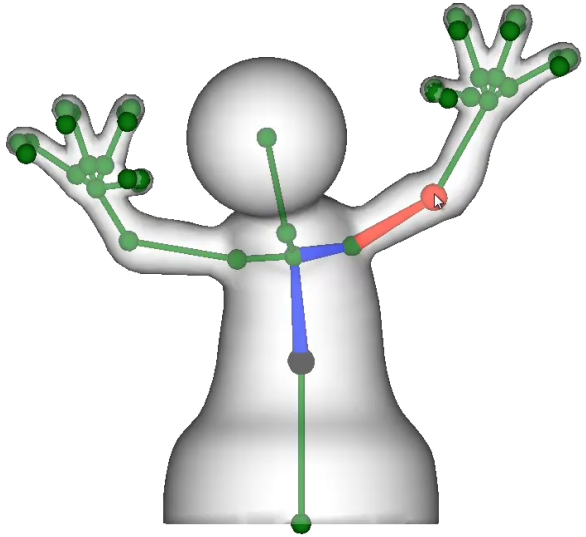
RigMesh: Automatic Rigging for Part-Based Shape Modeling and Deformation

Péter Borosán
Ming Jin
Doug DeCarlo
Yotam Gingold
Andrew Nealen



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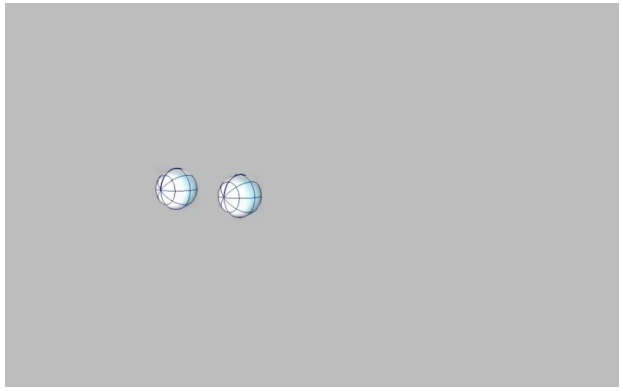
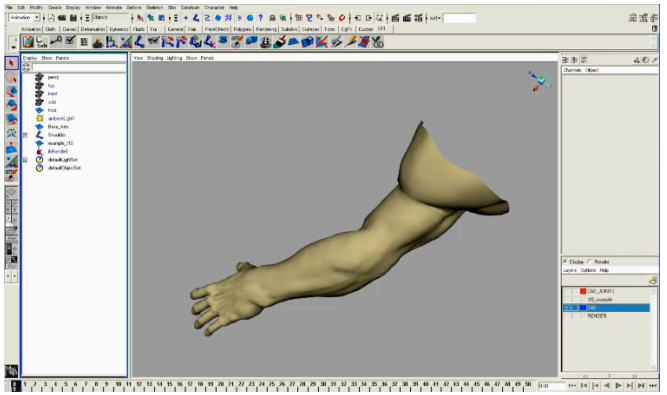
Problem





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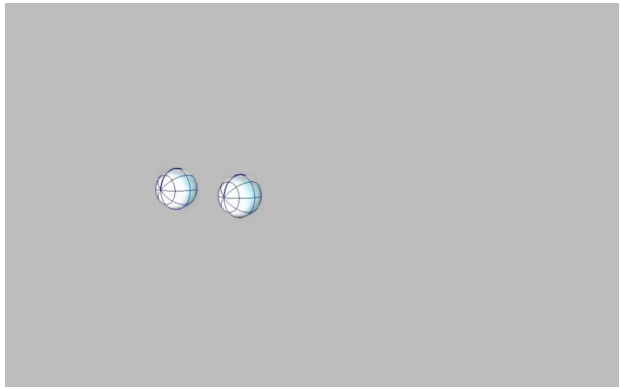
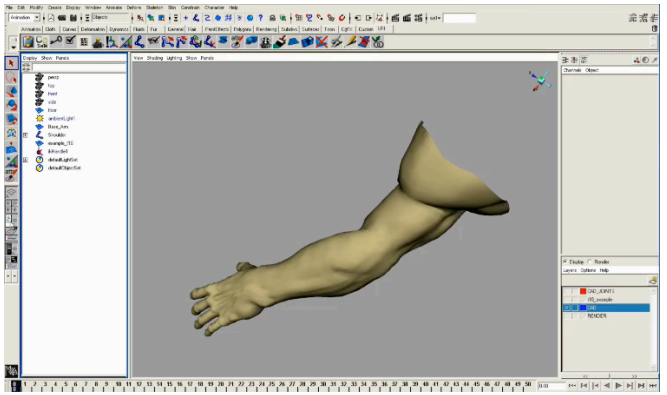
- Creating ready-to-animate 3D models is **hard**





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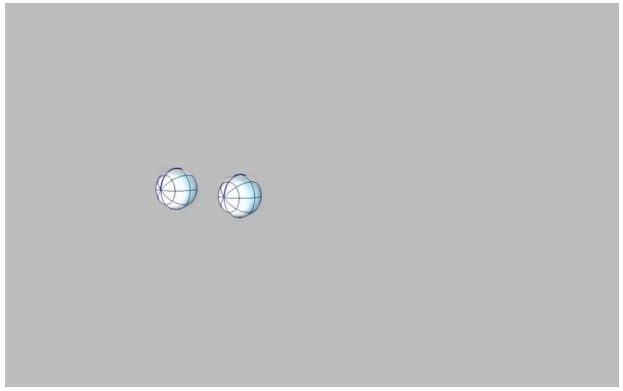

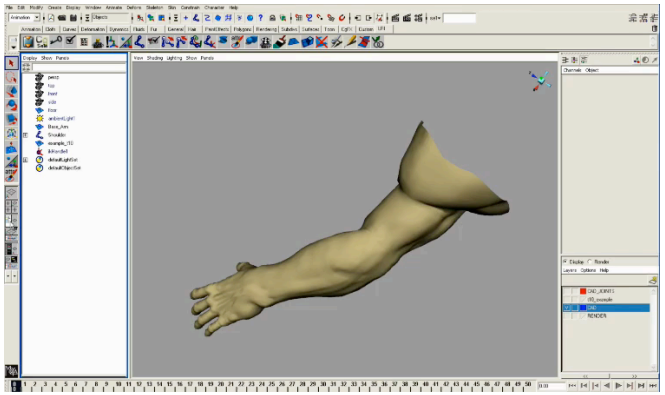

[youtube user: MasahiroUshiyama]

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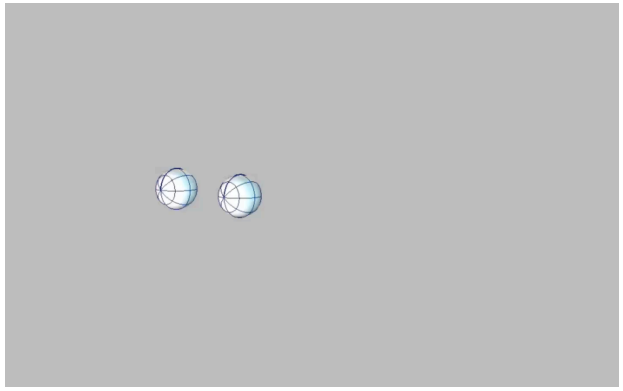

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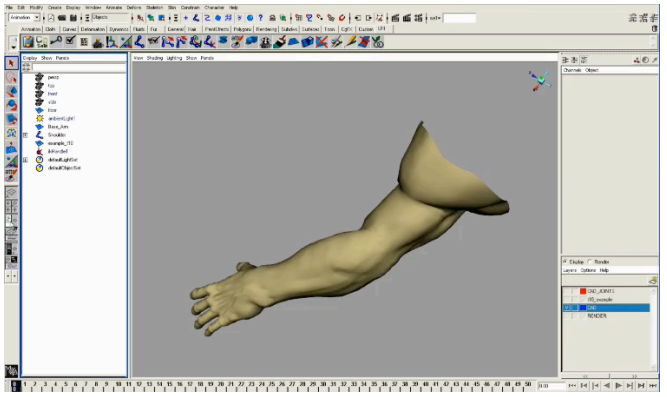
Rigging



[Weber et al. 07]

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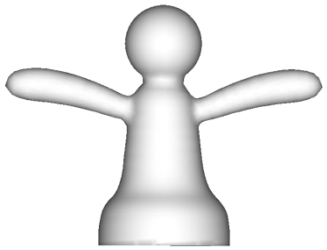

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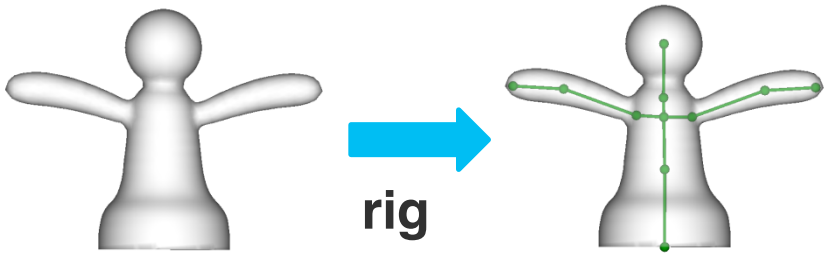

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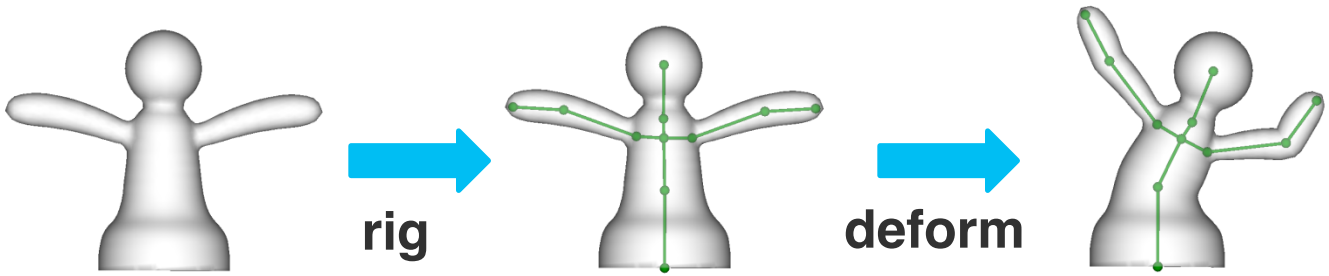

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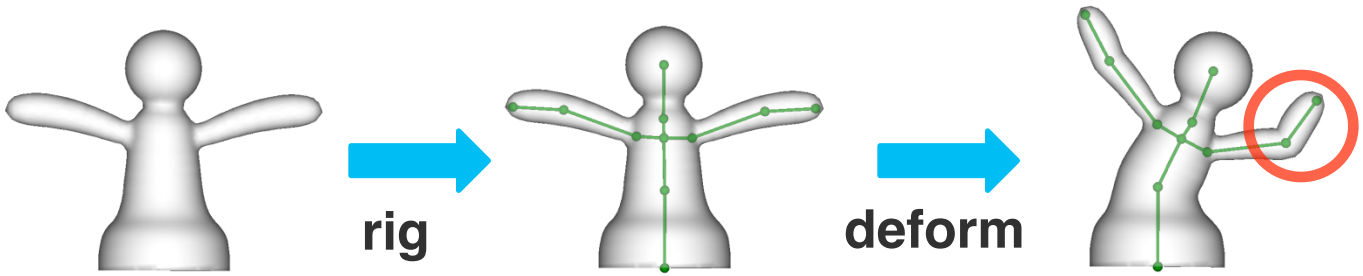

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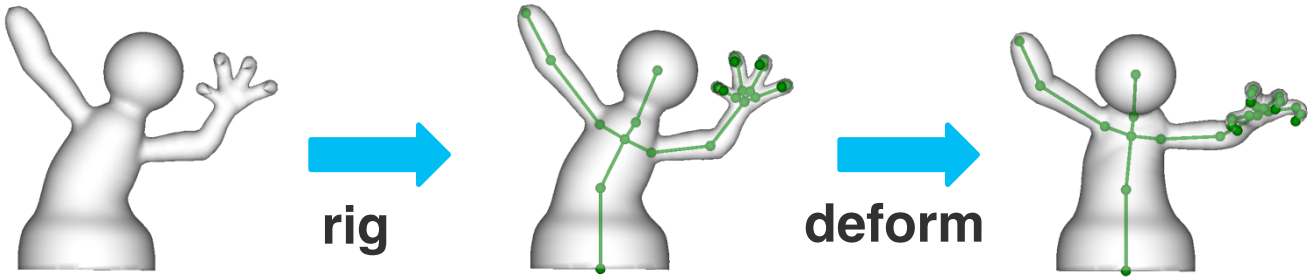

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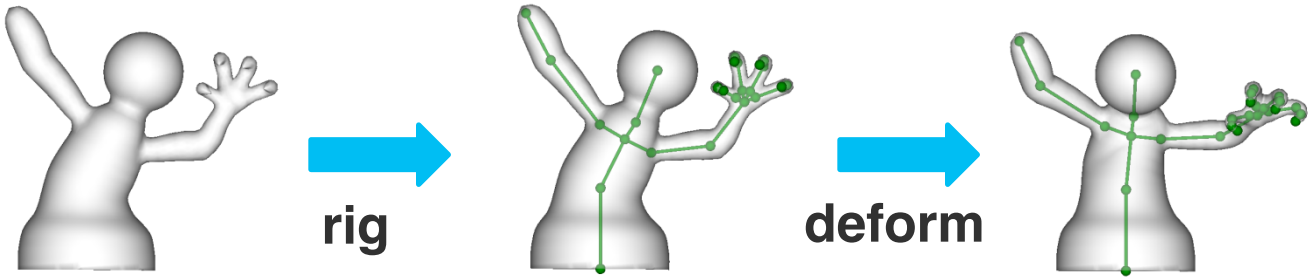

- Fundamental problem: static sequential pipeline

Sketch-based Modeling

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- Teddy [Igarashi et al. 99]

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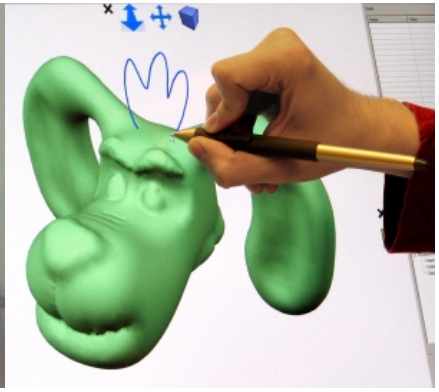
- ShapeShop [Schmidt et al. 05]



Sketch-based Modeling

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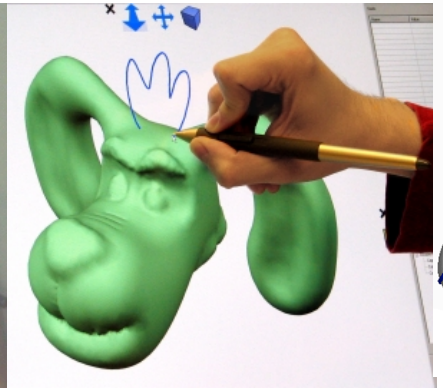

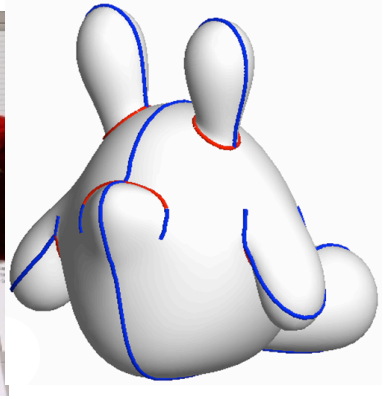

Sketch-based Modeling

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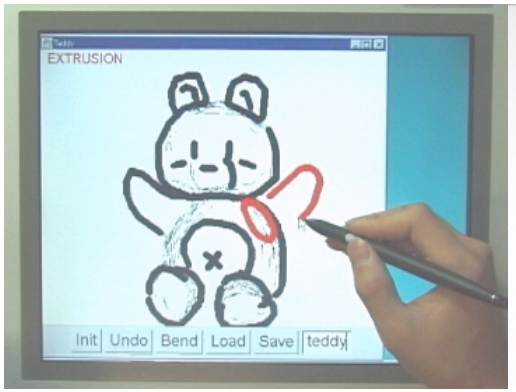
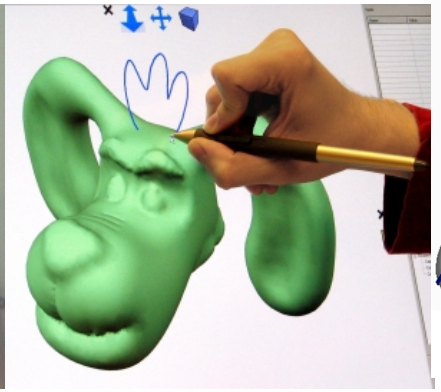
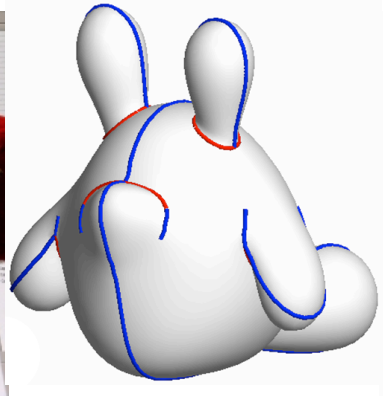
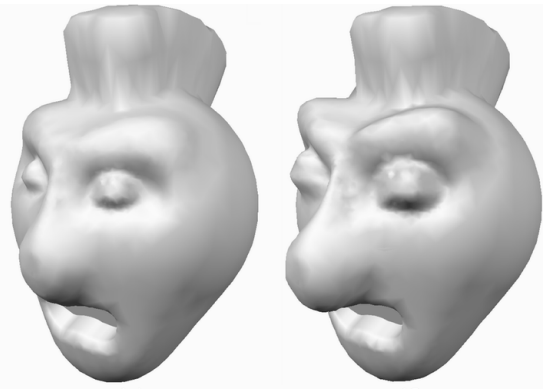
- SurfaceTrees [Schmidt and Singh 08]



