

Spring 2018

CSCI 621: **Digital Geometry Processing**

Exercise 6. Remeshing



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Incremental Remeshing

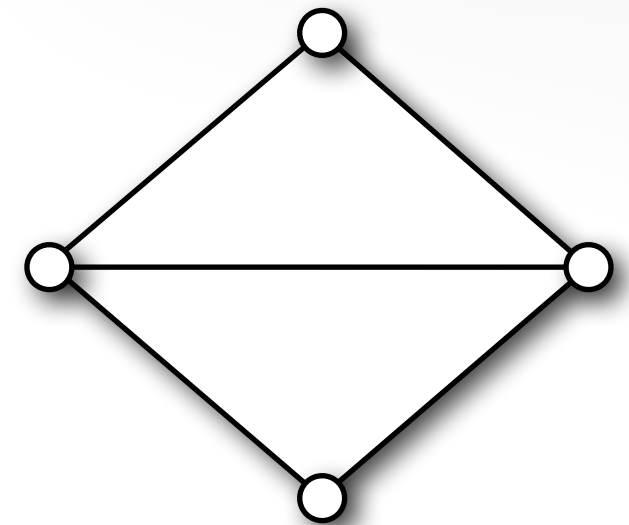
- **Split** long edges
- **Collapse** short edges
- **Flip** edges for optimal valences
- **Shift** vertices for tangential relaxation

