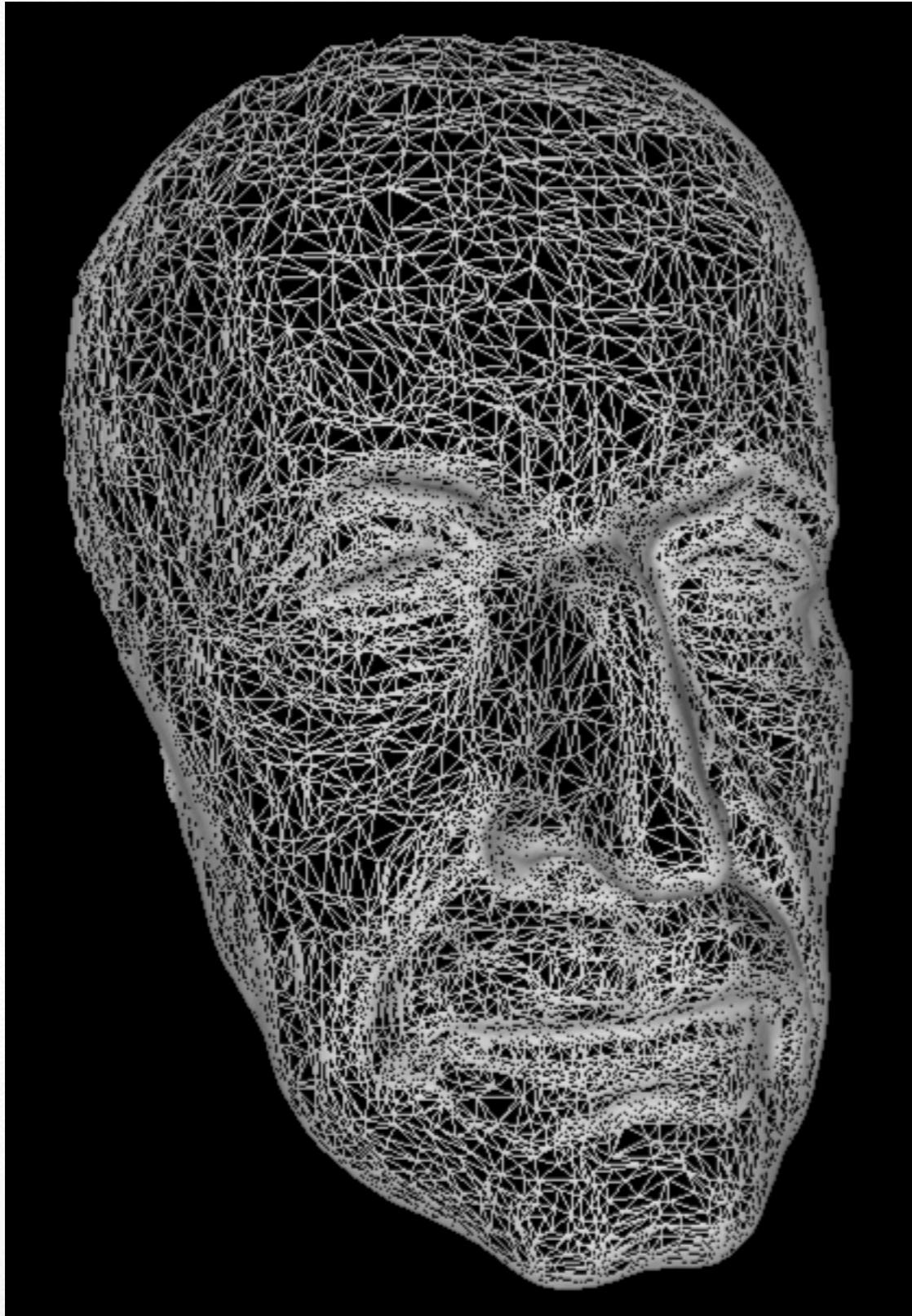
- Restrict movement to tangent plane
- `tangential_relaxation()` in `remesh.cc`