Automatic Rigging

Automatic Rigging

- Skeleton extraction

  [Sharf et al. 07] [Pan et al. 09] [Ju et al. 11]

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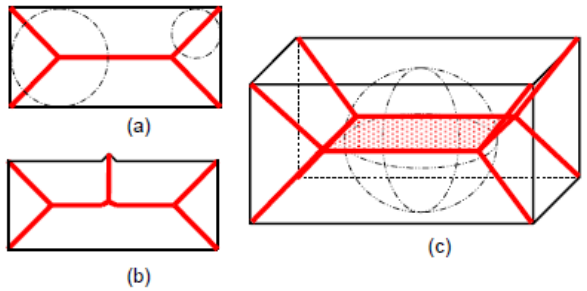

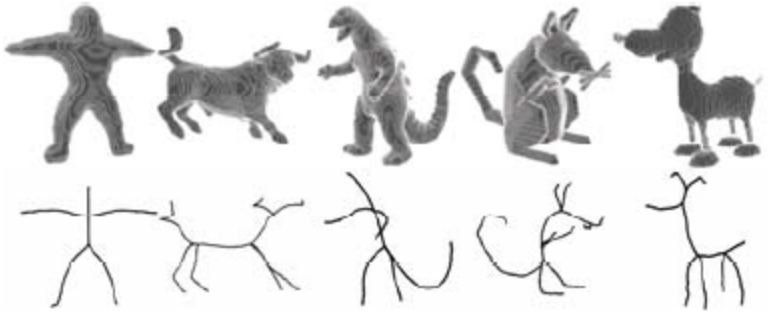

[Cornea et al. 07]

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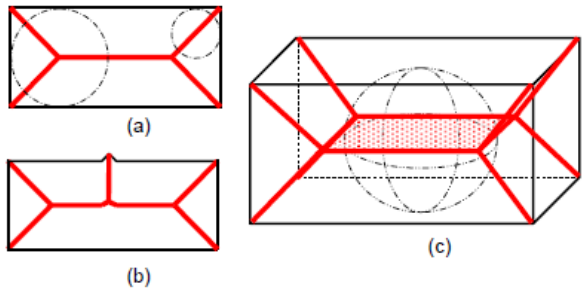
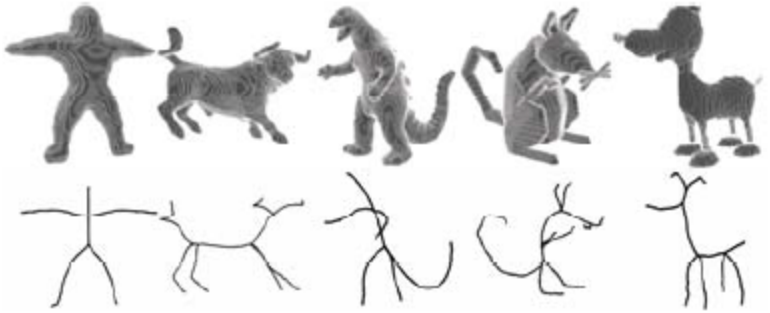
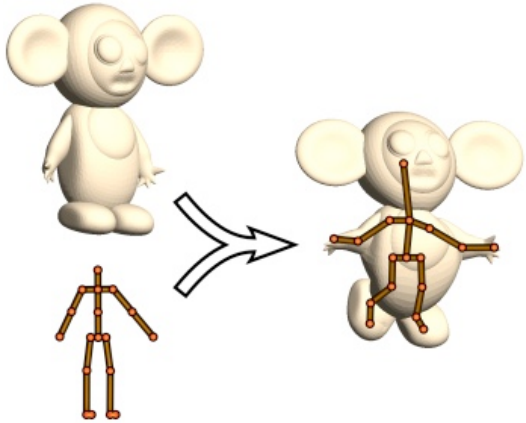




[Cornea et al. 07]

- Automatic skinning

  Pinocchio [Baran and Popović 07]



Solution?

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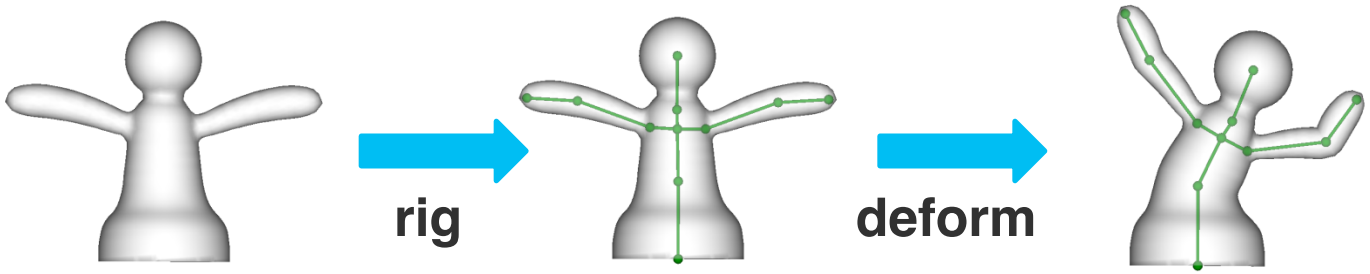

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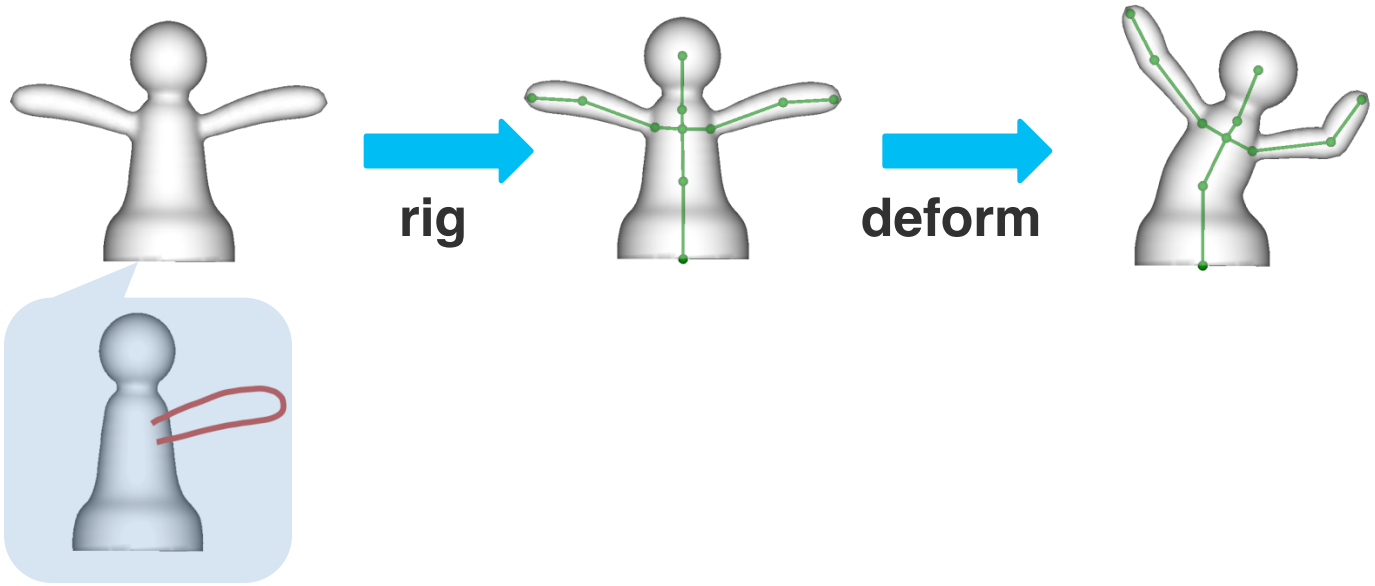

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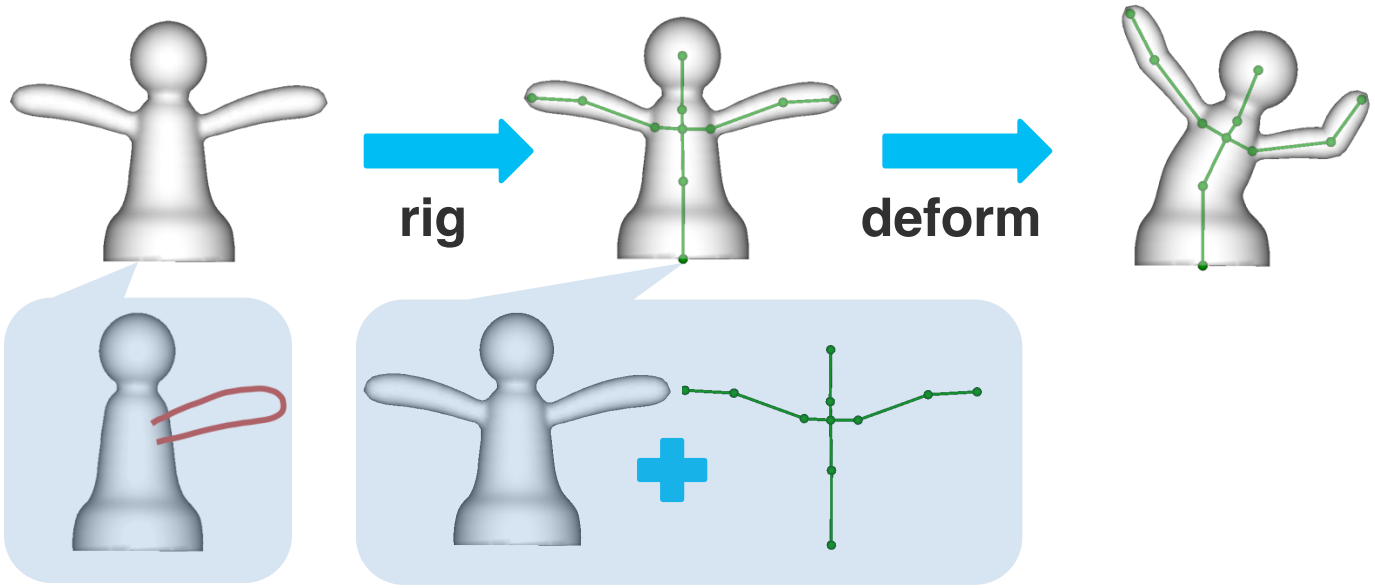

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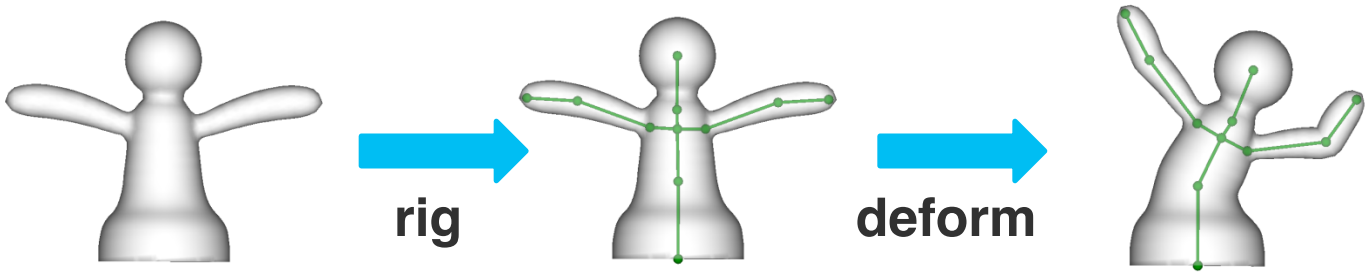

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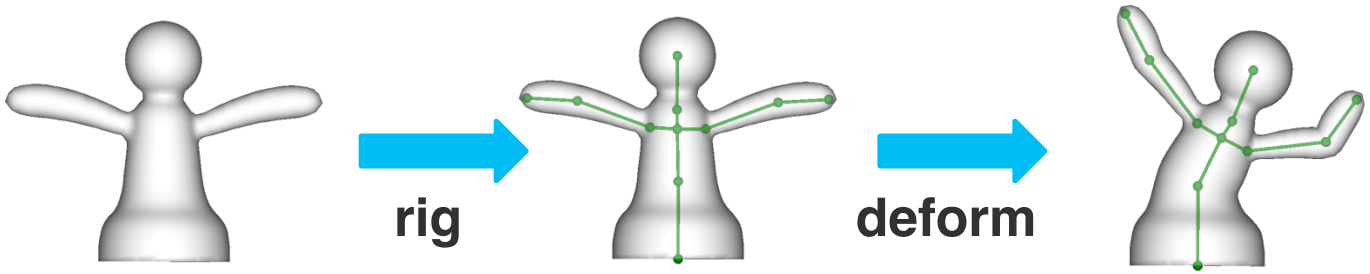

Models rigged at all times

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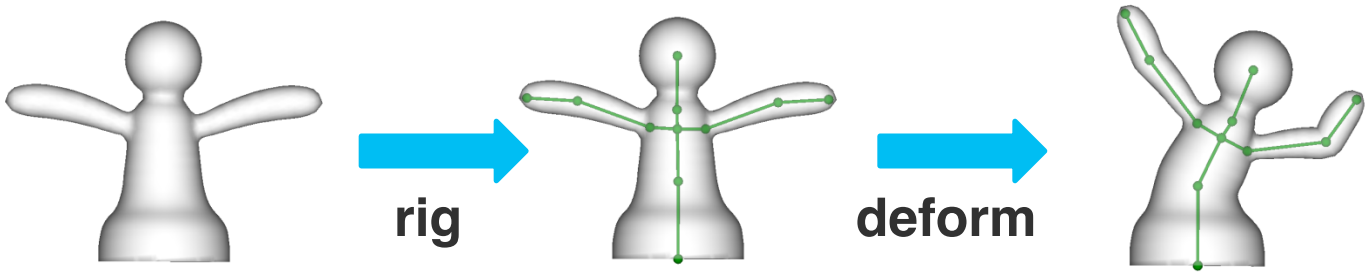

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- **Non-linear editing**

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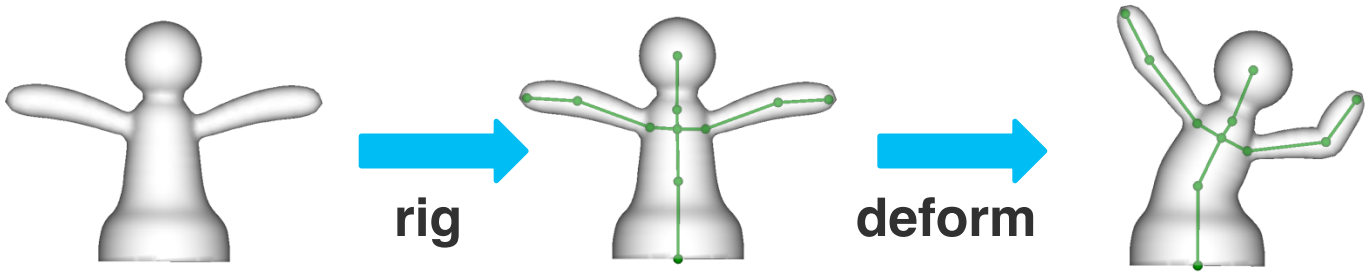

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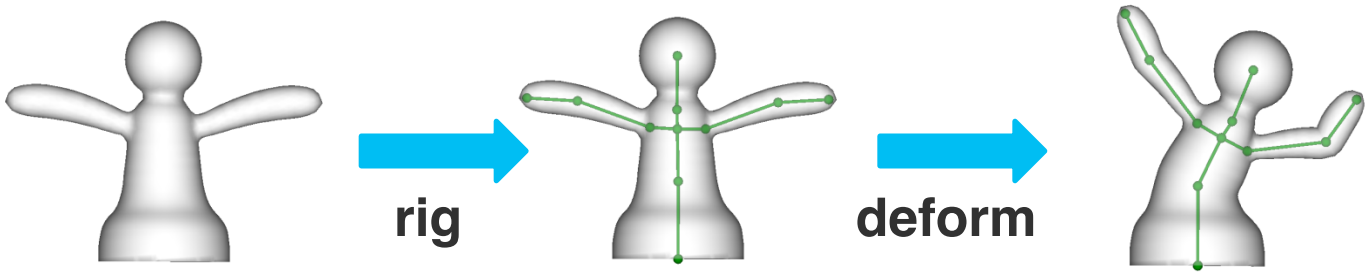

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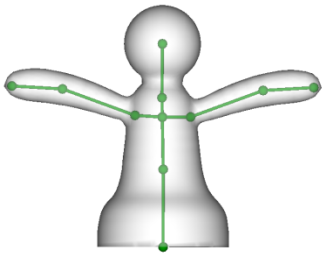