Split

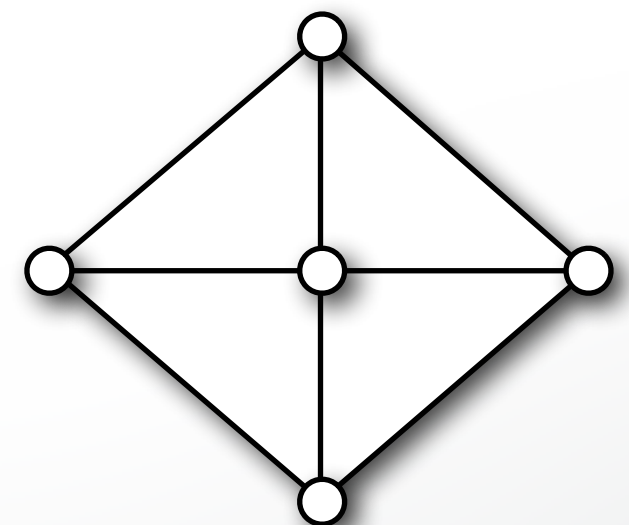

- Split edges longer than

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

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



Edge
Split

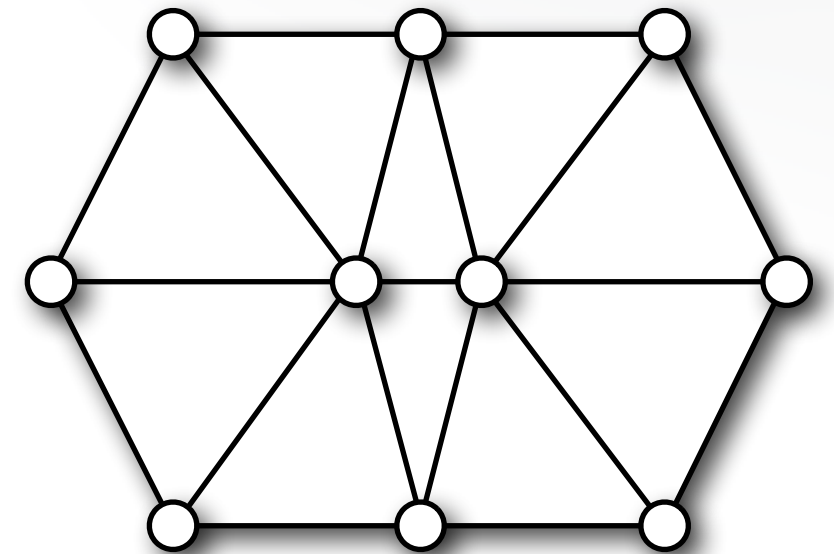


Collapse

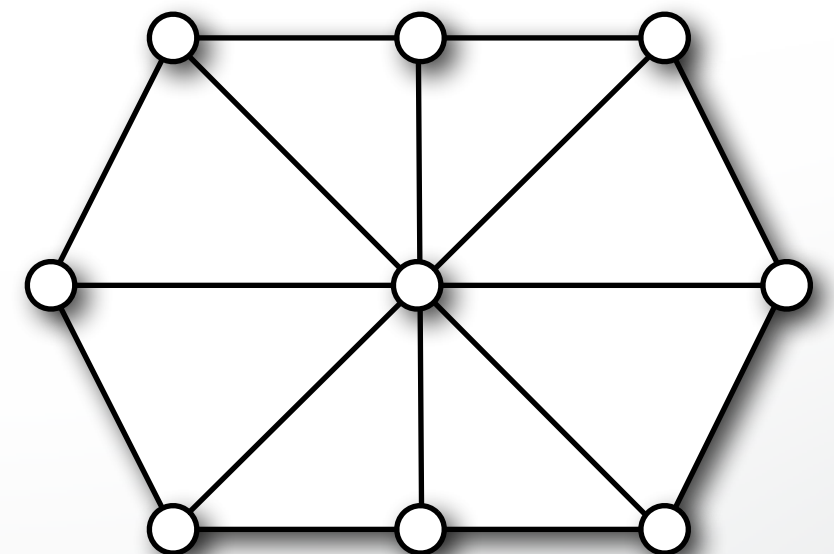
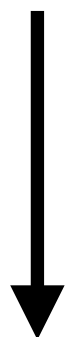
- Collapse edges shorter than

