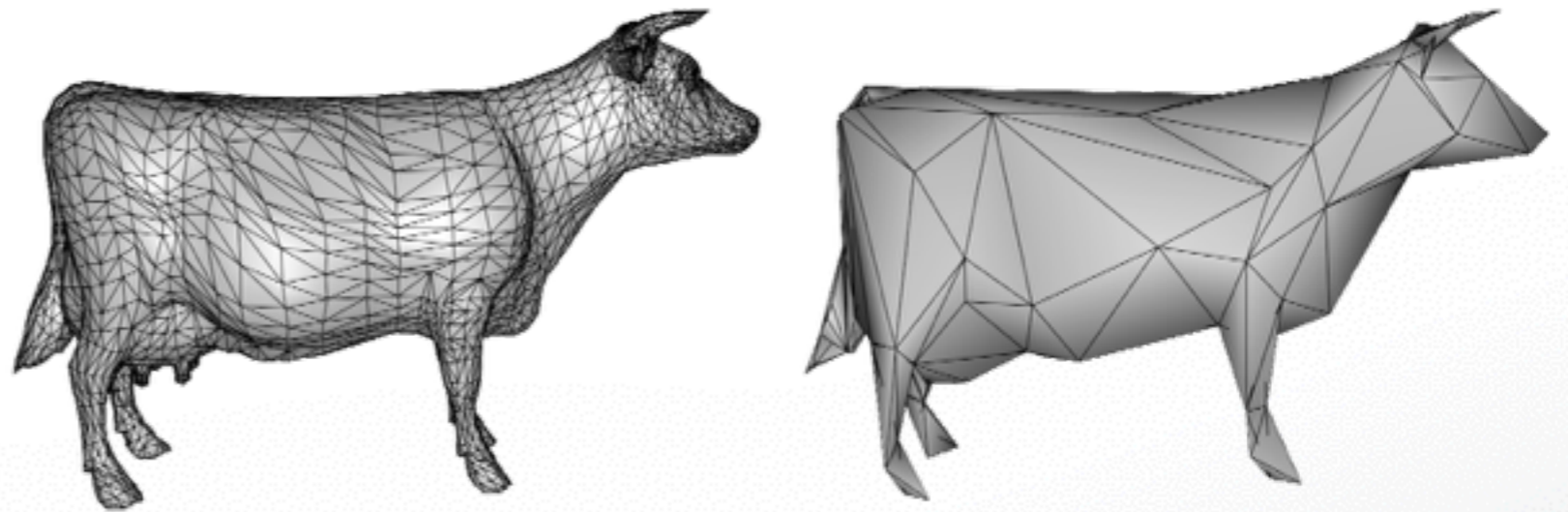


Spring 2015

CSCI 599: Digital Geometry Processing

Exercise 5. Mesh Decimation



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

Mesh Decimation

- Vertex clustering
- **Iterative decimation**
 - **Initialize error quadrics [Garland, Heckbert 97]**
 - **Construct priority queue**
 - **Edge collapse**

Error Quadrics

- Sum of squared distances to planes

$$\mathbf{p} = (x, y, z, 1)^T, \quad \mathbf{q} = (a, b, c, d)^T$$

$$\text{dist}(\mathbf{q}, \mathbf{p})^2 = (\mathbf{q}^T \mathbf{p})^2 = \mathbf{p}^T (\mathbf{q}\mathbf{q}^T) \mathbf{p} =: \mathbf{p}^T \mathbf{Q}_q \mathbf{p}$$