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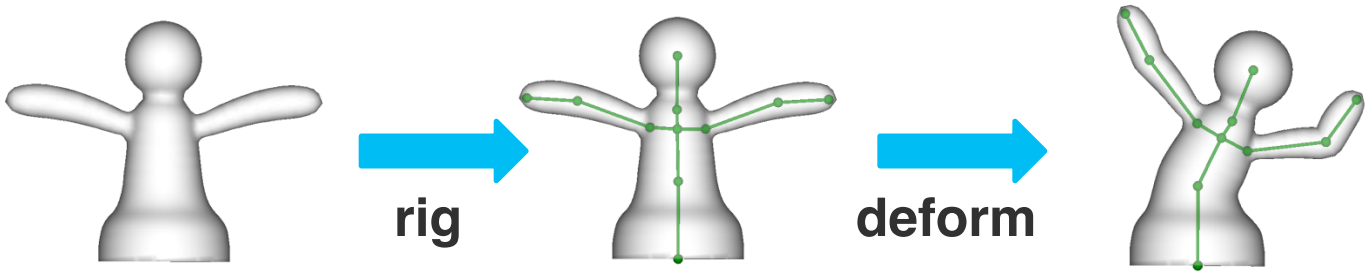

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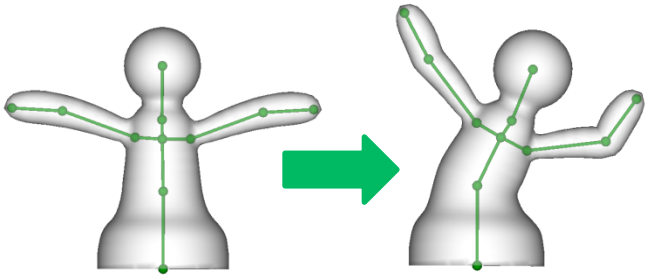

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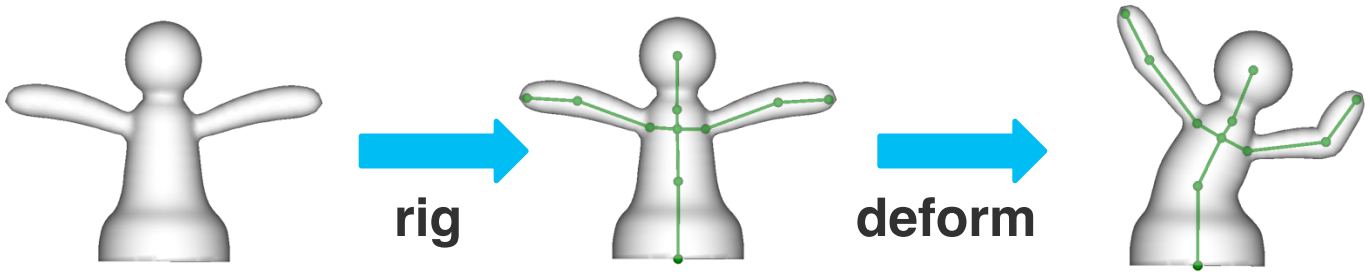

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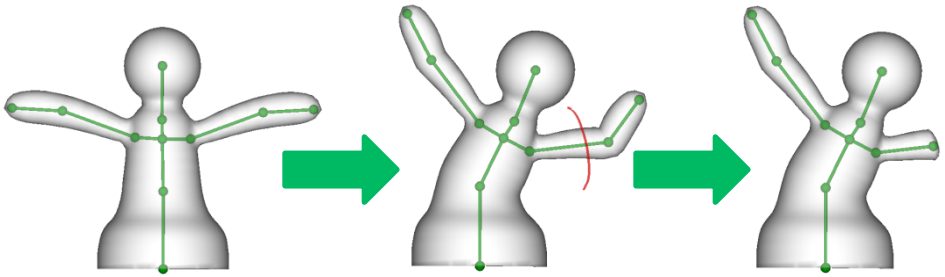

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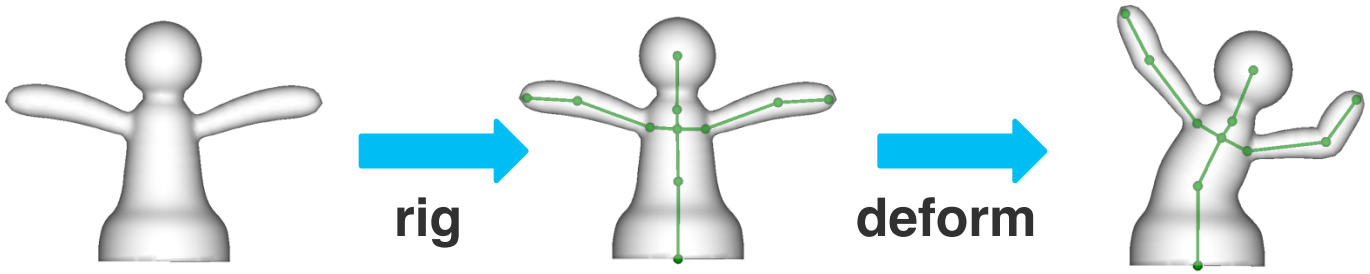

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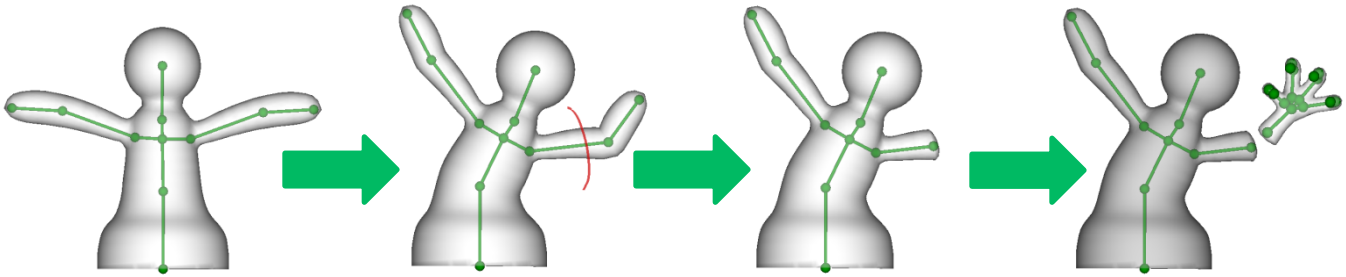

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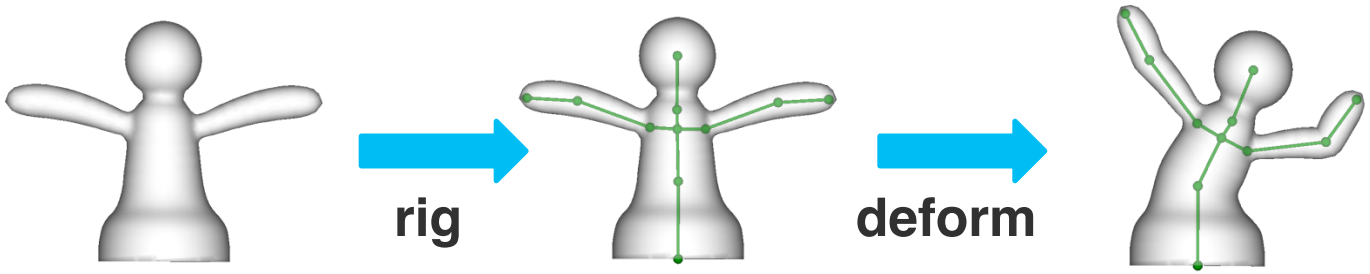

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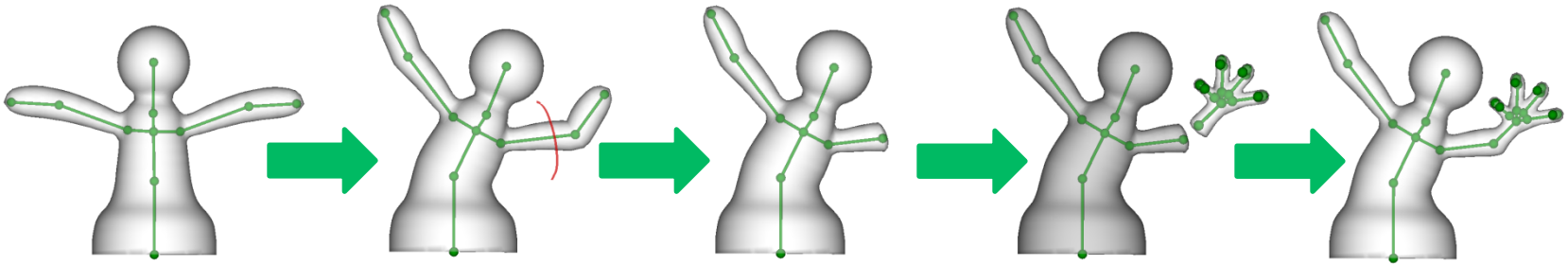
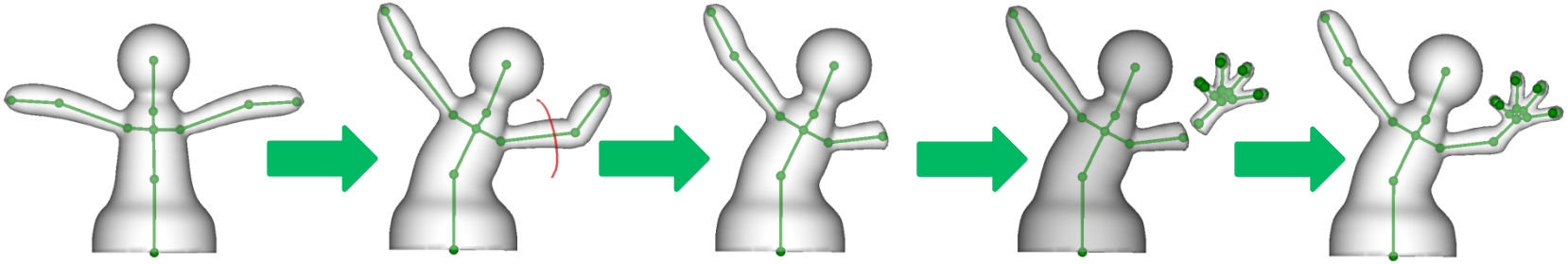


RigMesh
Contributions

Models rigged at all times

- **Non-linear editing**
- **Modeling by parts**

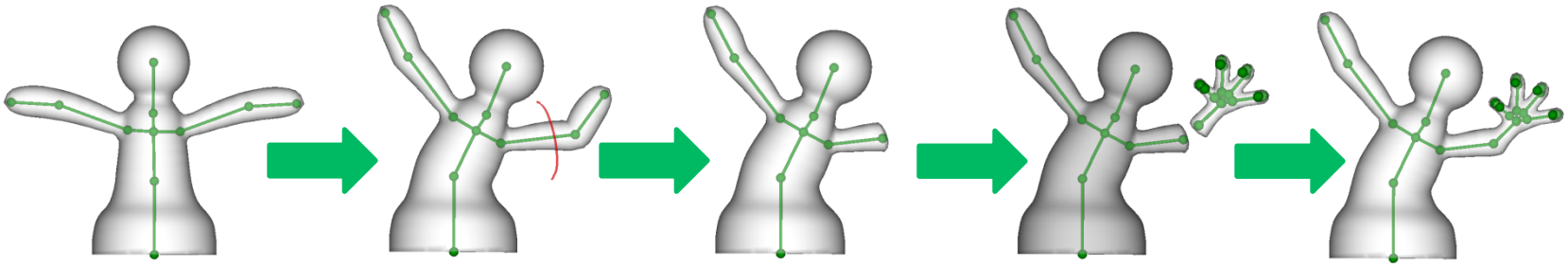


RigMesh

Contributions

Models rigged at all times

- Non-linear editing
- Modeling by parts: Sketch, Cut & Merge

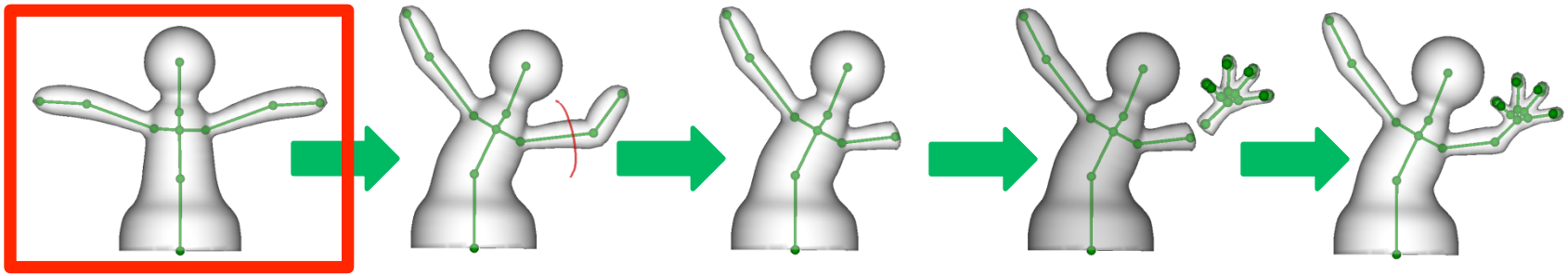


RigMesh

Contributions

Models rigged at all times

- Non-linear editing
- Modeling by parts: Sketch, Cut & Merge
- Automatically determining skeletal structure from sketch

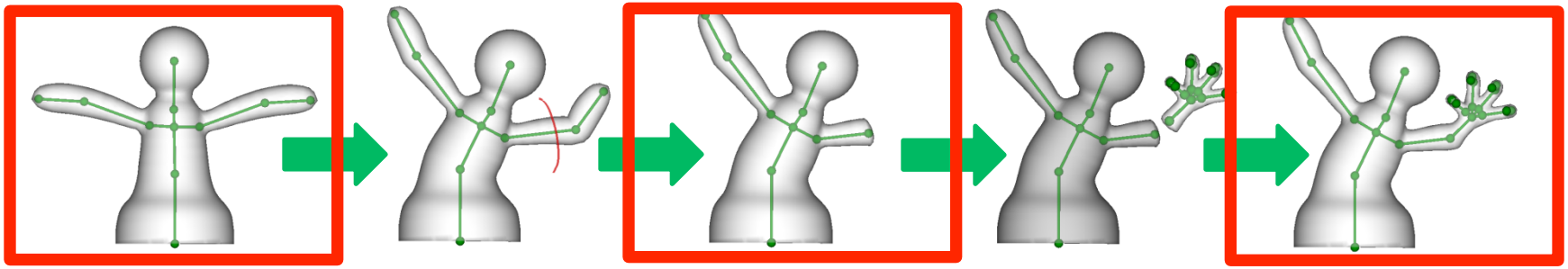


RigMesh

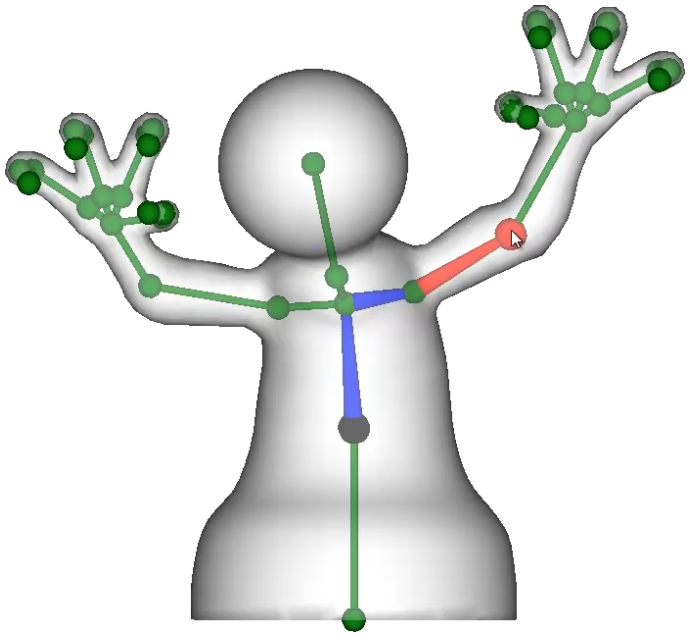
Contributions

Models rigged at all times

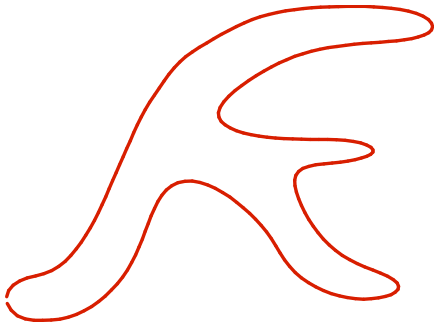
- Non-linear editing
- Modeling by parts: Sketch, Cut & Merge
- Automatically determining skeletal structure from sketch
- Efficient local skin weights computation