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

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



Edge
Collapse



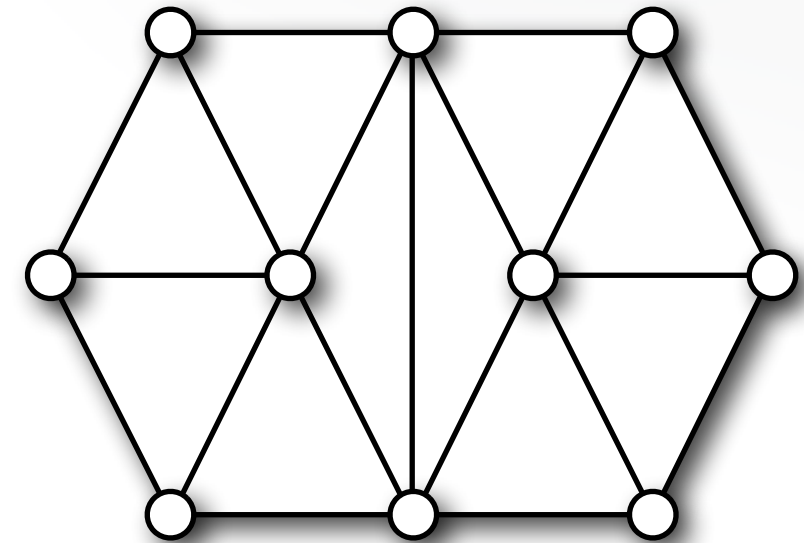
Flip

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

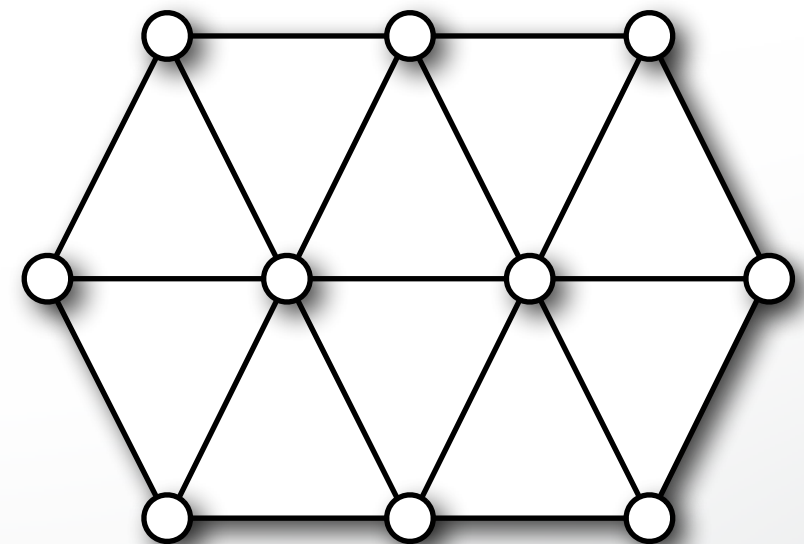
