

# CV 804: 3D RENDERING & GEOMETRY PROCESSING

**WEEK 16 / EXERCISE 7: Mesh Decimation**

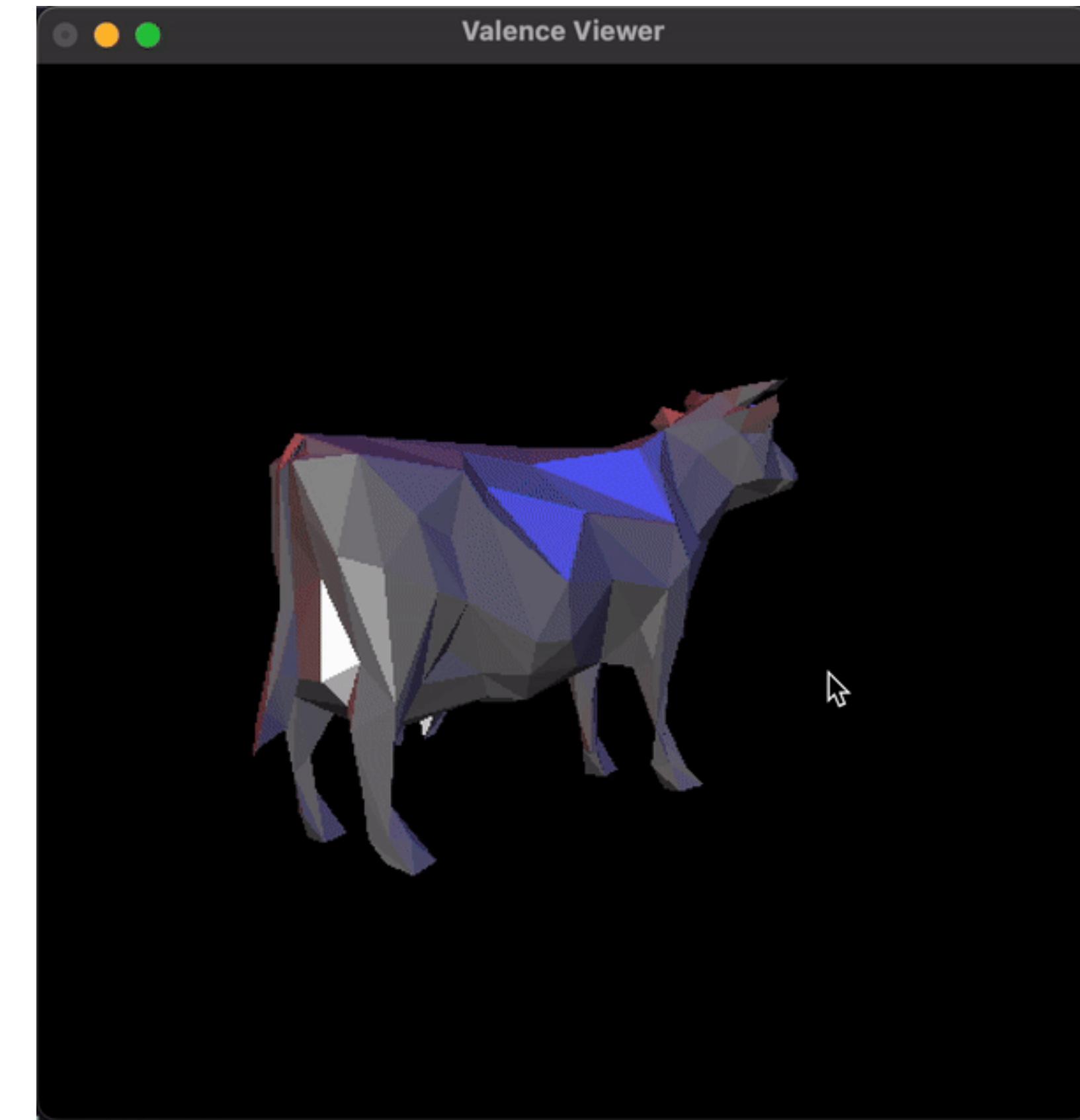
Lecturer: Hao Li

TAs: Phong Tran, Long Nhat

# Mesh Decimation

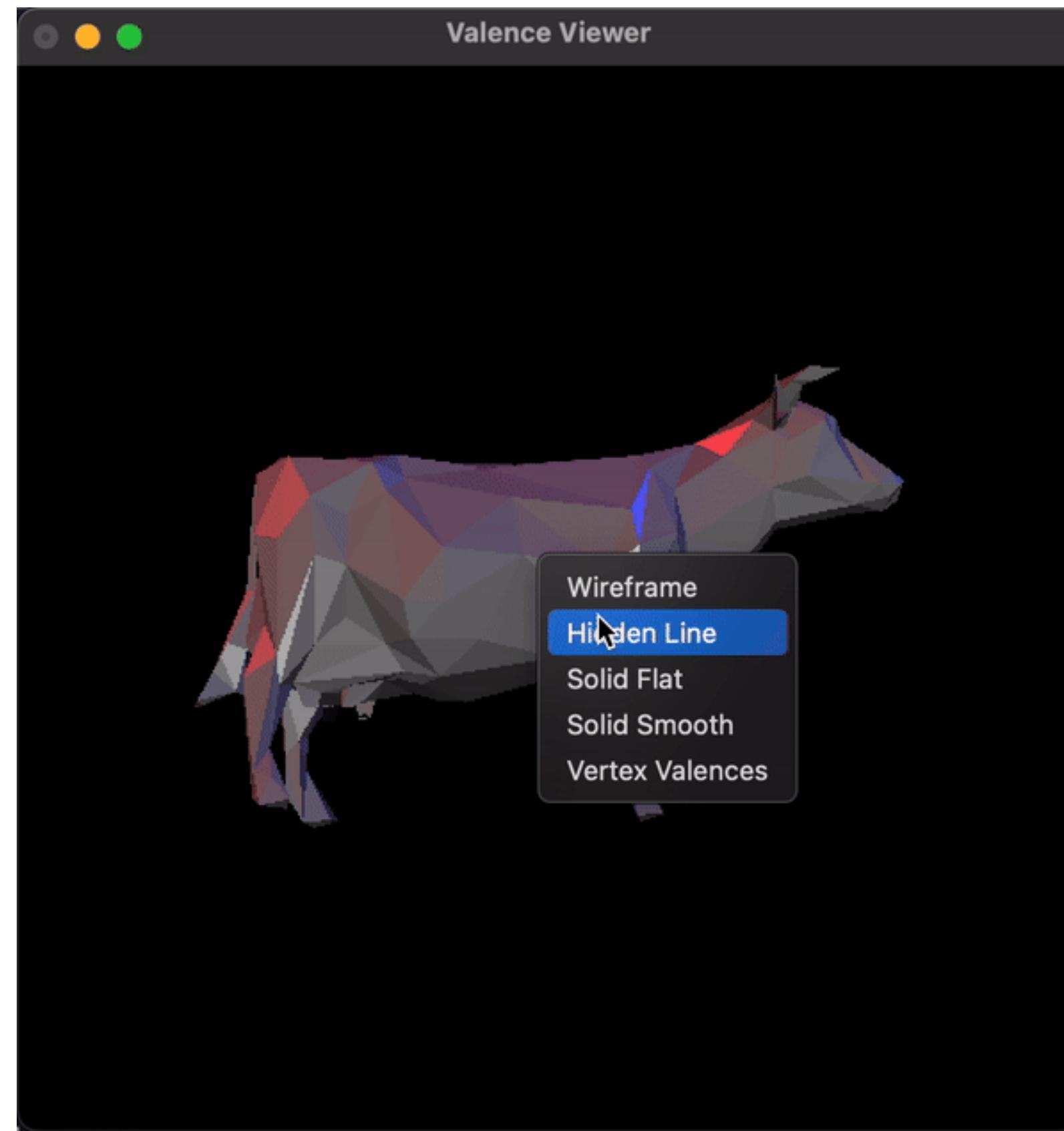


The original mesh



Simplified mesh (10%)

# Surface Registration: GUI



- Support multiple rendering mode
- Use right-click to change rendering mode

# Compiling the code

- Same dependencies as the second exercise
  - CMake, OpenGL, OpenMesh
  - Step 1: Mesh decimation
  - Step 2: View the generated mesh and record the screen