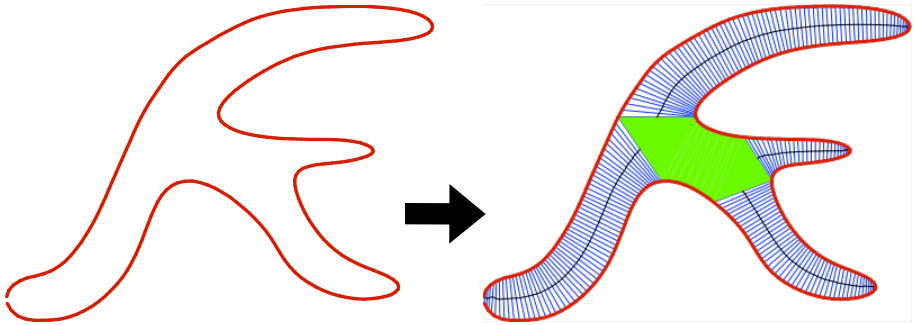
Demo



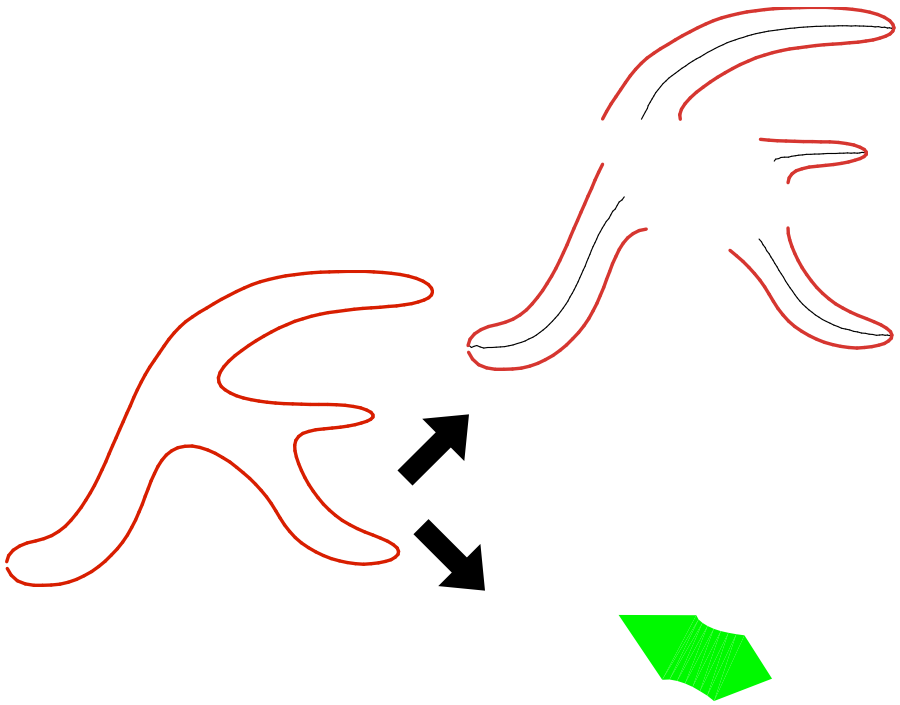
Shape creation



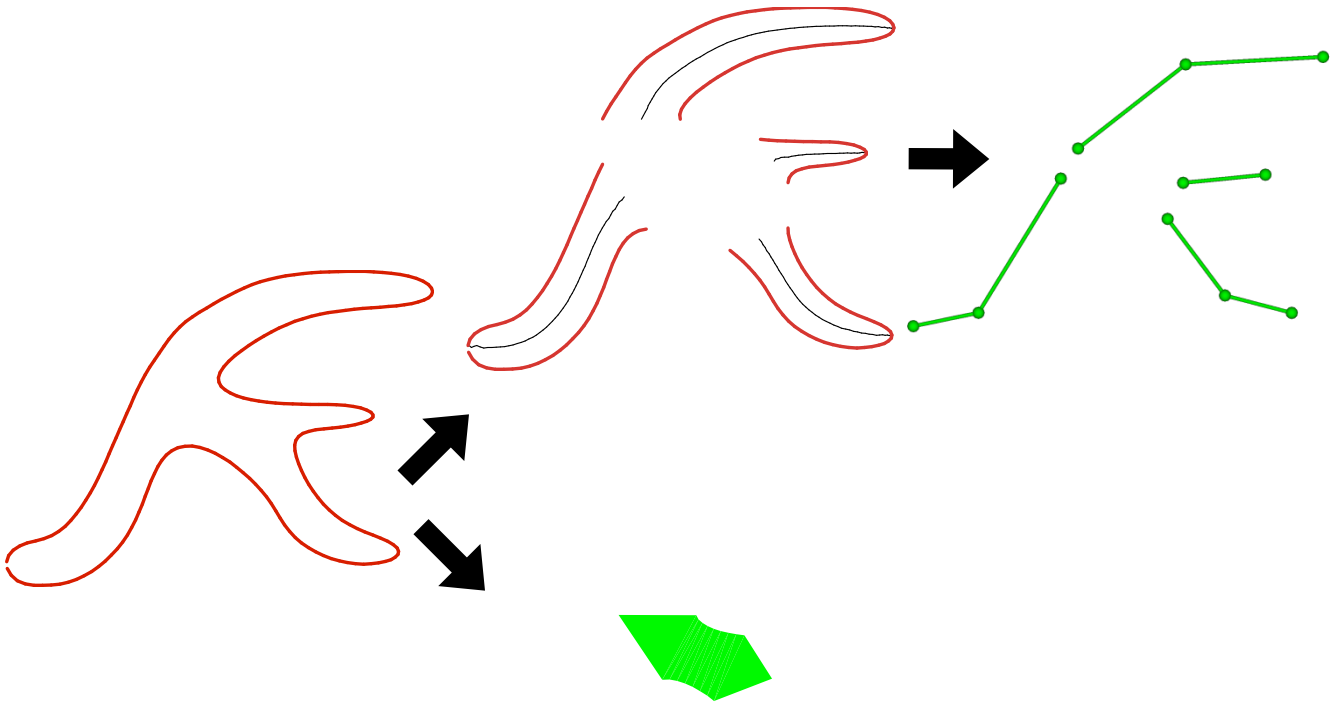
Shape creation



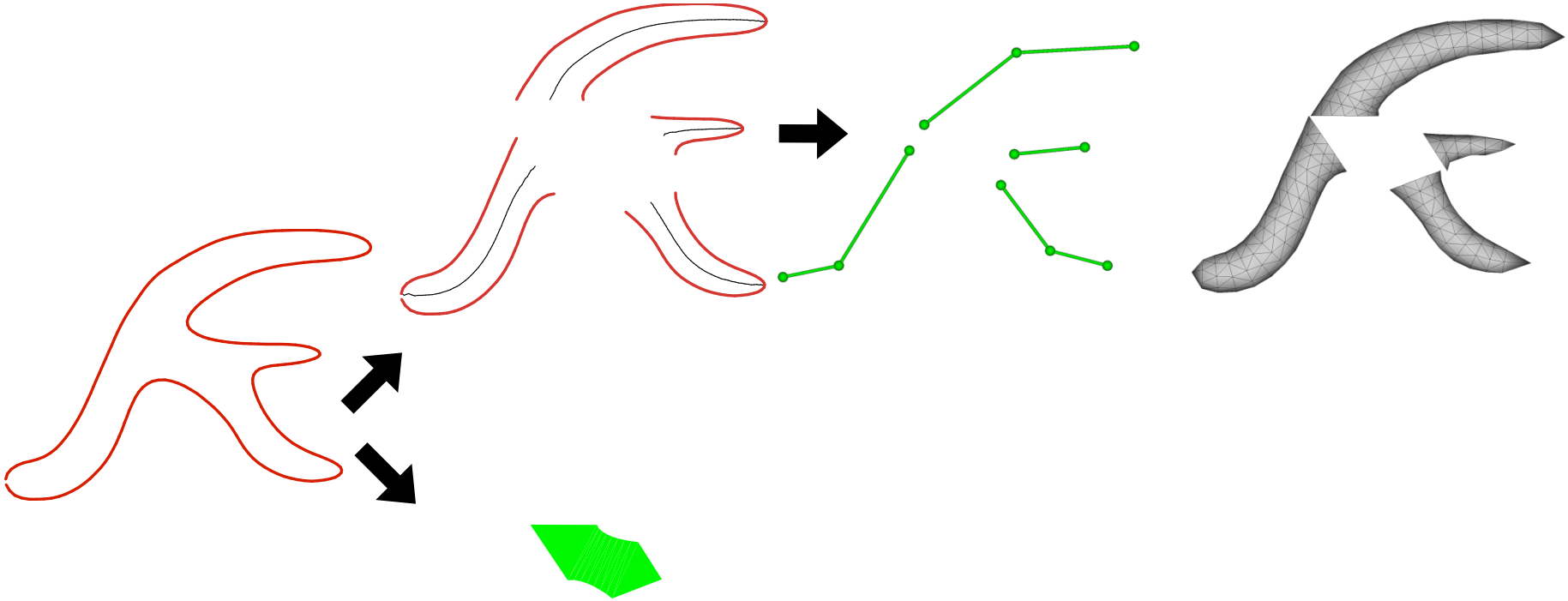
Shape creation



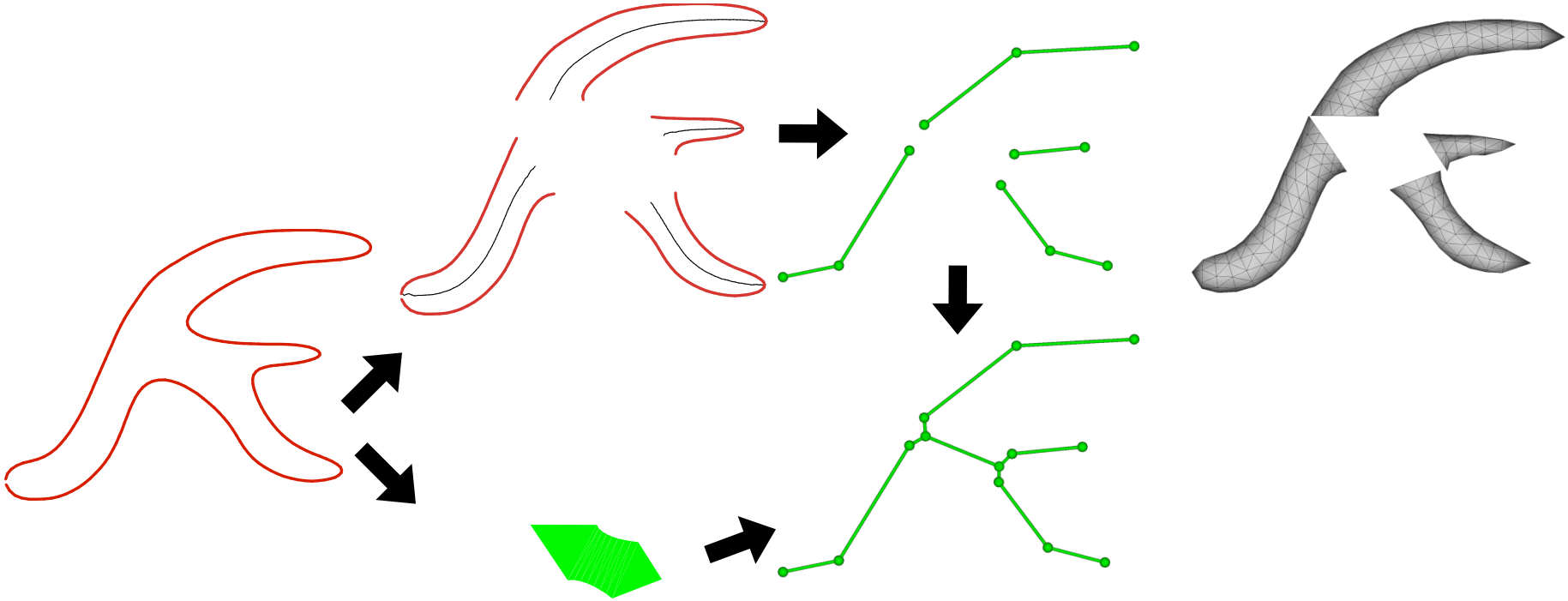
Shape creation



Shape creation



Shape creation



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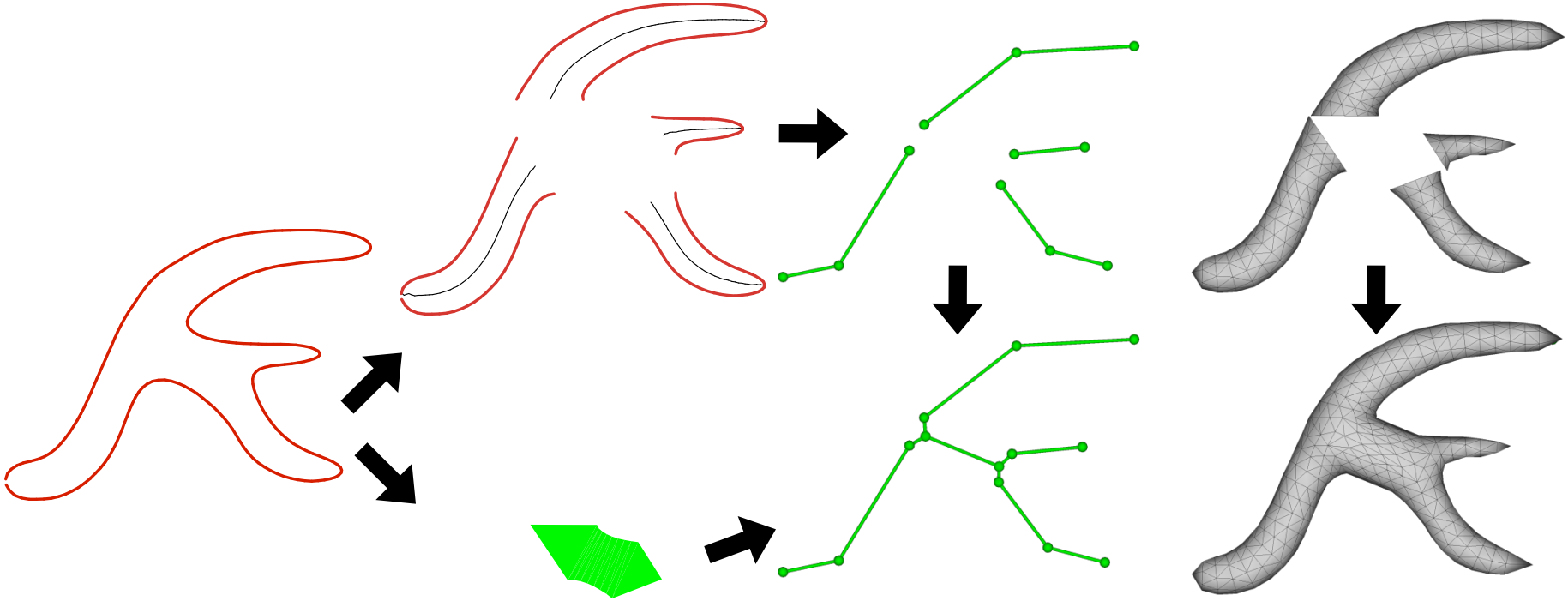
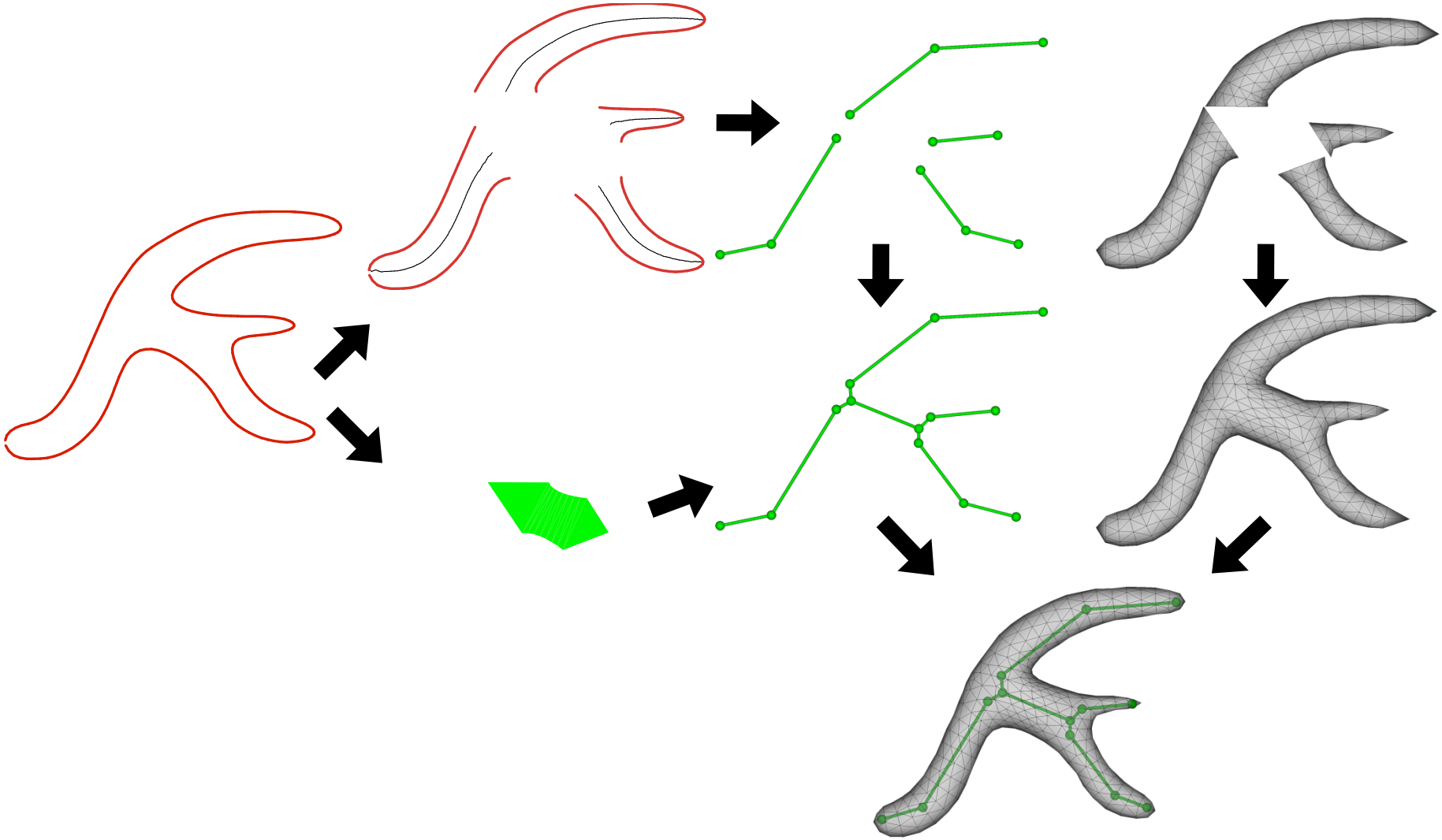