- Minimize valence excess

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

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



Edge
Flip

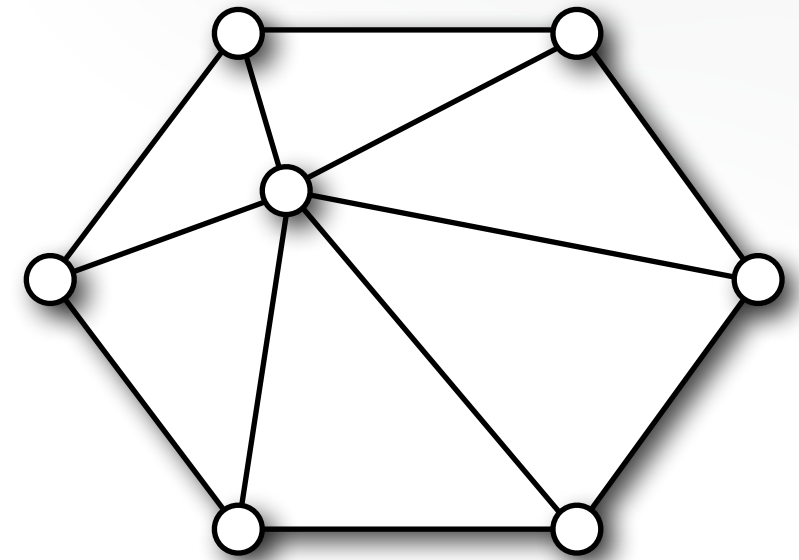


Shift

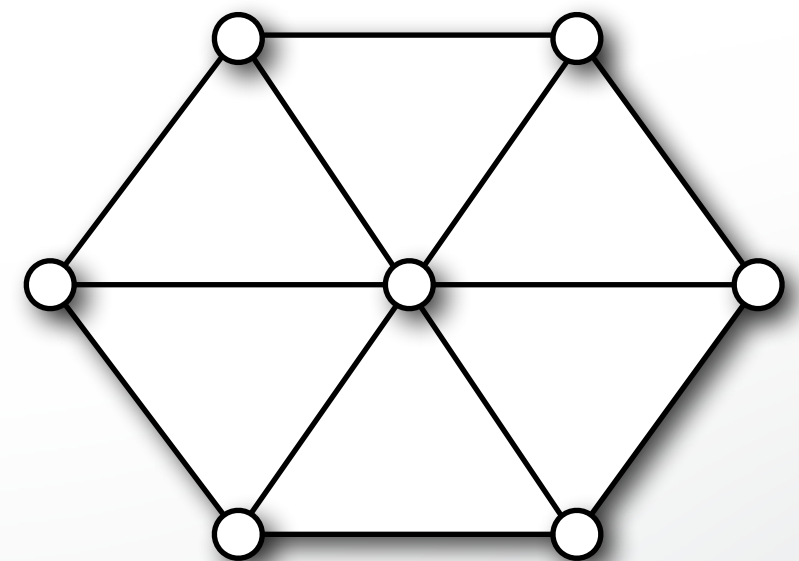

