COMP5411 Report: Mesh contraction of the skeleton extraction

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1. Methodology

The implementation of the Bonus part is a reproduction of the paper Skeleton Extraction by Mesh Contraction **[1]**. According to the method in the paper, we can generate the Laplacian matrix:

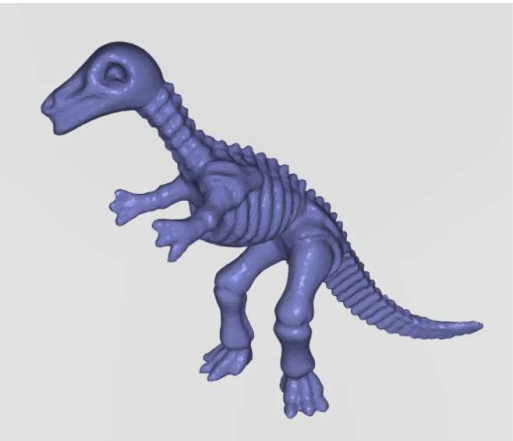
$$L_{ij} = \begin{cases} \omega_{ij} = \cot\alpha_{ij} + \cot\beta_{ij}, & if\ (i,j) \in E \\ \sum_{(i,k)\in E}^{k} -\omega_{ik}, & if\ i = j \\ 0, & otherwise \end{cases}$$

In the least-squares sense, our goal of mesh contraction is to solve the equation below using a similar method in Laplacian Mesh Editing.

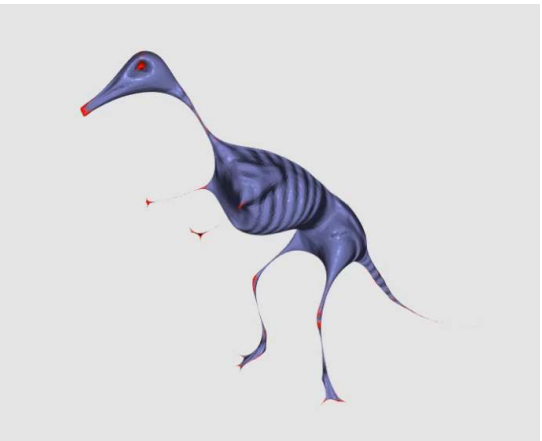
$$\begin{bmatrix} W_L L \\ W_H \end{bmatrix} V' = \begin{bmatrix} 0 \\ W_H V \end{bmatrix}$$

We update the parameter by $W_L^{t+1} = S_L W_L^t, S_L = 2, W_L^0 = 1$ for this operation, S_L is changeable for other scenarios. And $W_{H,i}^{t+1} = W_{H,i}^0 \sqrt{\frac{A_i^0}{A_i^t}}, A_i^0 = 10^{-3}\sqrt{A}$, where A is the average face area of the model and A_i^t denotes the current (t iteration) one-ring areas of vertex i.

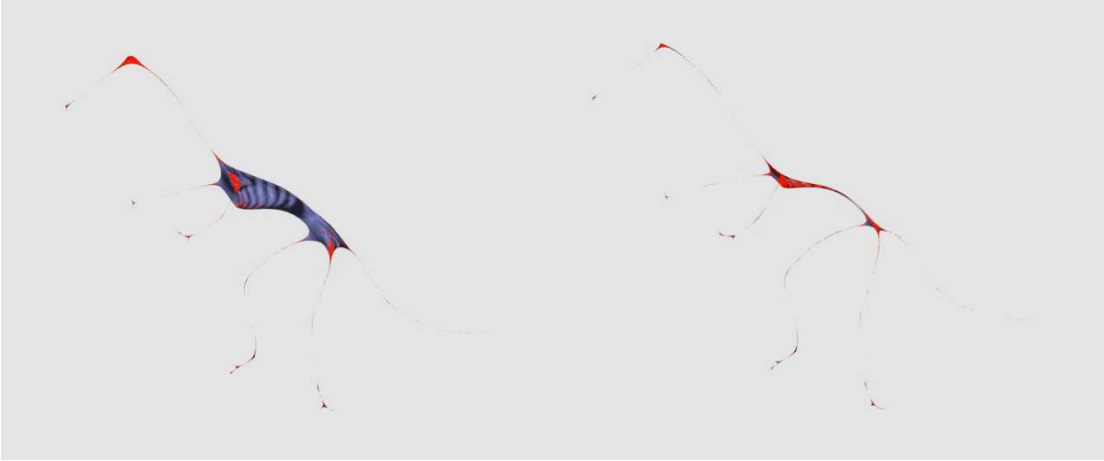
2. Results



(Fig 1) The original mesh



(Fig 2) 3-iterations of the mesh



(Fig 3) 5-iterations of the mesh

(Fig 4) 6-iterations of the mesh

Reference

[1] O. K.-C. A. a. C.-L. T. a. H.-K. C. a. D. C.-O. a. T.-Y. Lee, "Skeleton Extraction by Mesh Contraction," ACM Trans. Graph., vol. 27, no. 3, 2008.