Shape creation



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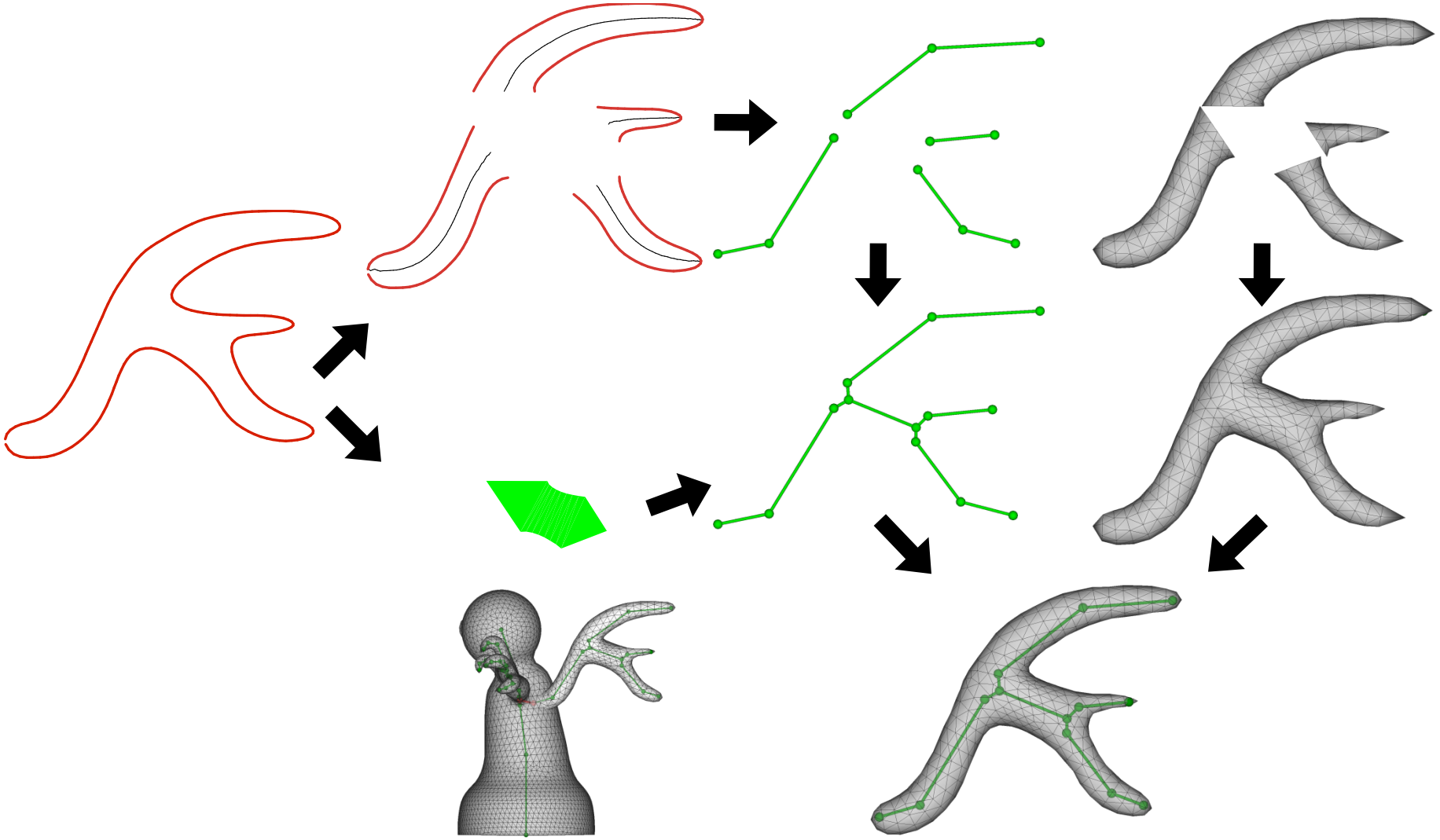

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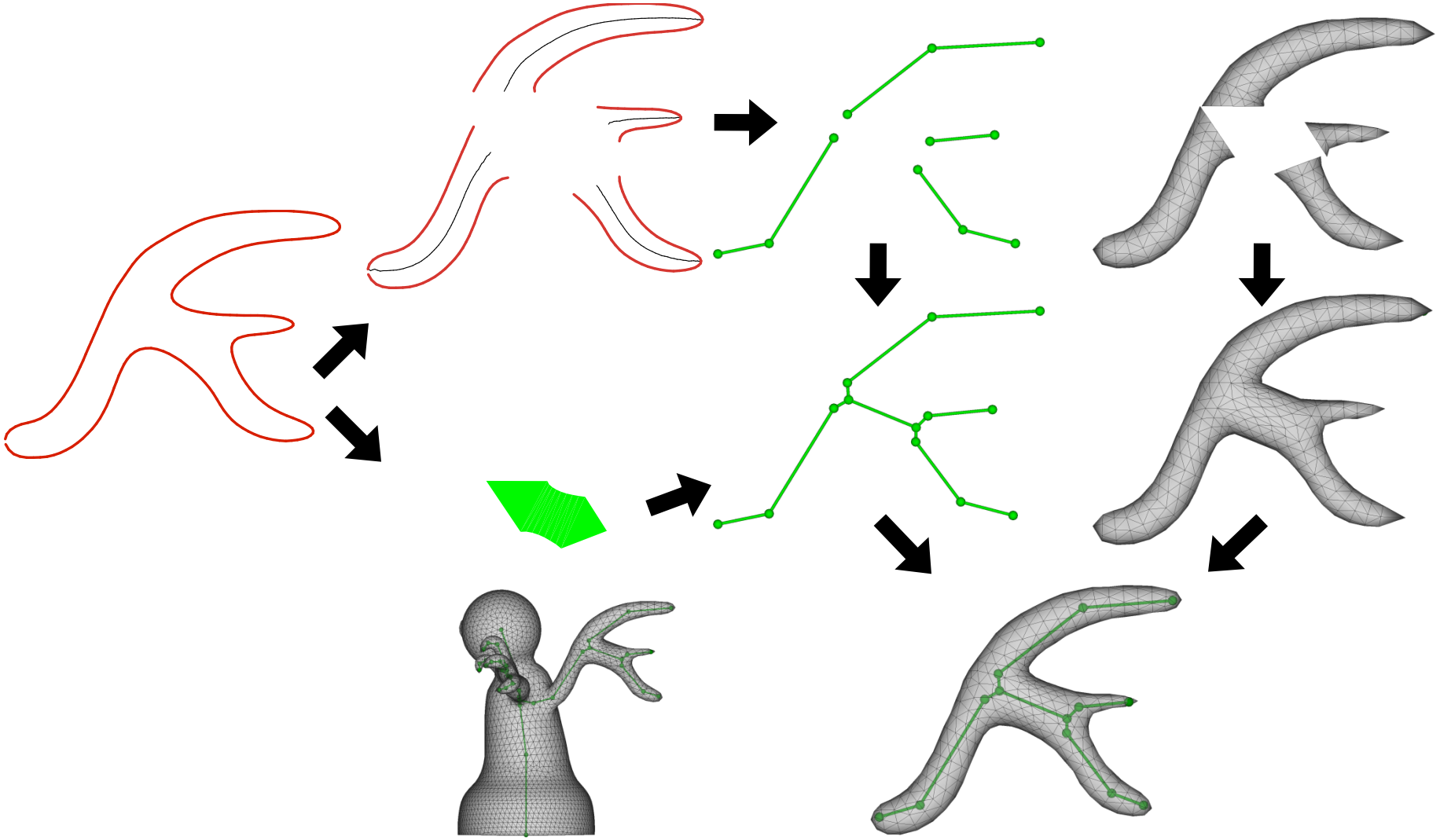

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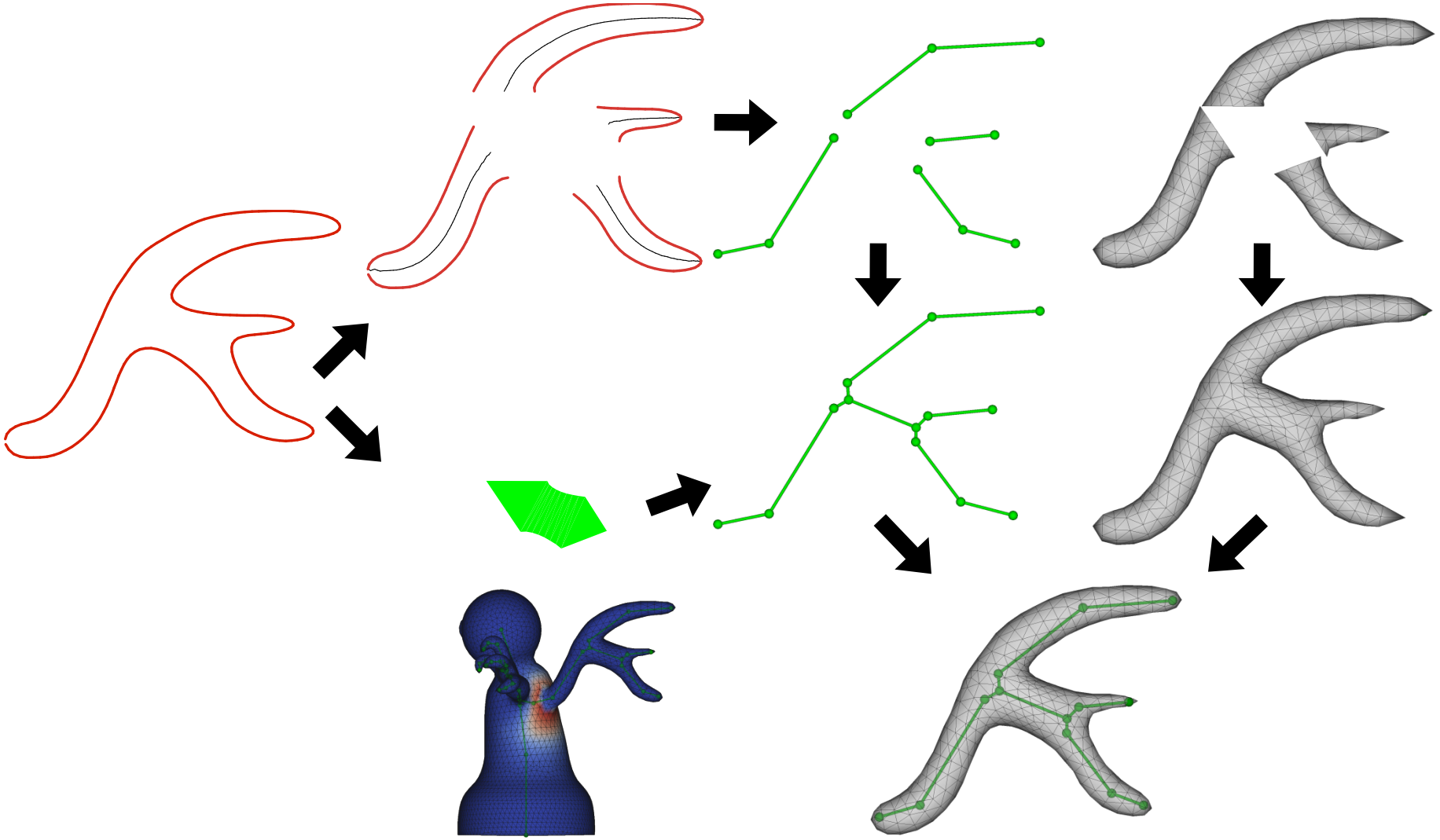

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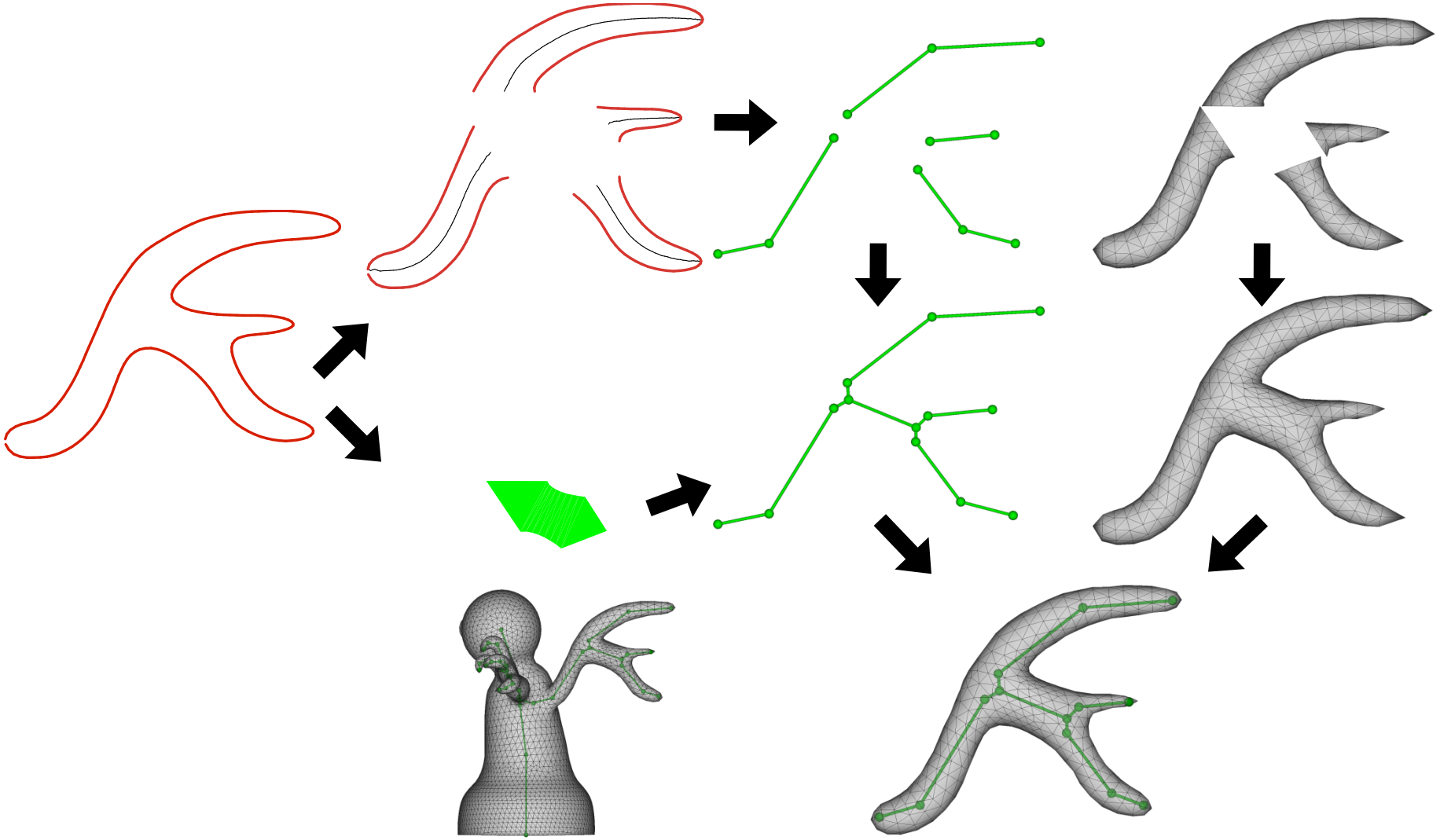
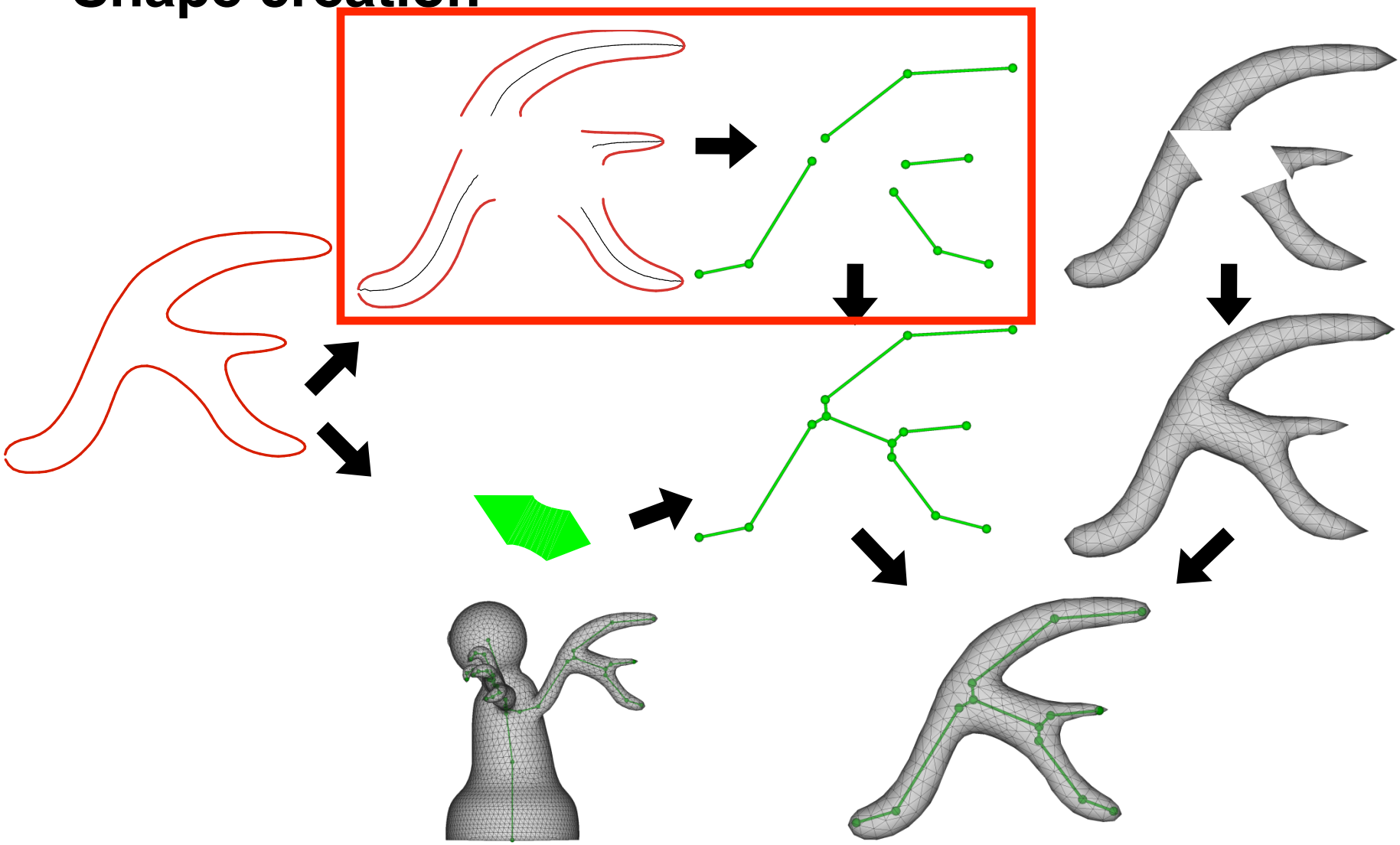
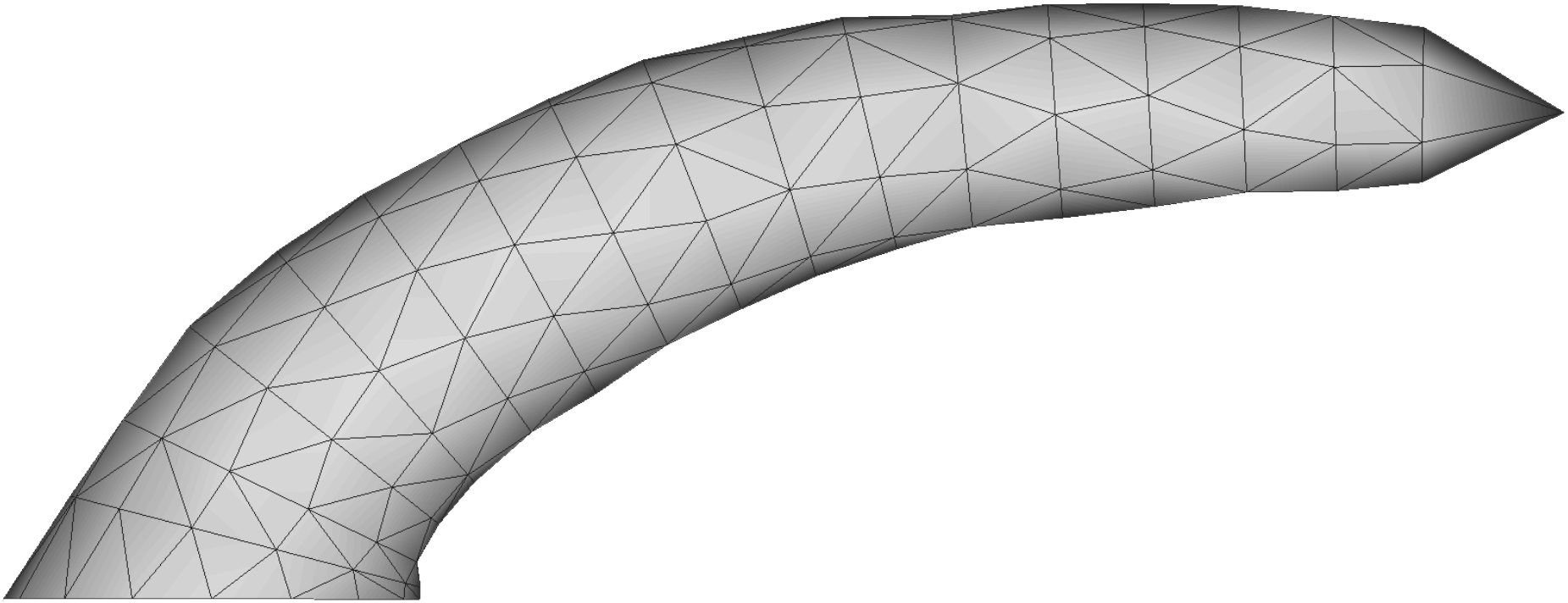