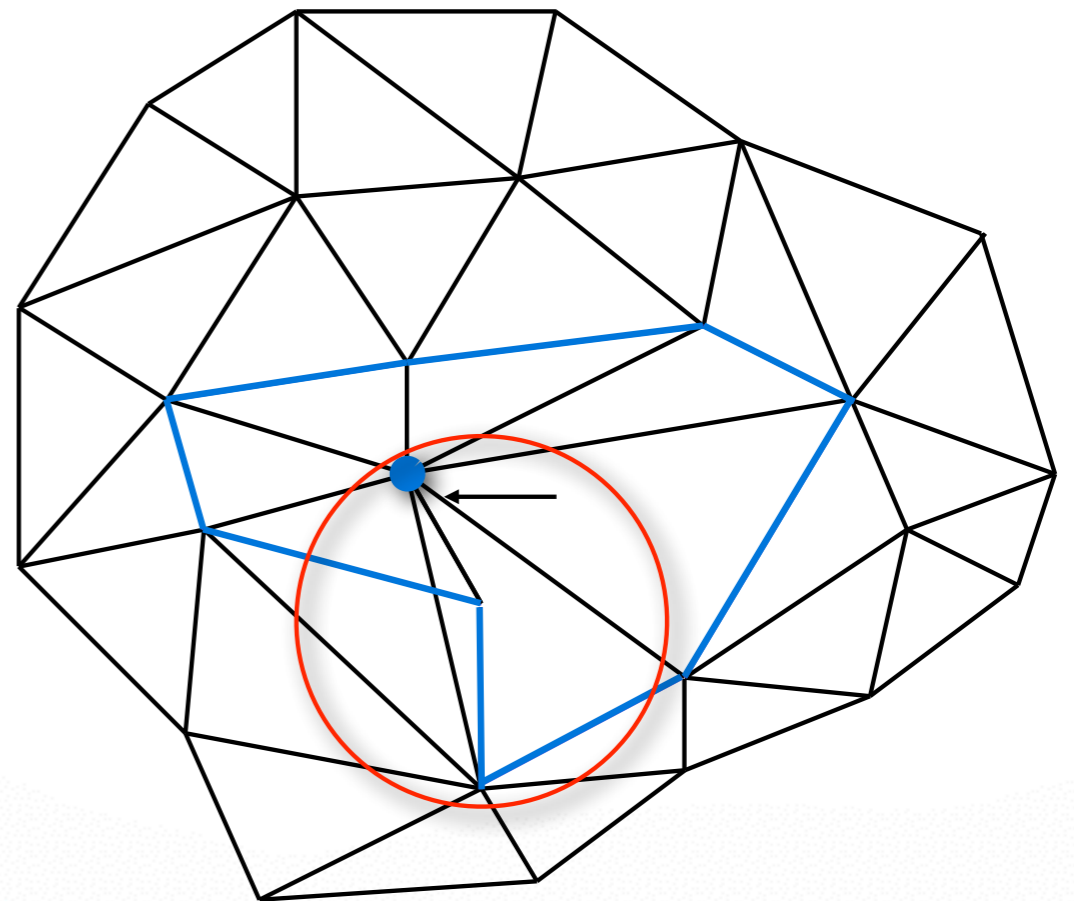
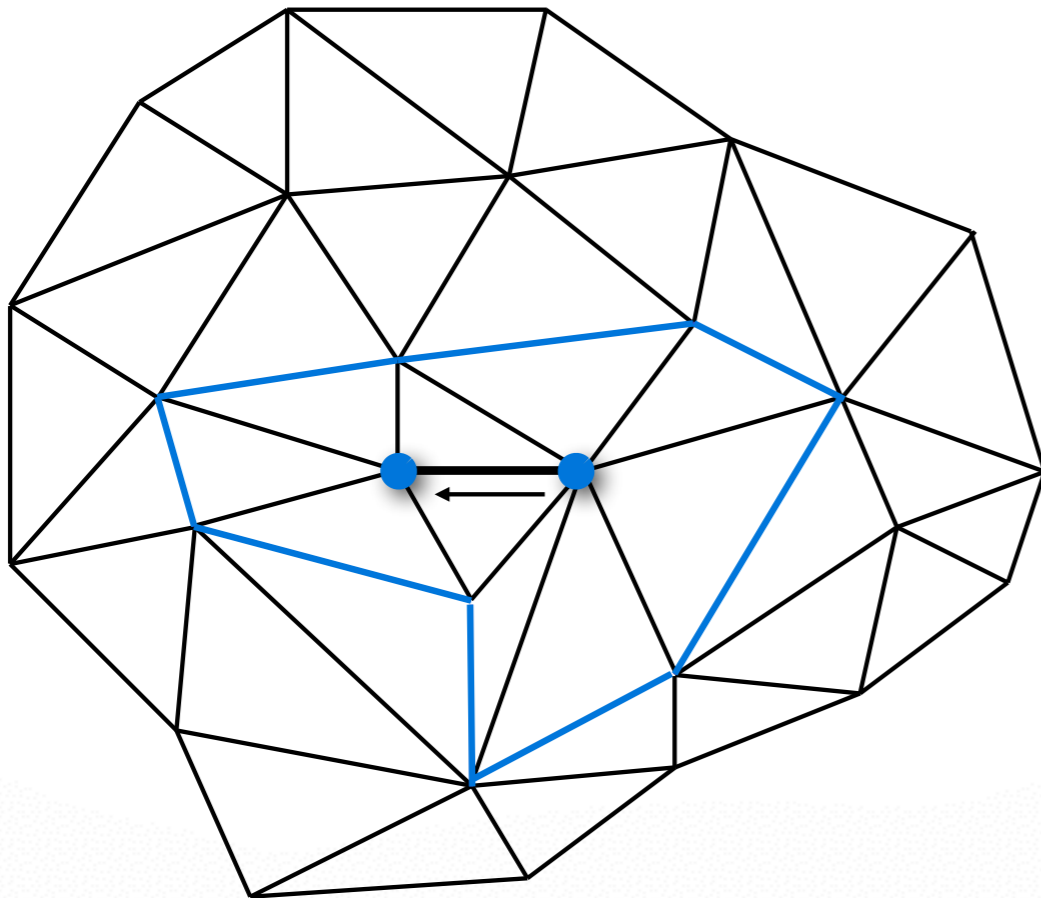
- After collapsing edge, simply add the corresponding quadrics $\mathbf{Q}_3 = \mathbf{Q}_1 + \mathbf{Q}_2$
- `init()` in `deci.cc`