Vertex  
Shift



# Result

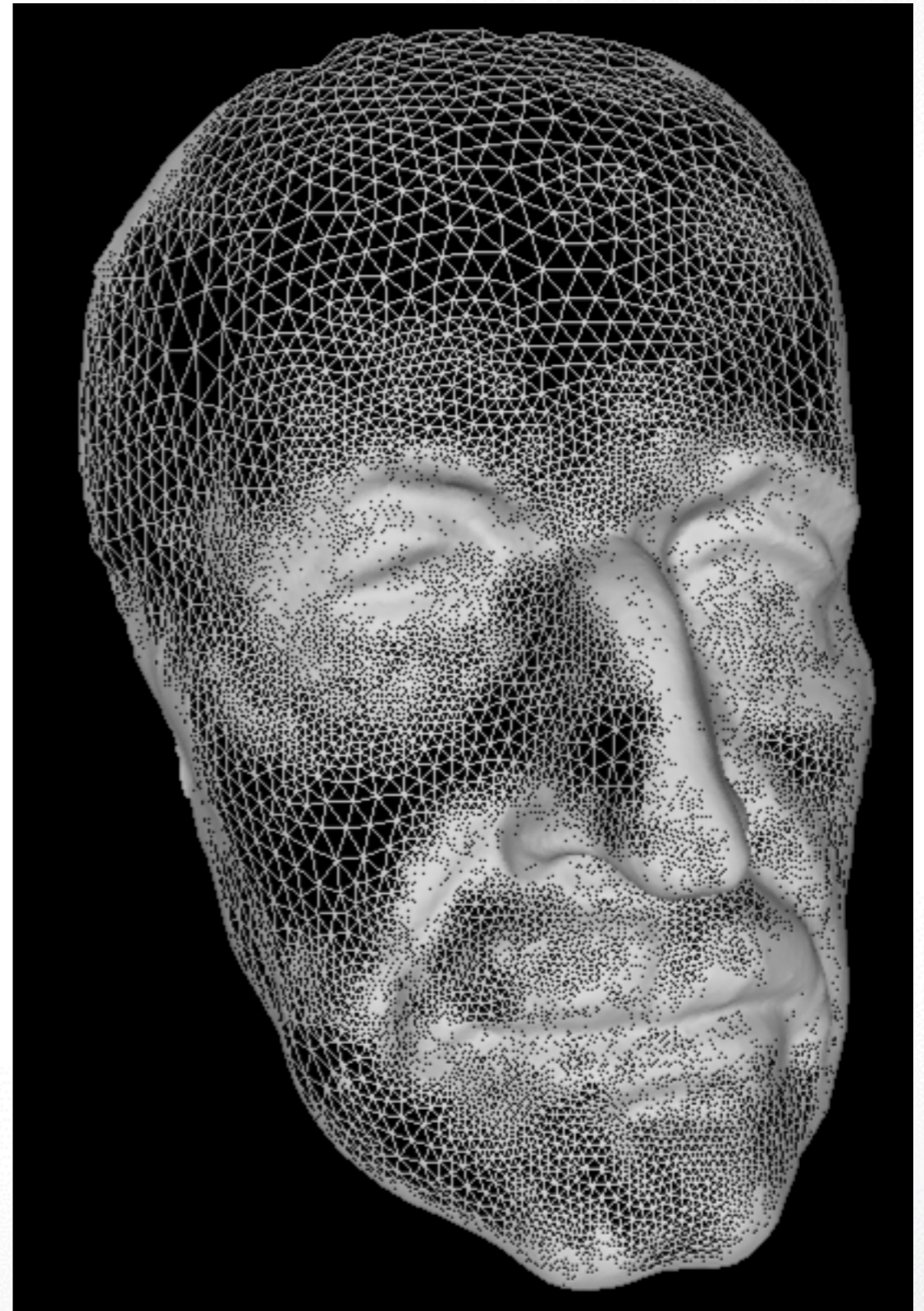