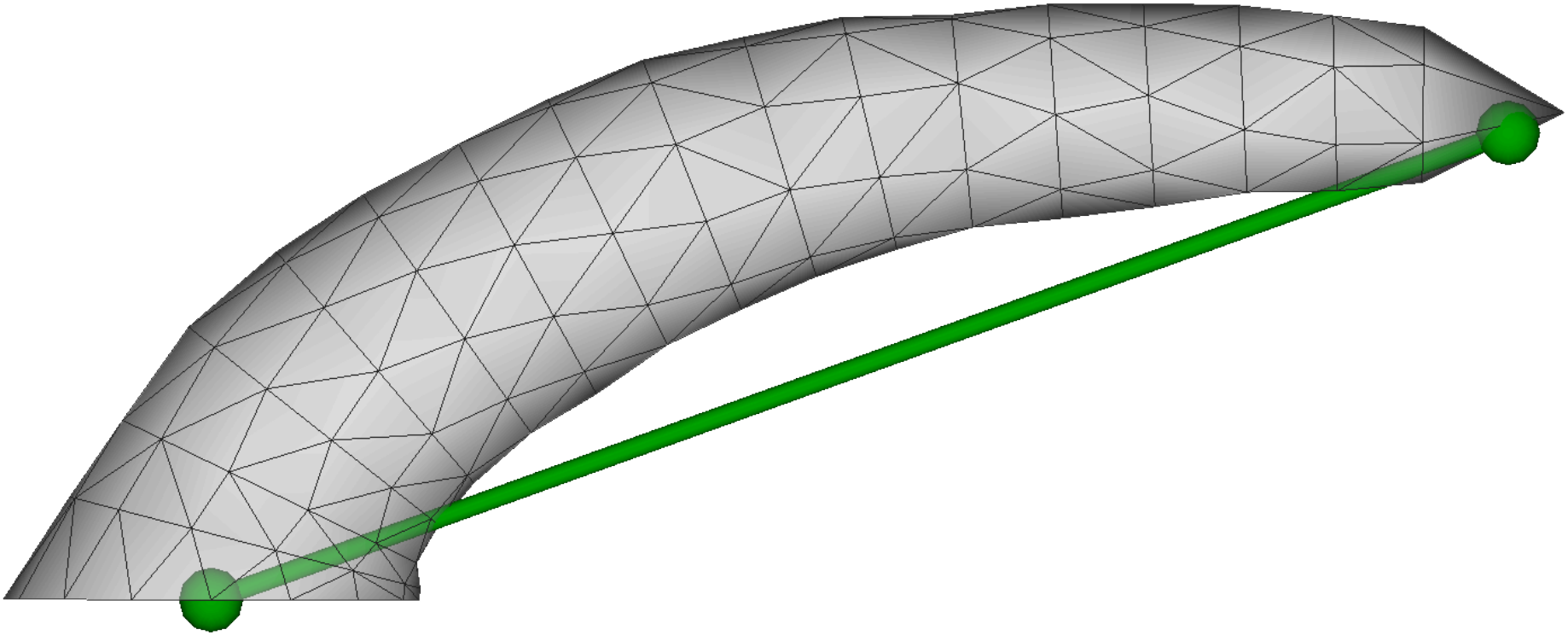
Shape creation



Skeletonization



Skeletonization



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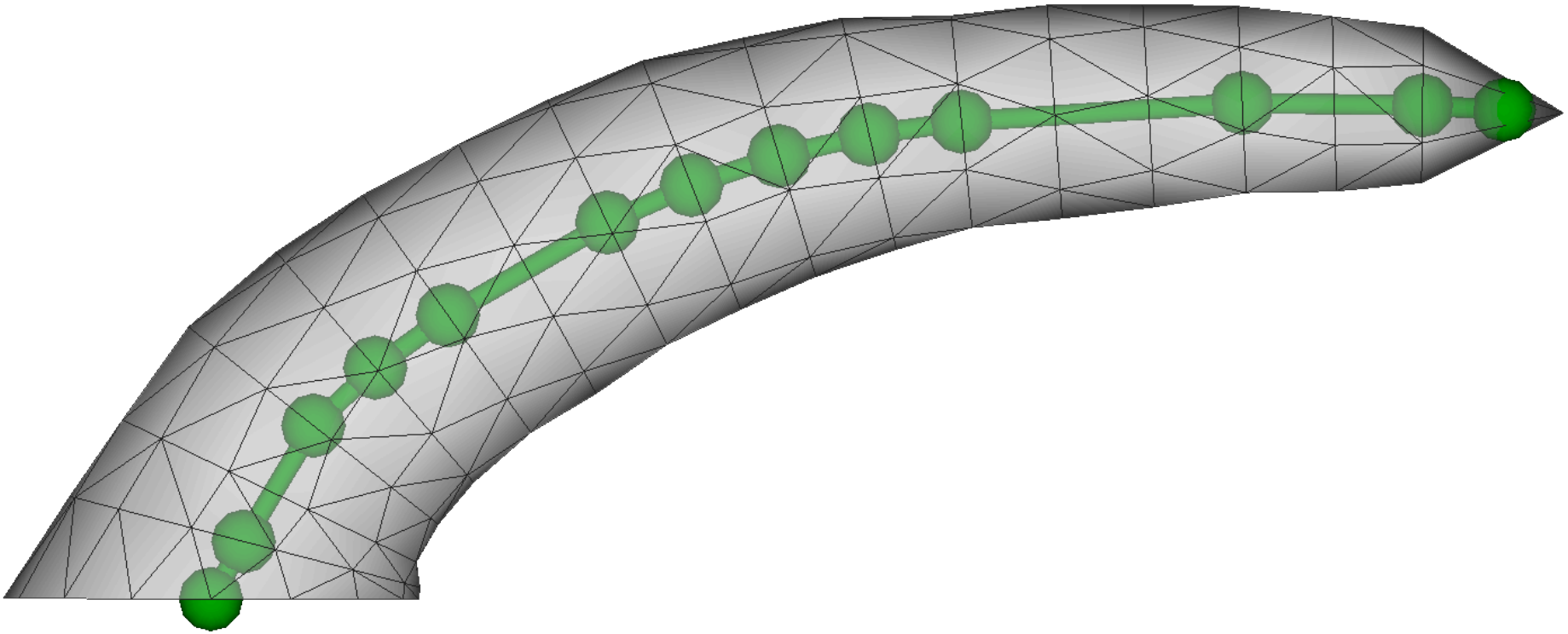

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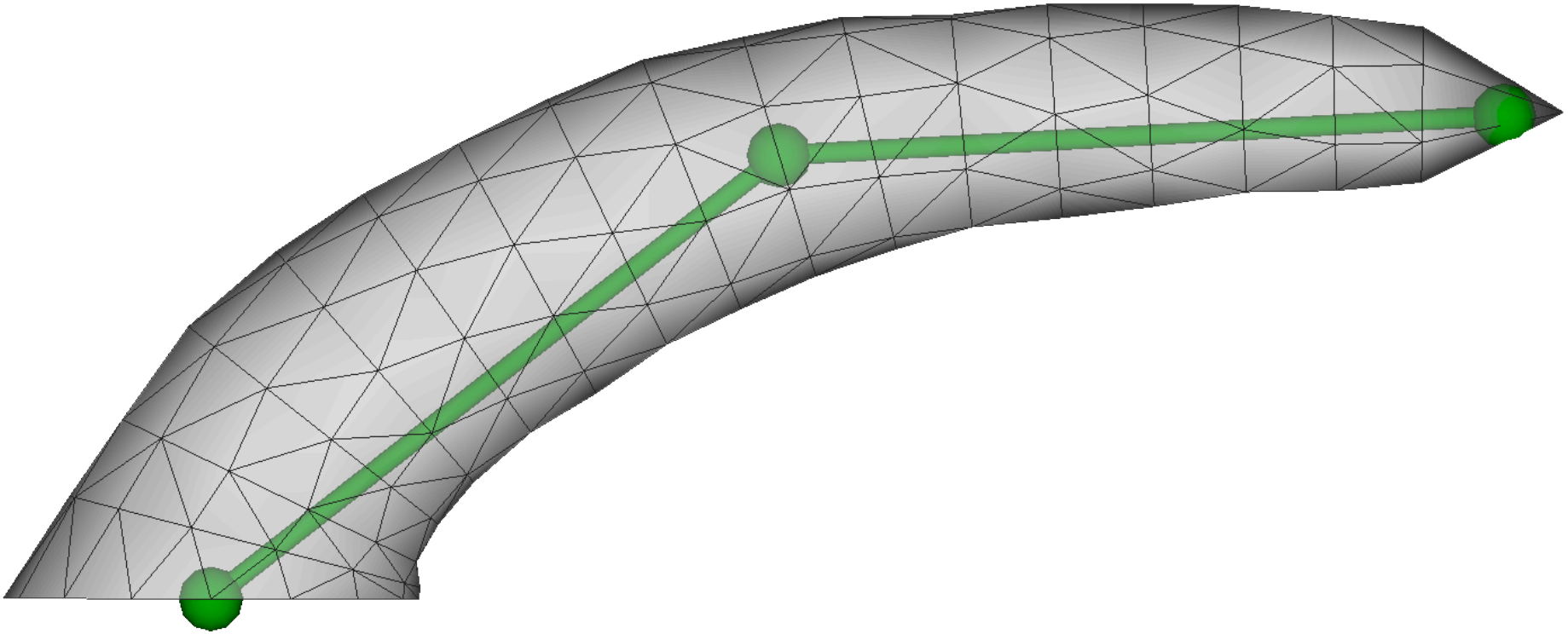

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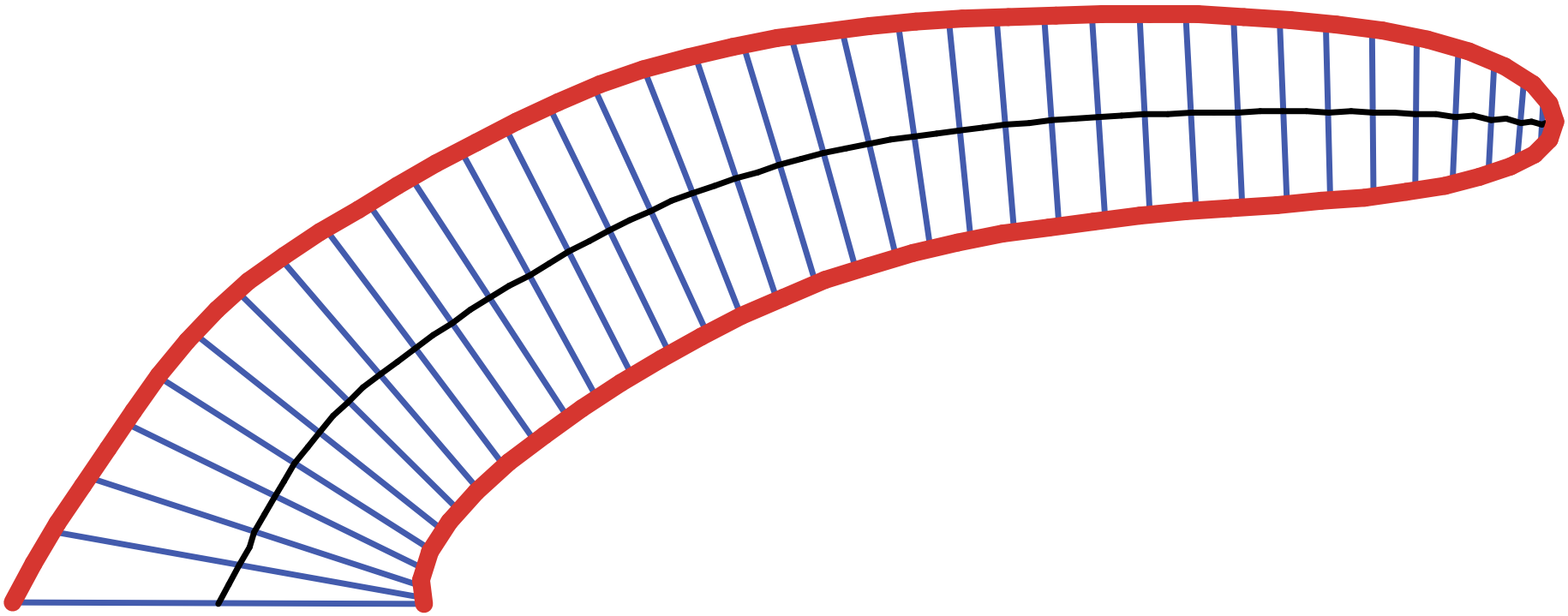