- Uniform Laplacian smoothing

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

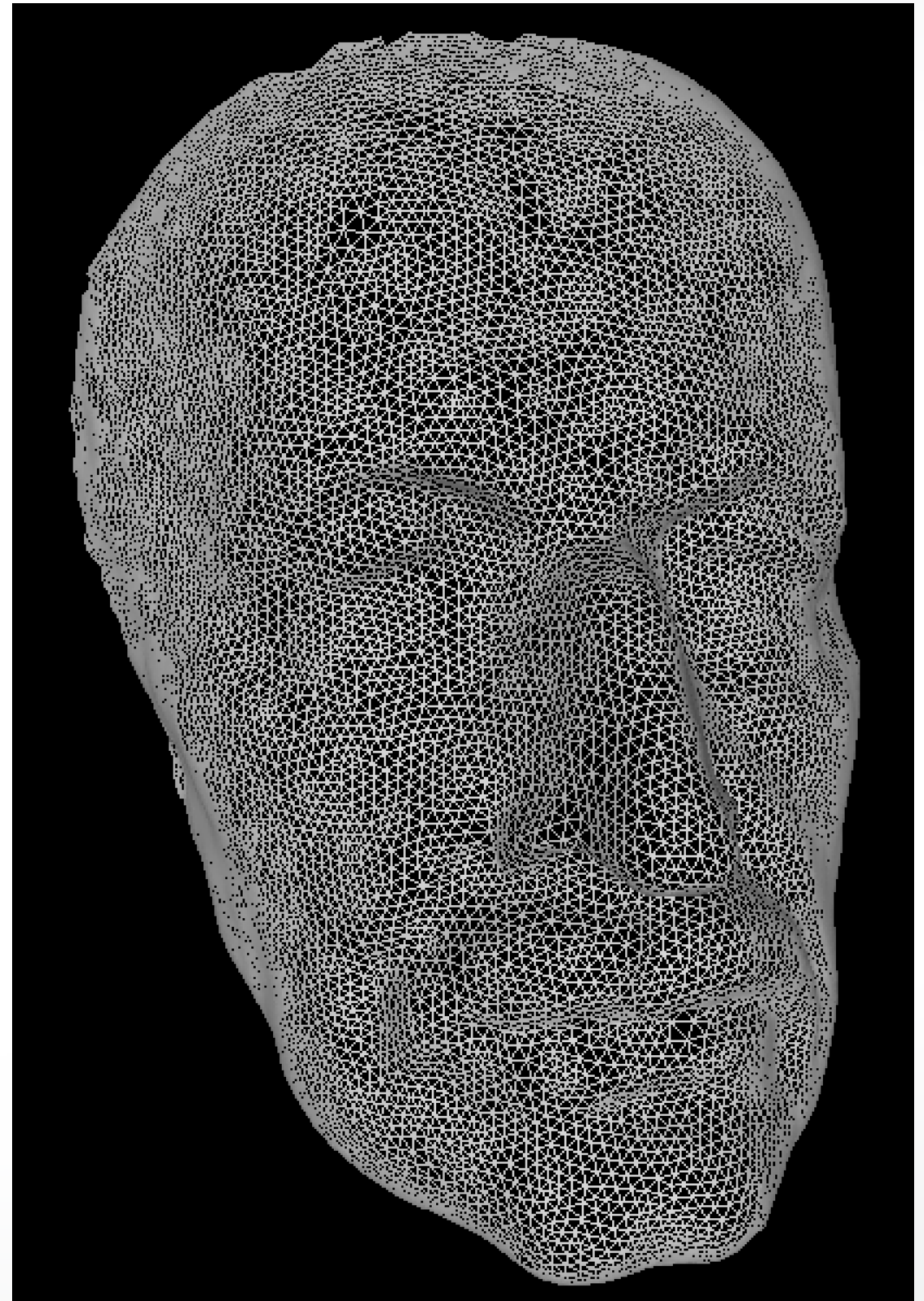
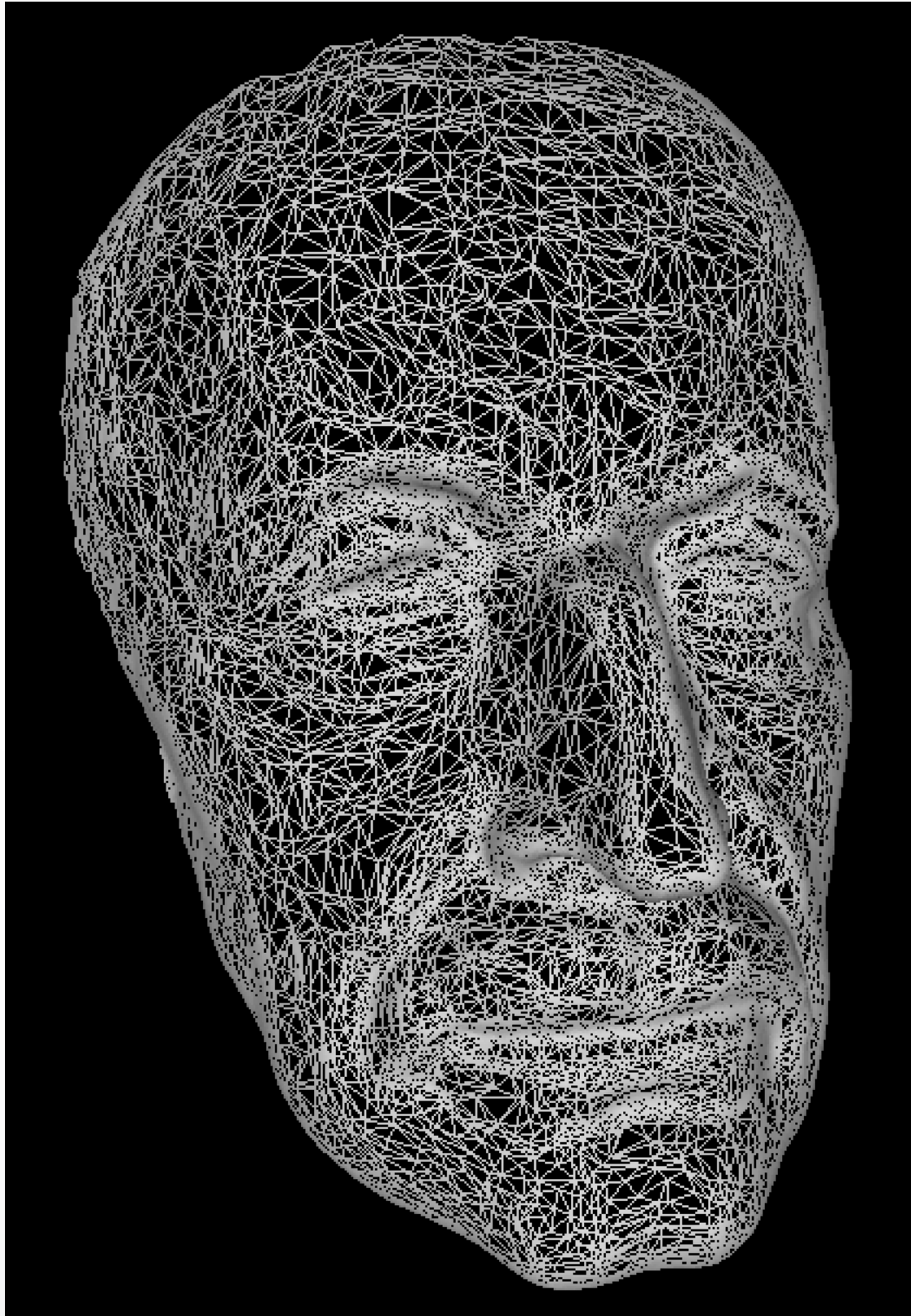
- Restrict movement to tangent plane
- `tangential_relaxation()` in `remesh.cc`