# Task 1: Initialization

- Sum of squared distances to planes

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

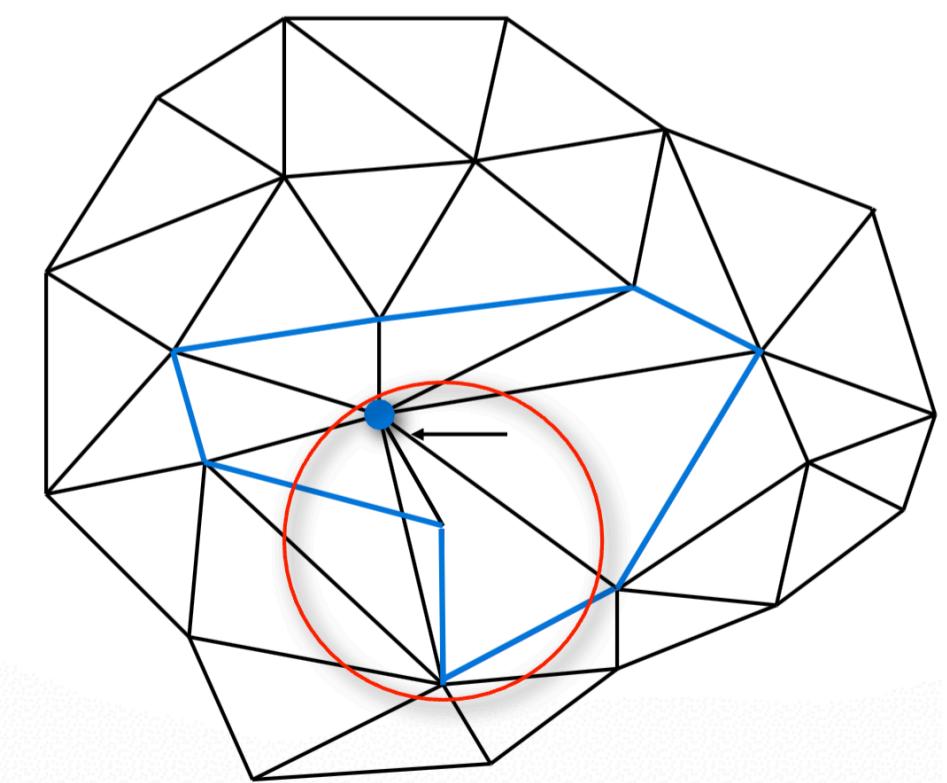
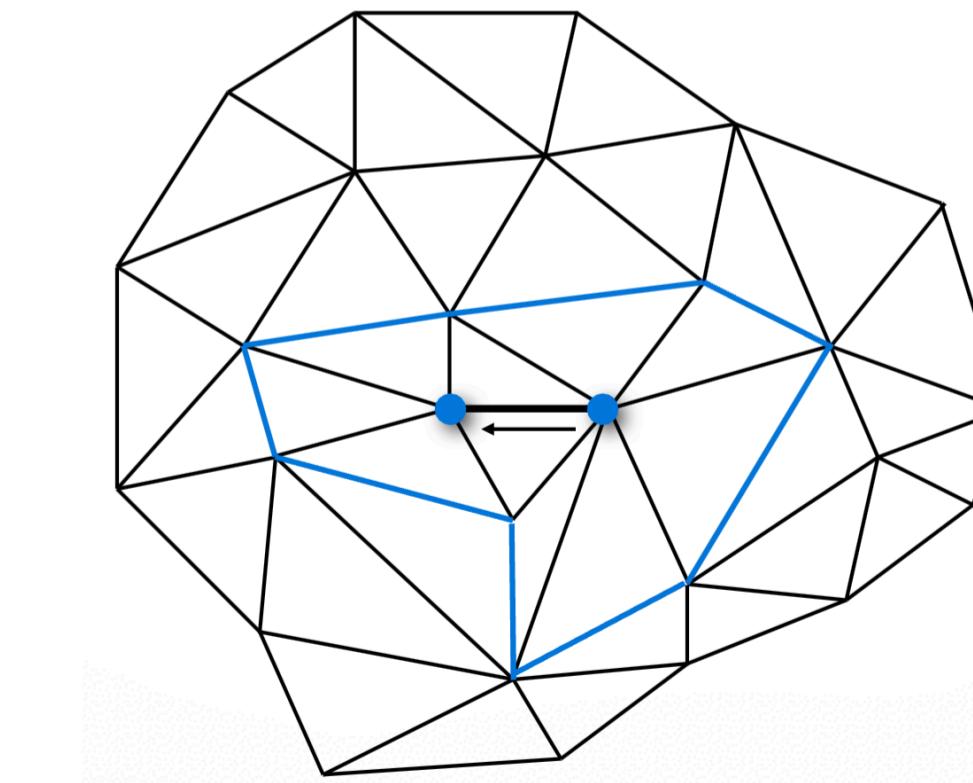
$$\text{dist}(p, q)^2 = (q^T p)^2 = p^T (q q^T) p$$

$$Q_v := \sum_i (q_i q_i^T)$$

- `init()` and `priority()` in `deci.cpp`

## Task 2: Avoid normal flipping

- Avoid normal flipping
- `is_collapse_ok(Mesh::halfedgeHandle)`
- If the normal vector of a new triangle changes by more than  $\pi/4$ : do not collapse
- `is_collapse_legal()` in `deci.cpp`



# Task 3: Calculate the approximation error

- Cost for collapsing  $v_1 \rightarrow v_2$ :  
$$p_{v_2}^T(Q_{v_1} + Q_{v_2})p_{v_2}$$
- priority() in deci.cpp

## Task 4: The main loop

- Maintain a priority queue of best halfedges (defined by the priority function)
- For each step:
  - Pop the first element from the queue
  - Perform edge collapsing
  - Update the queue
- `decimate()` in `deci.cpp`

# Submission

- Deadline: **Tuesday 8th May, 11:59 pm**
- Upload a .zip compressed file named “Exercise7-YourName.zip” to Moodle
- Include your code with comments
- Include a readme file:
  - Describe how you solved each exercise, using same exercise numbers (1.1 - 1.3) and titles as in handout
  - Describe problems you encountered
- Include JPEG frames or a video

# Contact

## INSTRUCTOR

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- Office: Building 1B, 1st floor (please schedule first)

## TEACHING ASSISTANTS

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## OFFICE HOURS

- \* Office Hours: TBD, will be posted soon
- \* Emails (include “CV804” in title)



QUESTIONS?

[www.hao-li.com](http://www.hao-li.com)

THANKS!



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