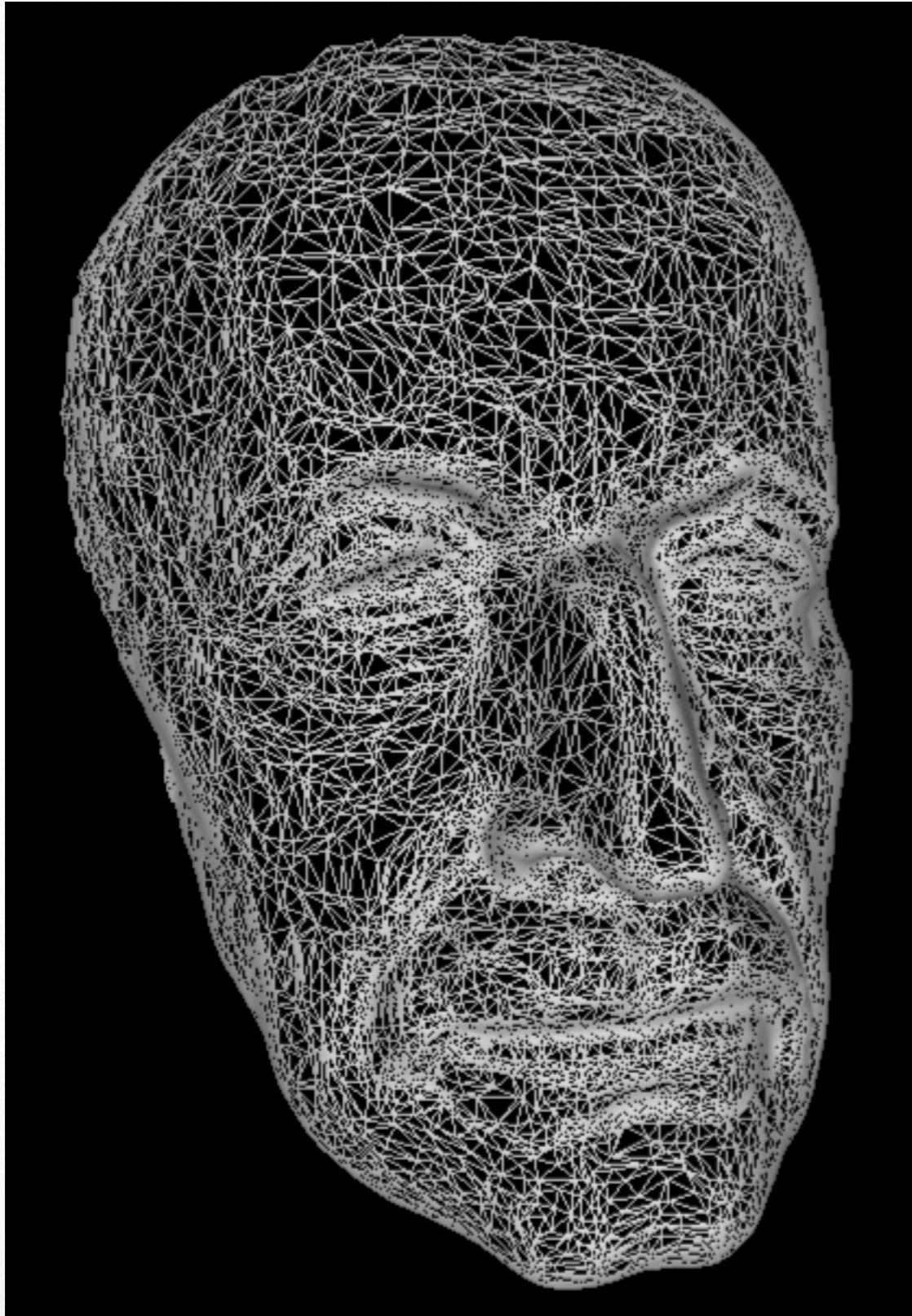