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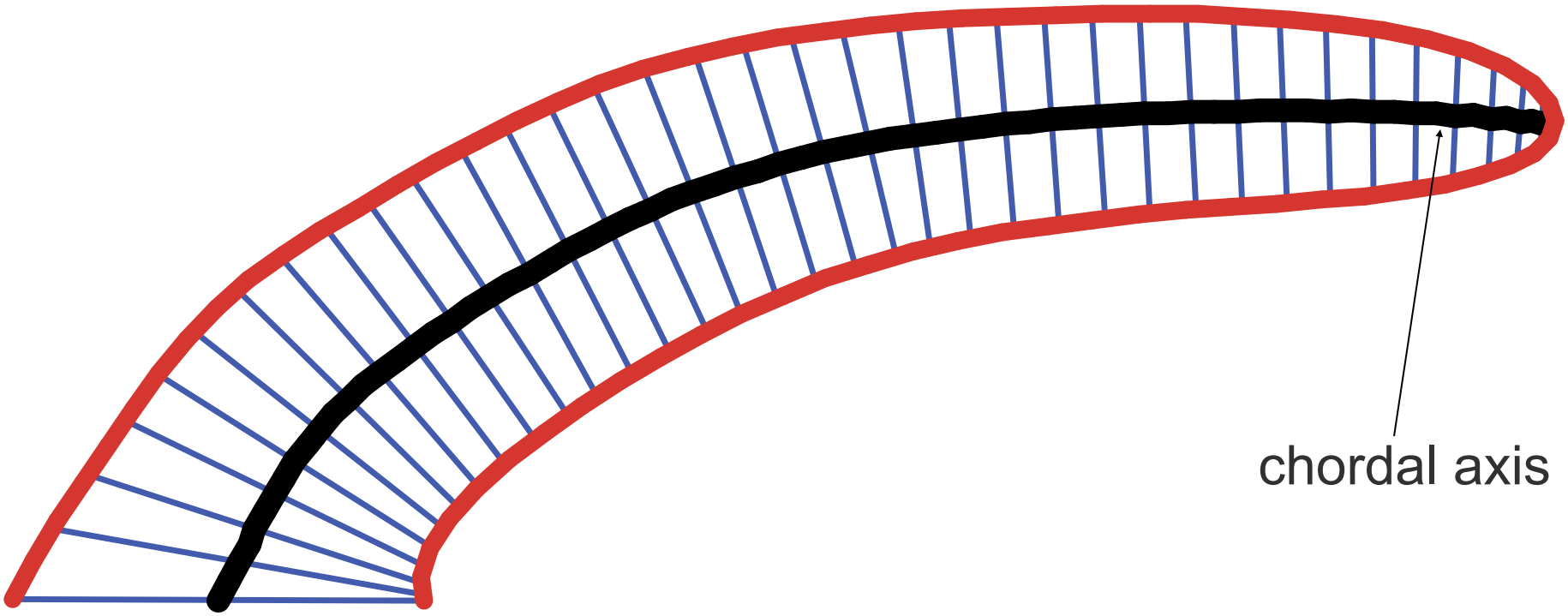

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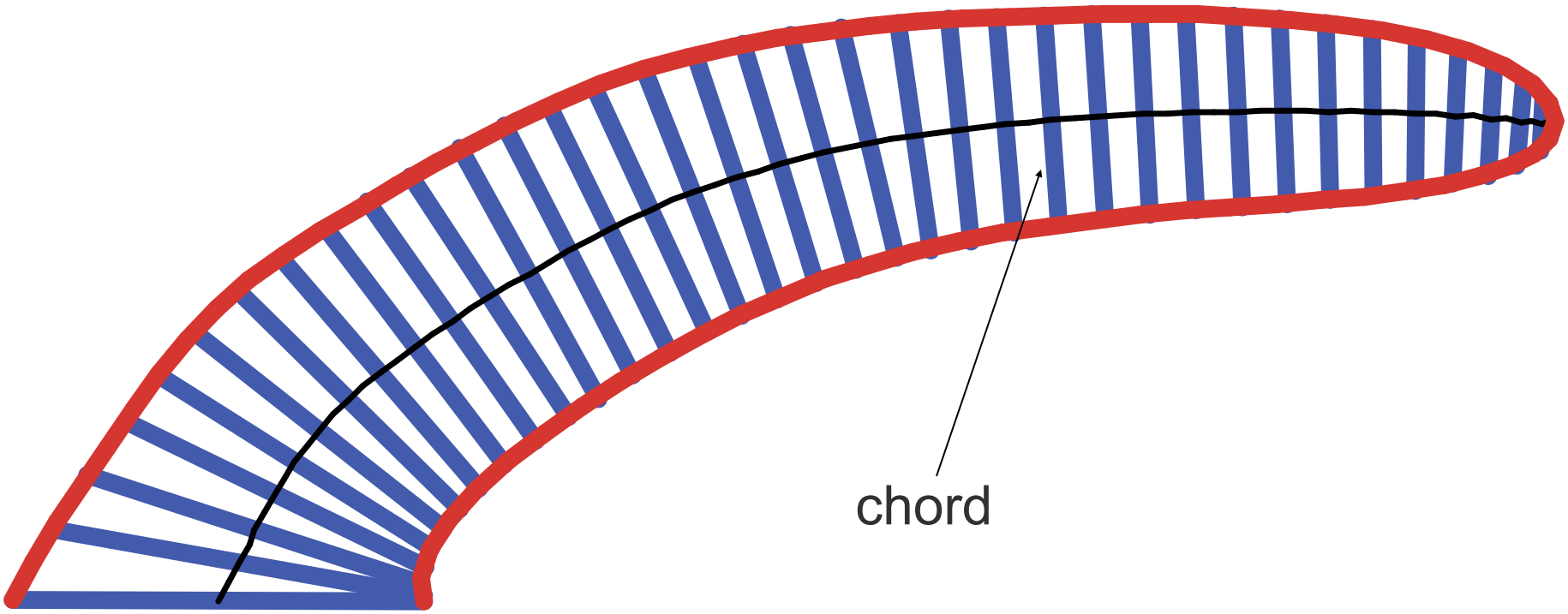

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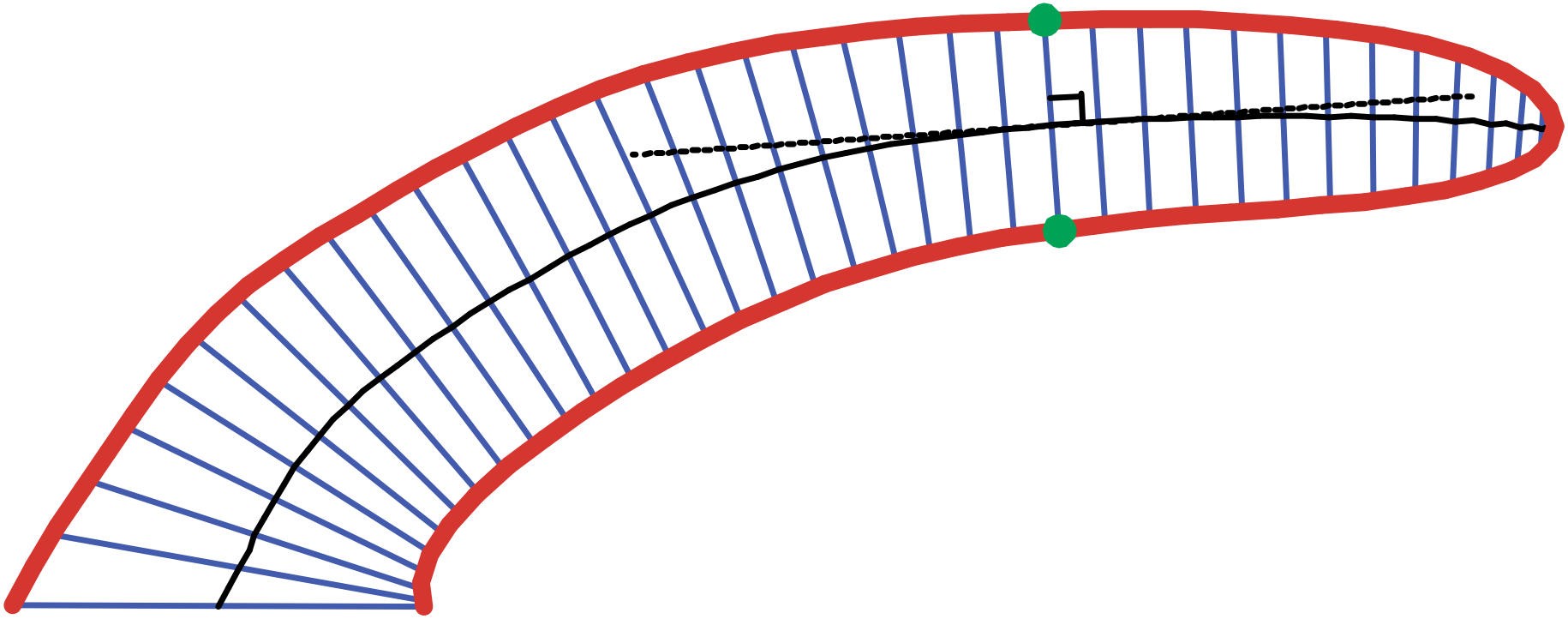
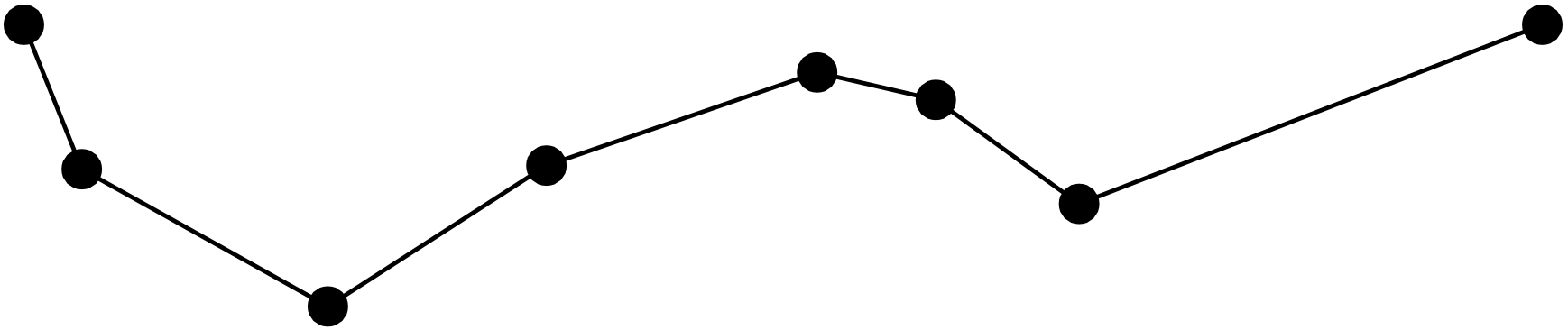
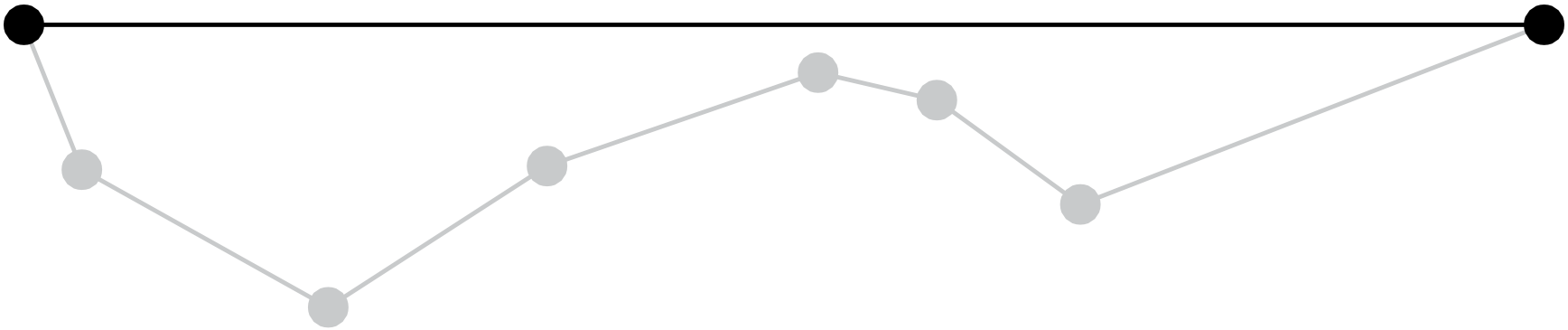