Vertex
Shift



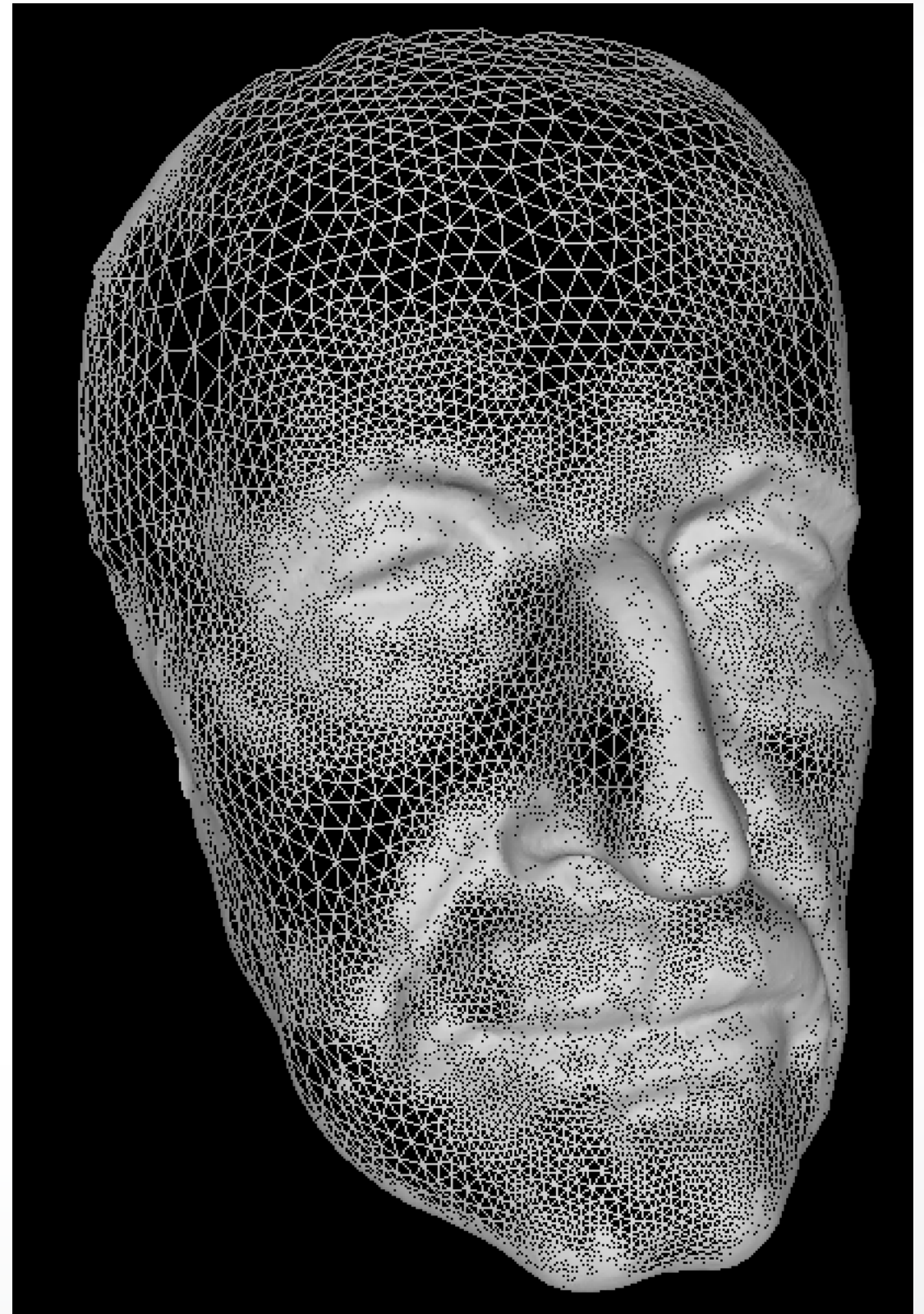
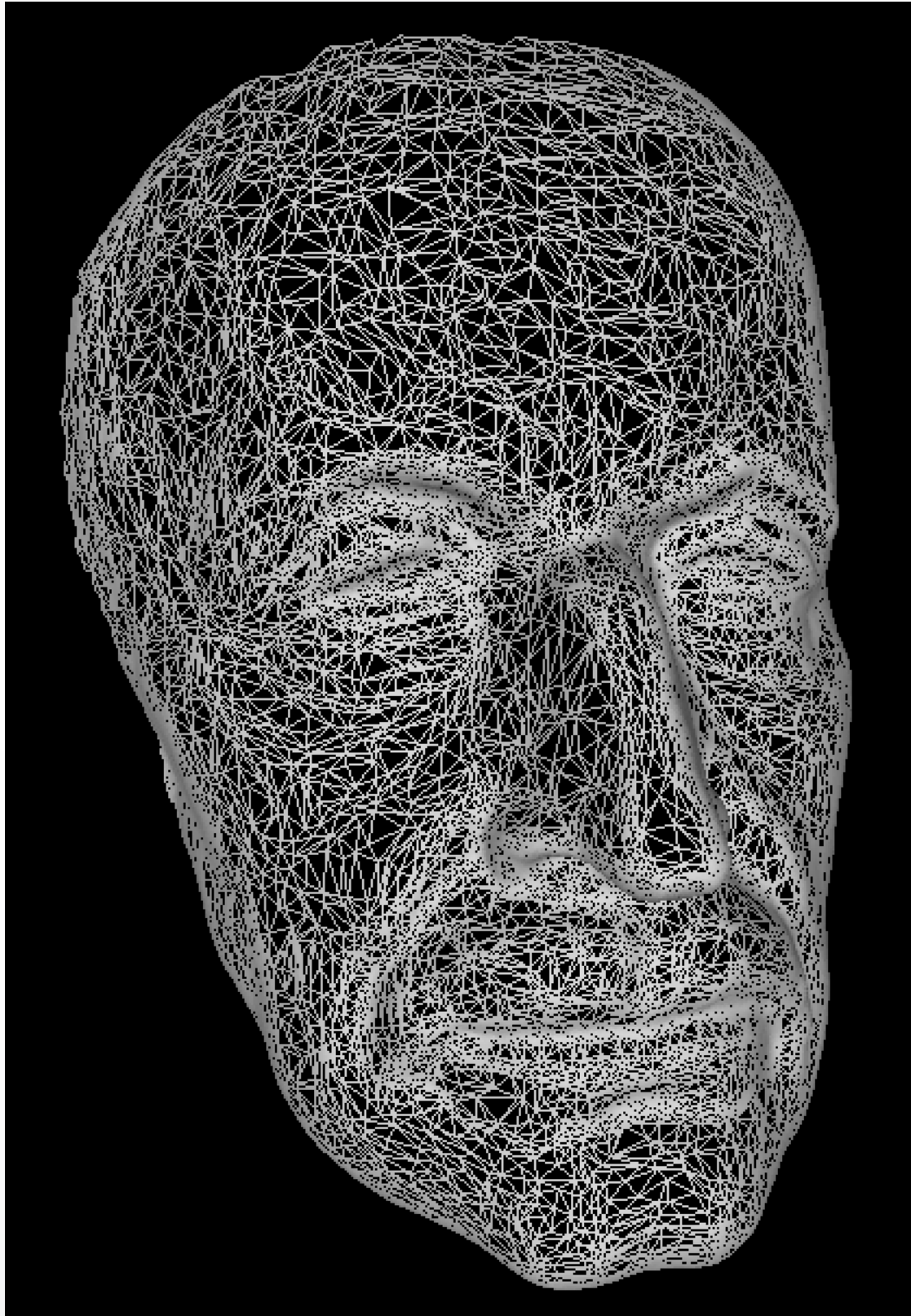
Result



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: **Apr 24, 2018 12:00pm (noon)**
- Upload a .zip compressed file named “Exercise6-YourName.zip” to Blackboard
- Include a “read.txt” file describing how you solve each exercise and the encountered problems

Contact

- Office Hours: Monday 3:00 - 4:00pm, PHE 108
- email: tianyeli@usc.edu
- Highly recommended to post your question on Piazza

<http://cs621.hao-li.com>

Thanks!