Priority Queue

- Pick an adjacent halfedge (or target vertex) to collapse for each vertex
 - avoid edge flipping
 - sort by contraction error

Priority Queue

- Avoid normal flipping
 - test if normal is flipped after edge collapse
 - `is_collapse_legal()` in `deci.cc`



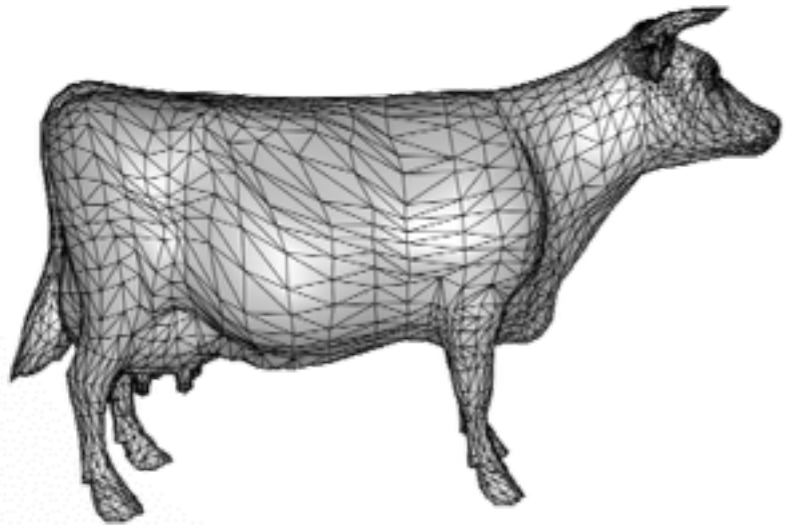
Priority Queue

- Update priority by the **contraction error** defined by the error quadrics
- `priority()` in `deci.cc`

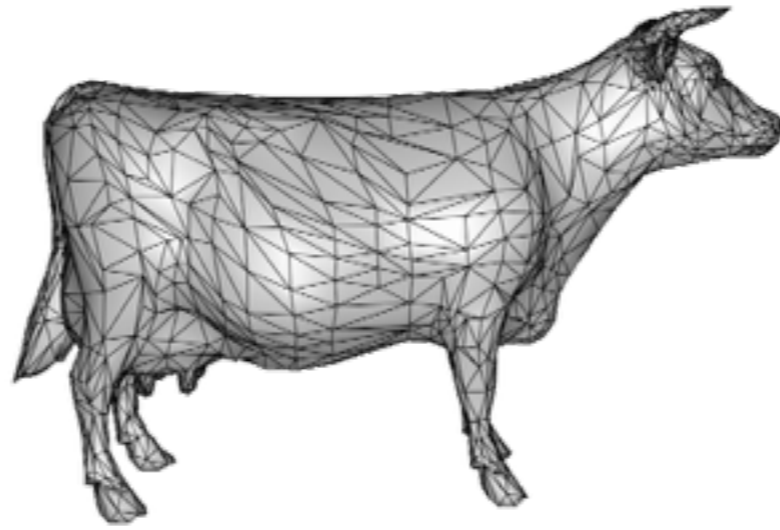
Edge Collapse

- Pop the first element from the queue
- Perform collapse
- Update queue
- `decimate()` in `deci.cc`