# Adaptive Remeshing

- Compute maximal curvature by mean curvature and Gaussian curvature:  $k_{max} = H + \sqrt{H^2 - K}$
- Scale target edge length by inverse of max curvature
- Uniformly smooth target edge length
- Scale target edge length such that the mean equals to user specified target length
- `calc_target_length()` in `remesh.cc`



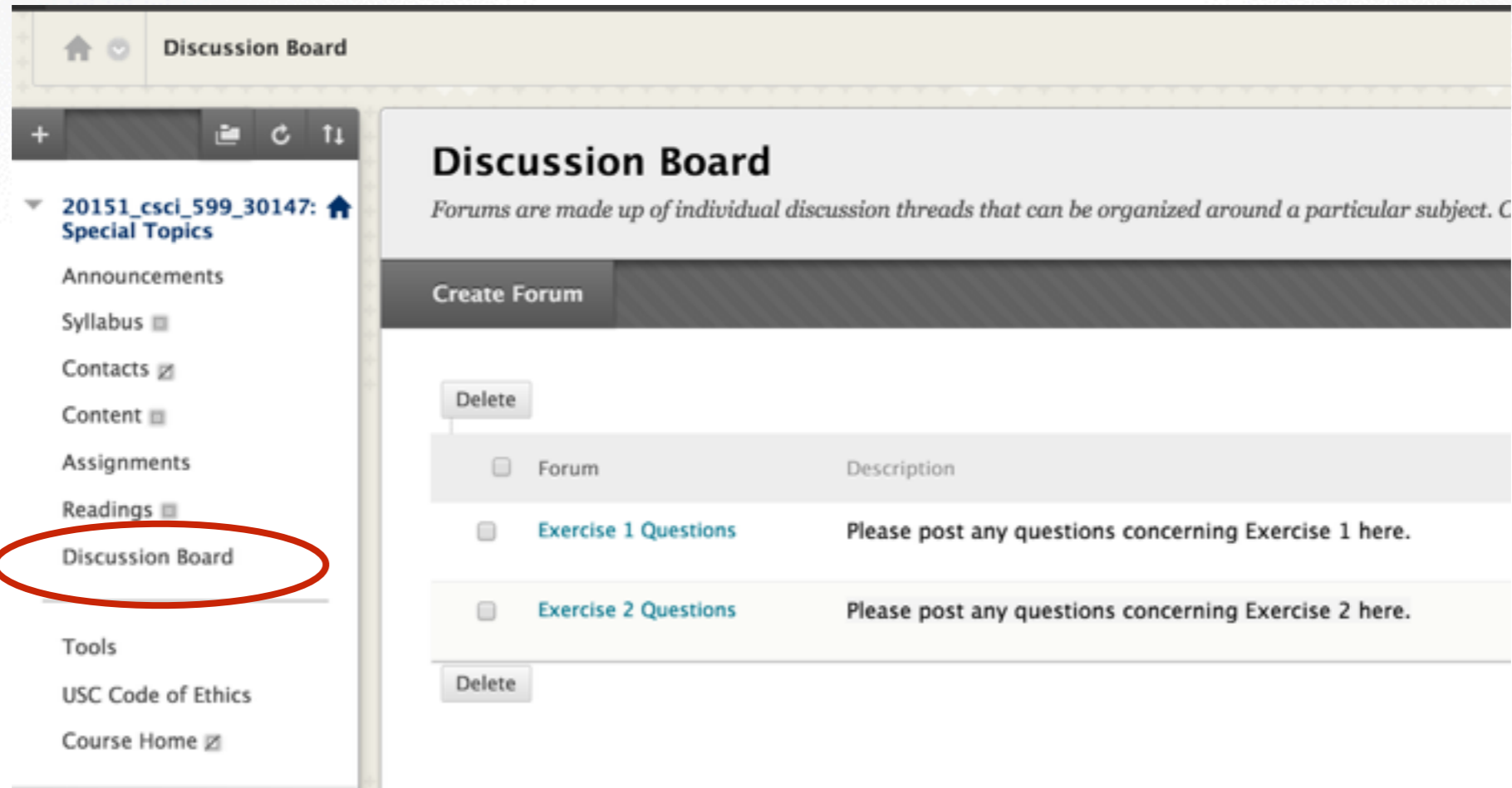
# Result



# Submission

- Deadline: **Wednesday, April 8, 2015 11:59pm**
- Upload a .zip compressed file named “Exercise6-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):  
[olszewsk@usc.edu](mailto:olszewsk@usc.edu)
- Highly recommended to post your questions on Blackboard

<http://cs599.hao-li.com>

# Thanks!