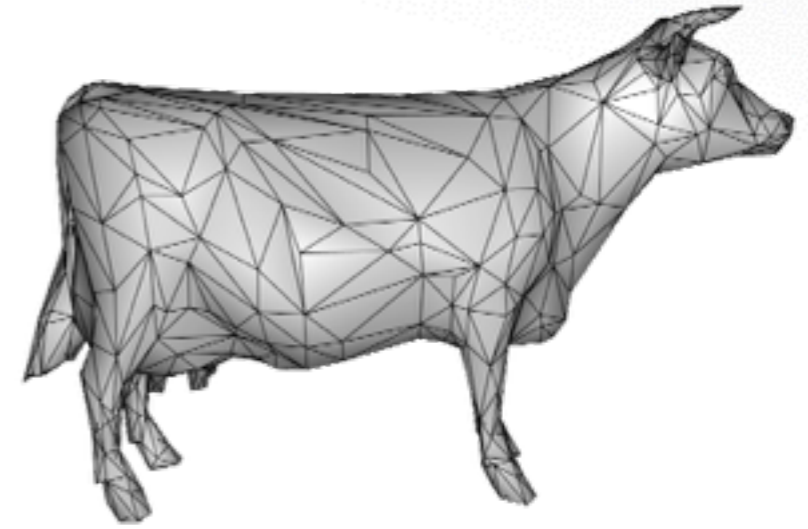
Result



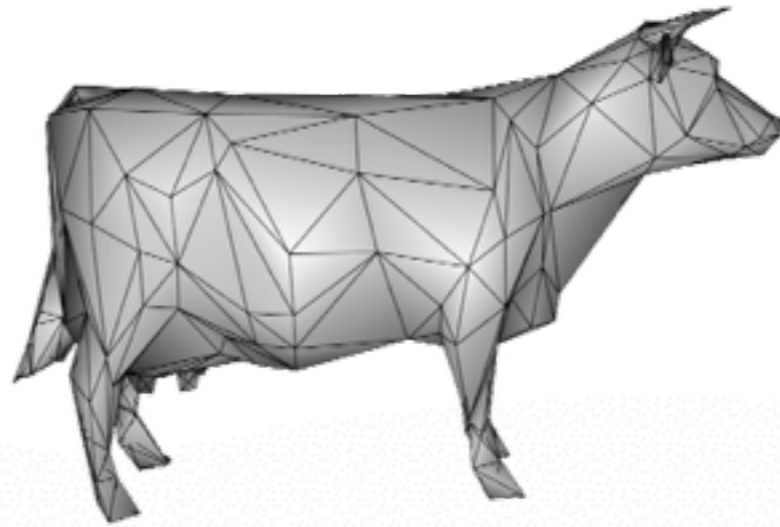
original



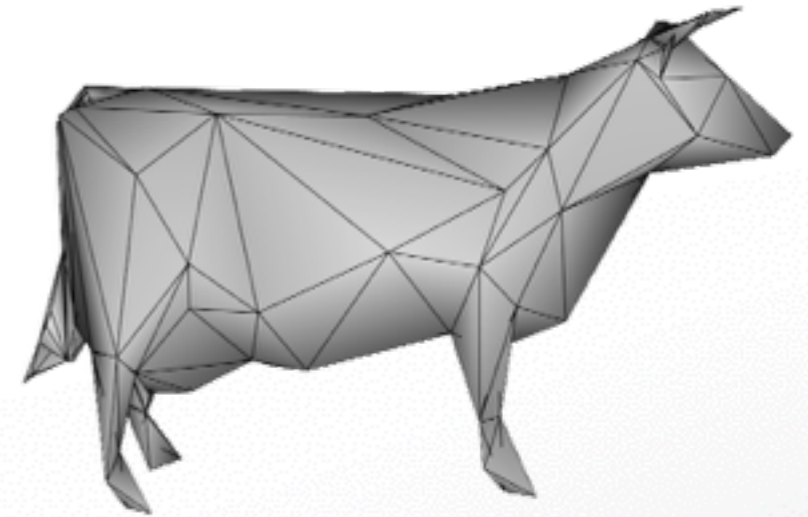
50%



20%



10%

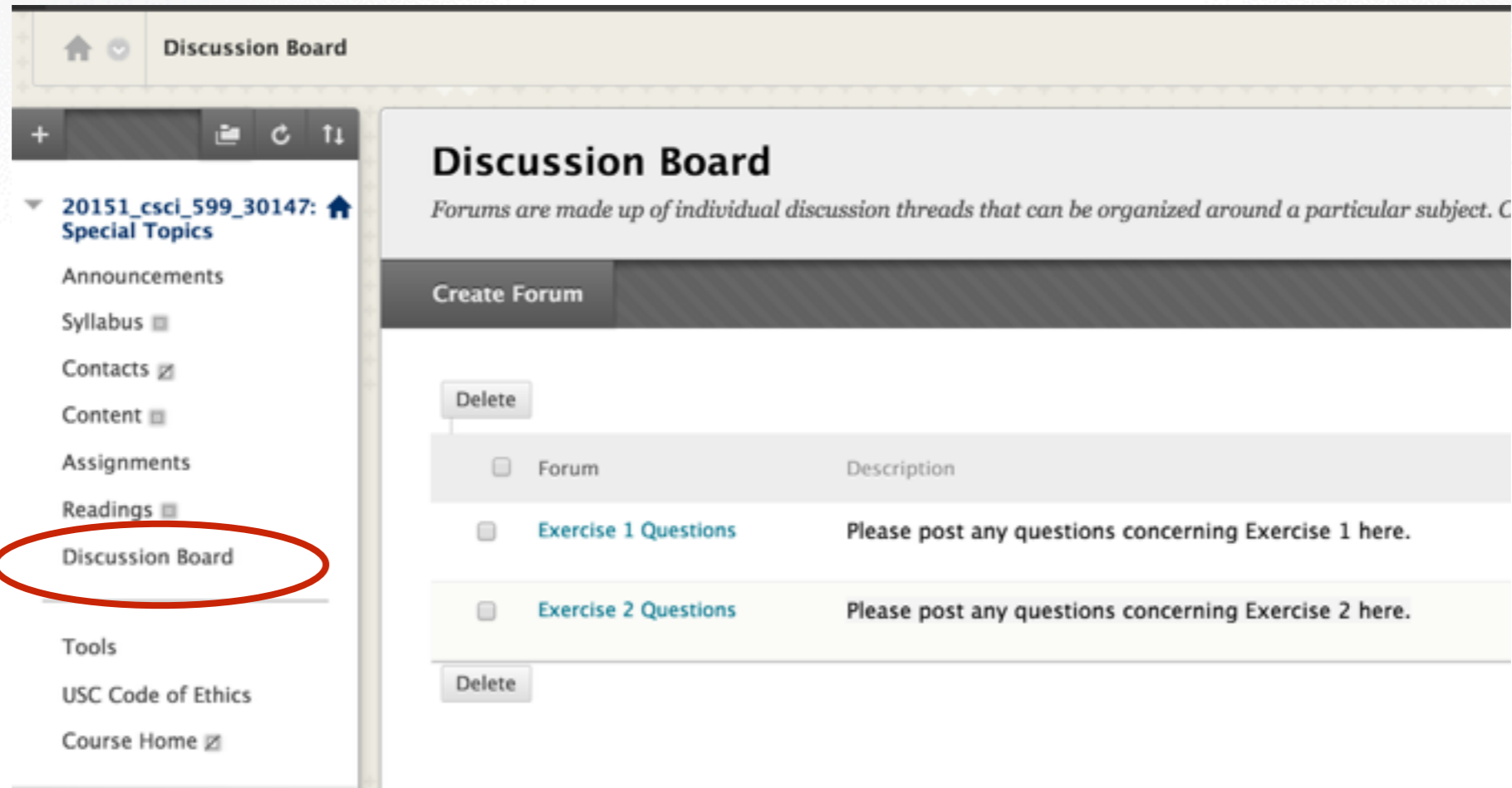


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Submission

- Deadline: **Wednesday, March 25, 2015 11:59pm**
- Upload a .zip compressed file named “Exercise5-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!