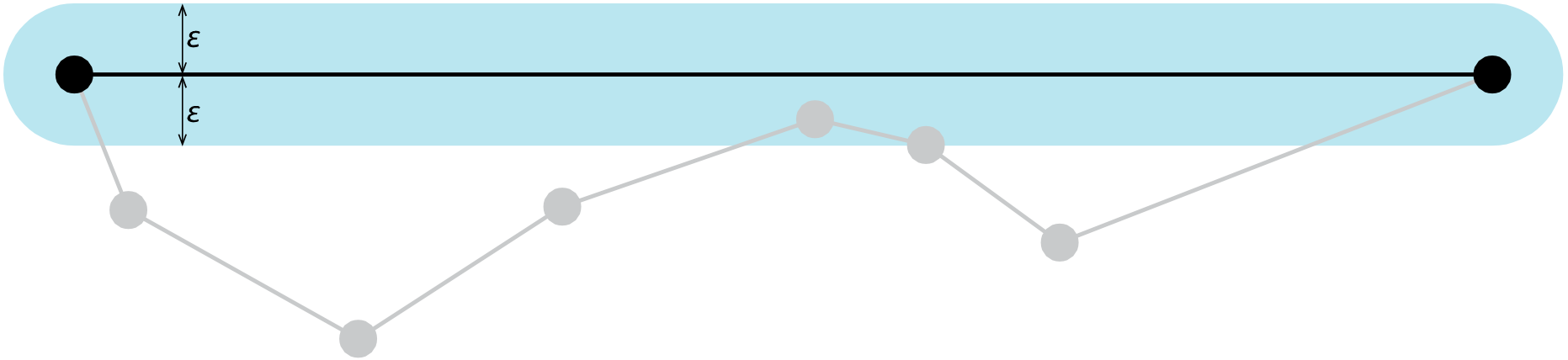
Douglas-Peucker algorithm



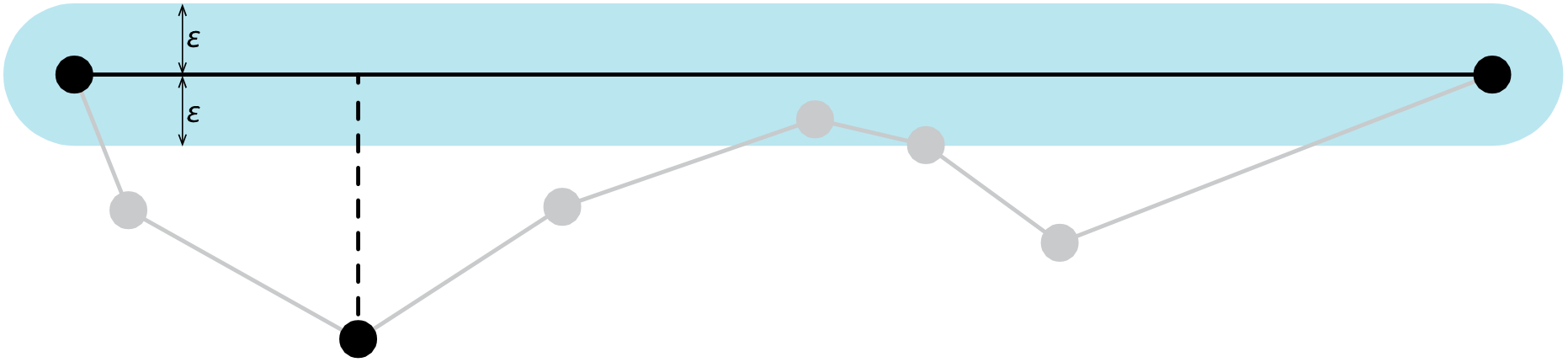
Douglas-Peucker algorithm



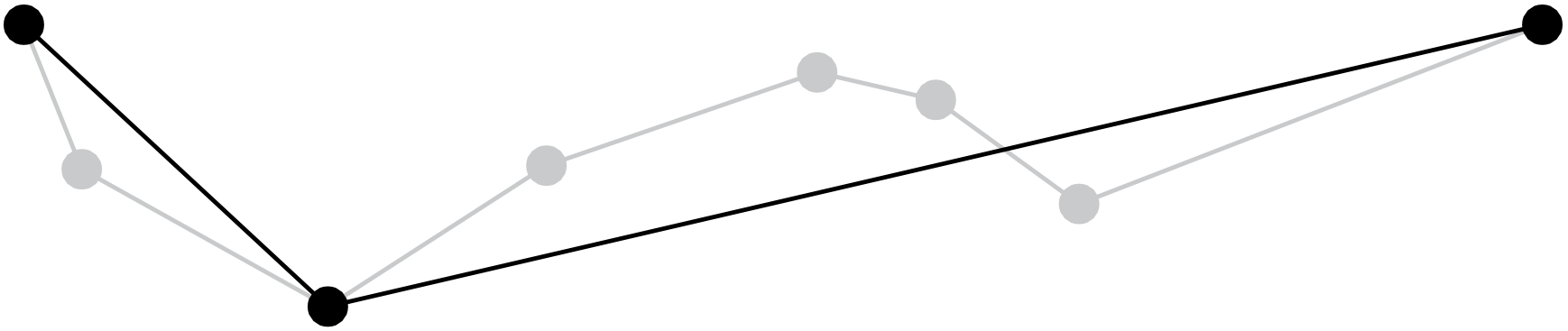
Douglas-Peucker algorithm



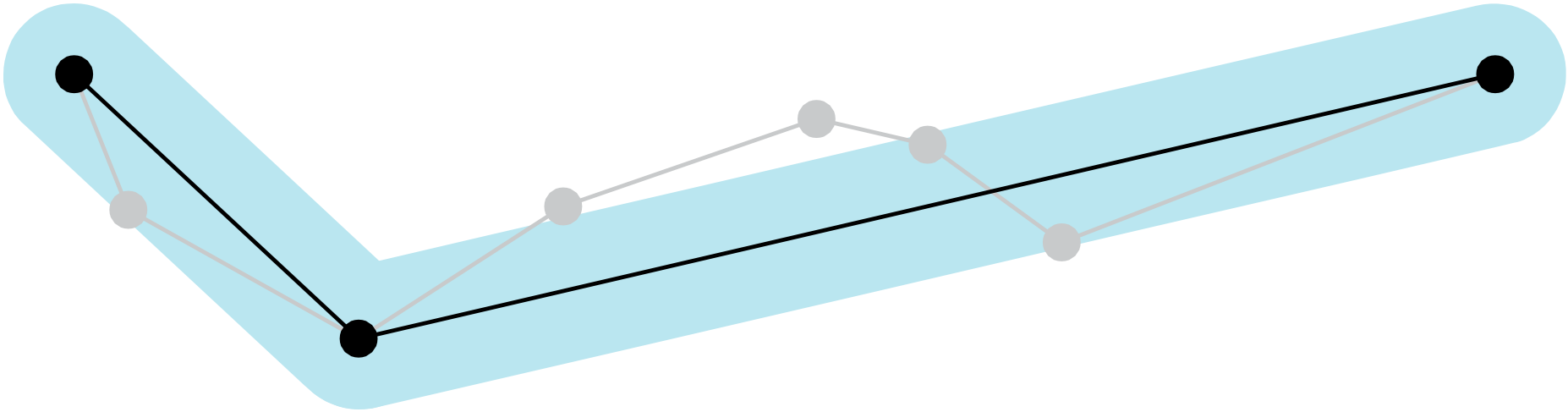
Douglas-Peucker algorithm



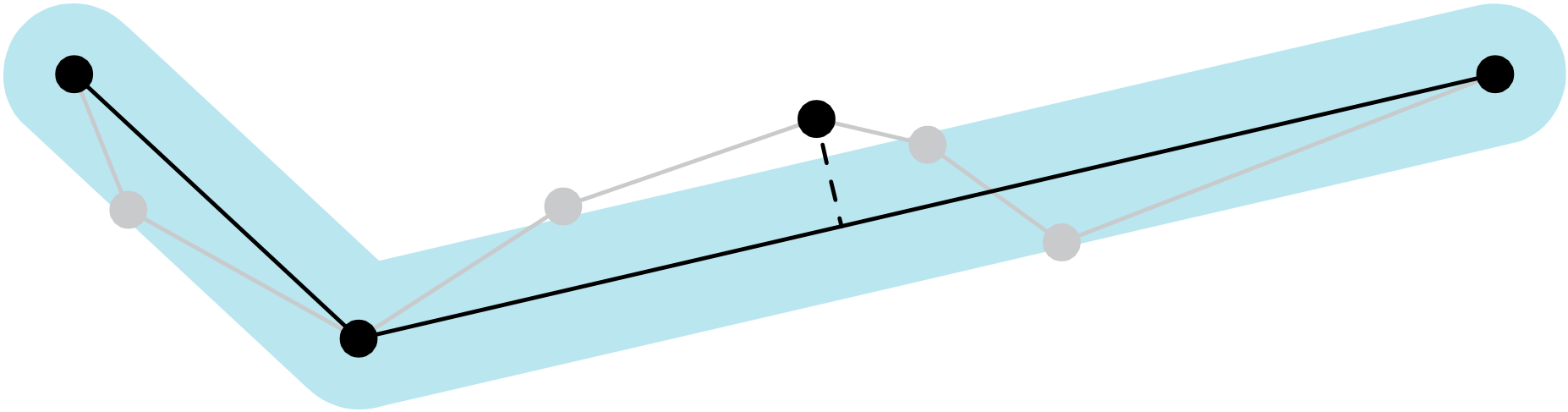
Douglas-Peucker algorithm



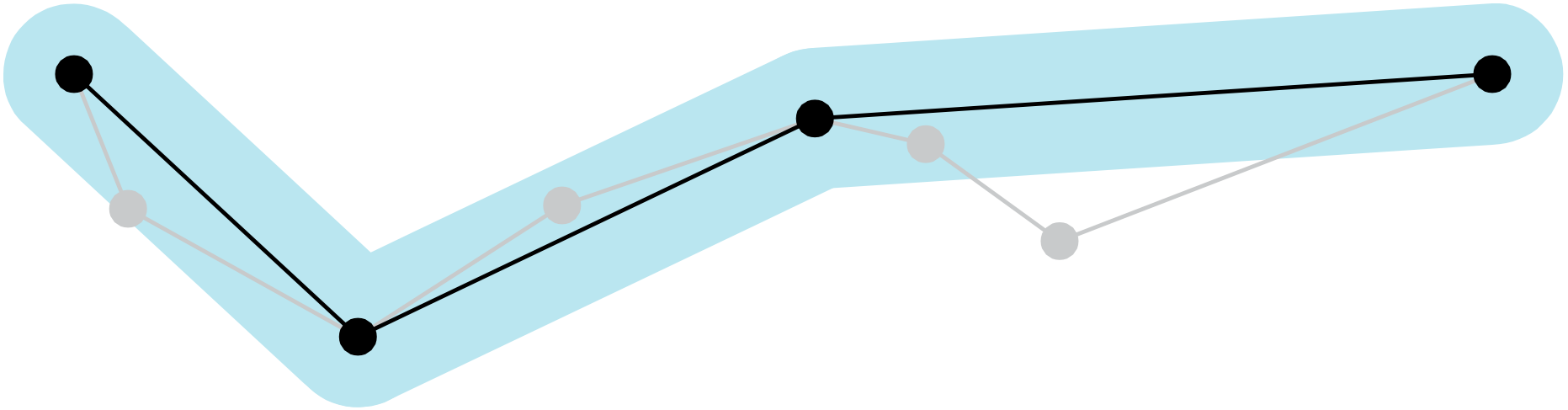
Douglas-Peucker algorithm



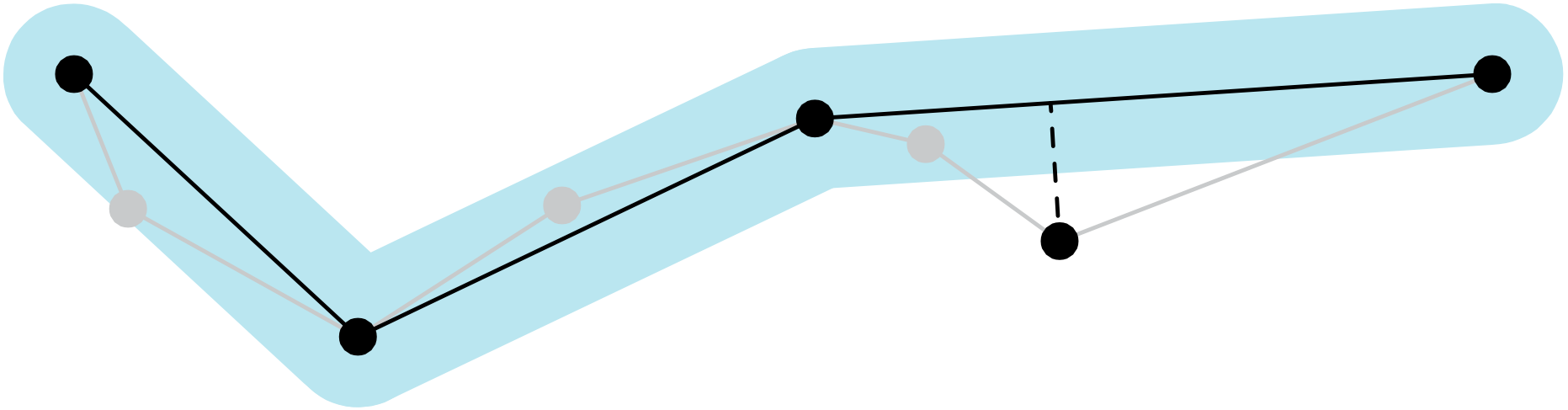
Douglas-Peucker algorithm



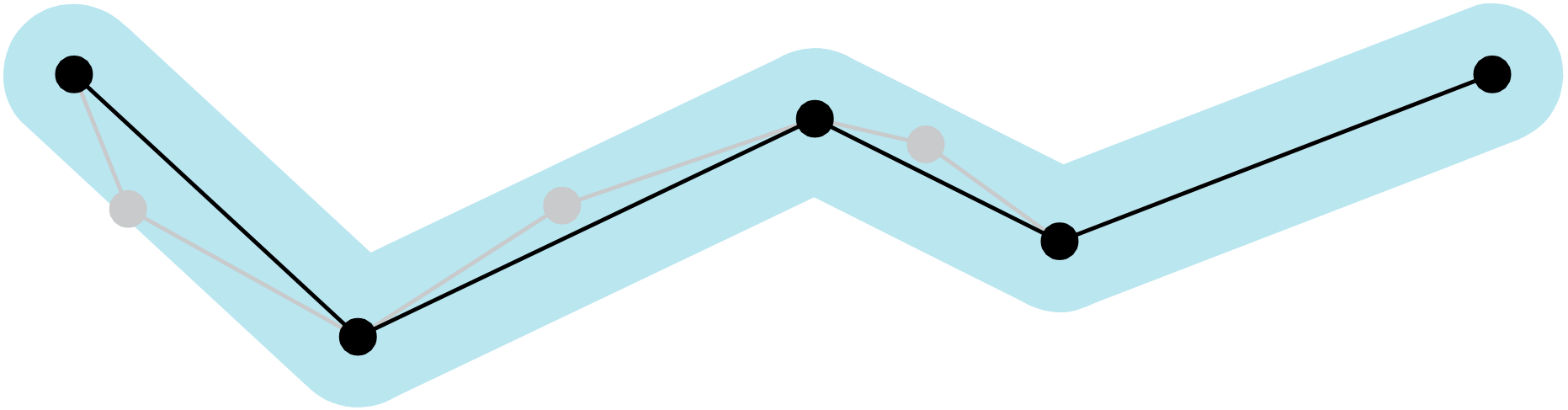
Douglas-Peucker algorithm



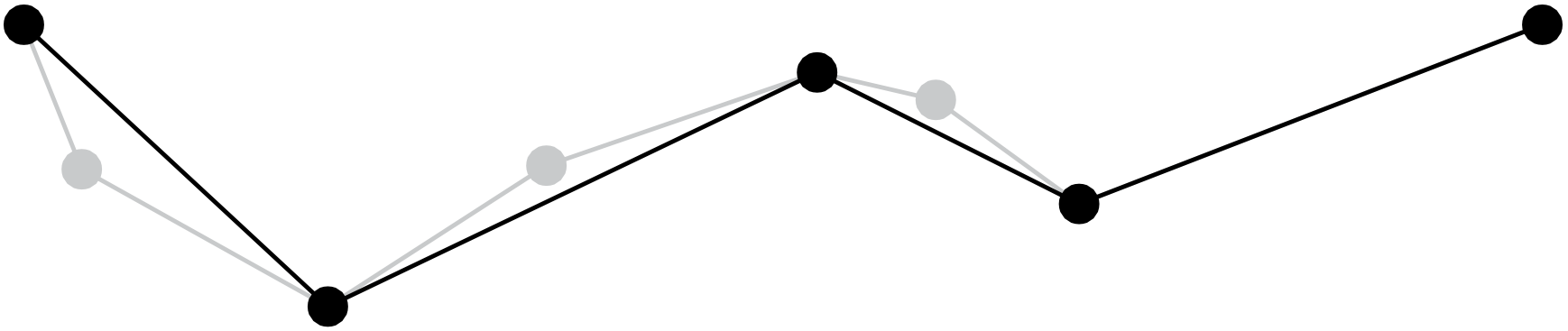
Douglas-Peucker algorithm



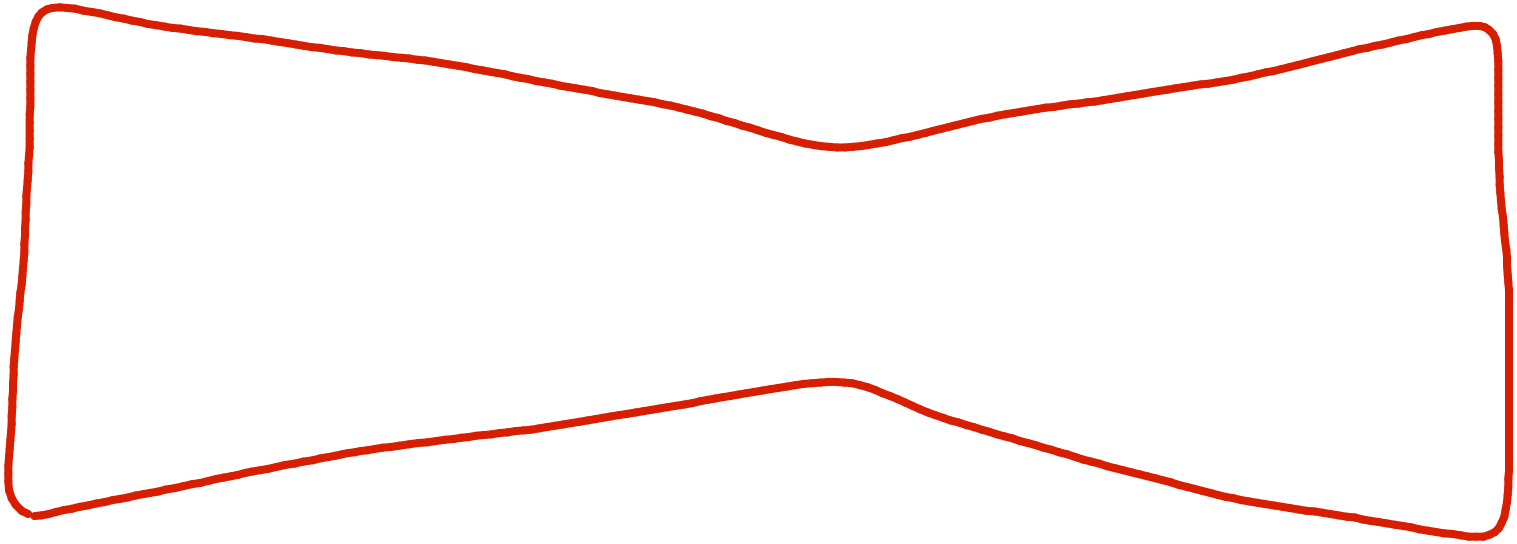
Douglas-Peucker algorithm



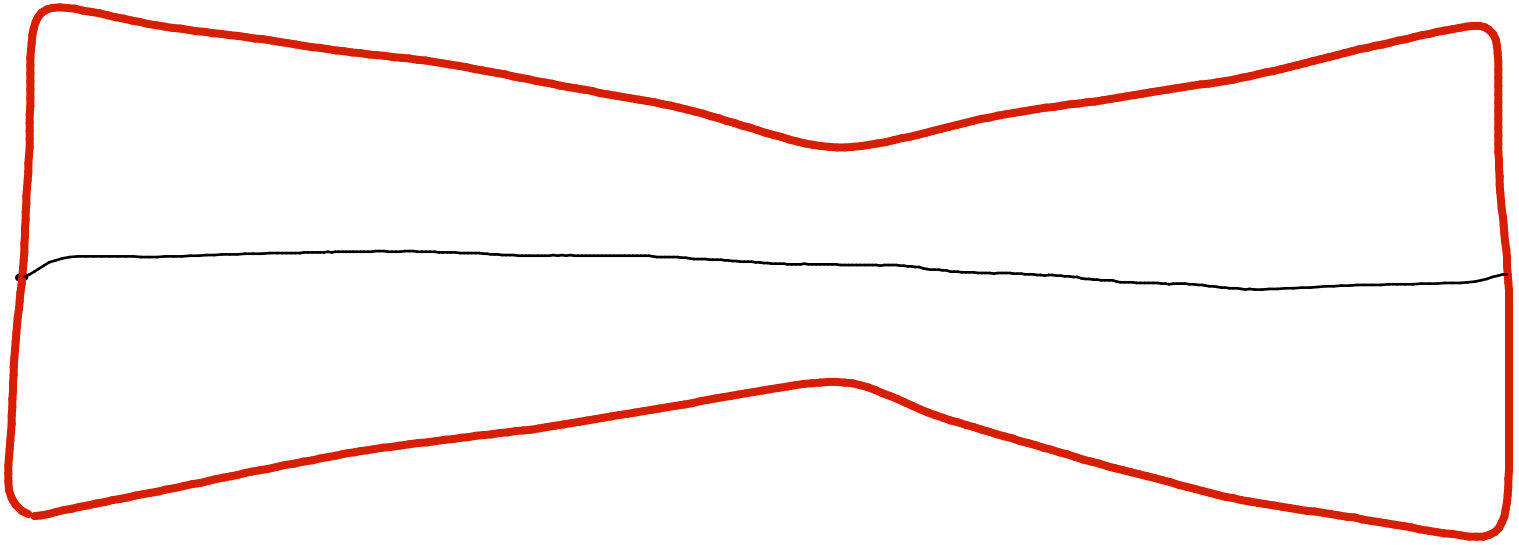
Douglas-Peucker algorithm



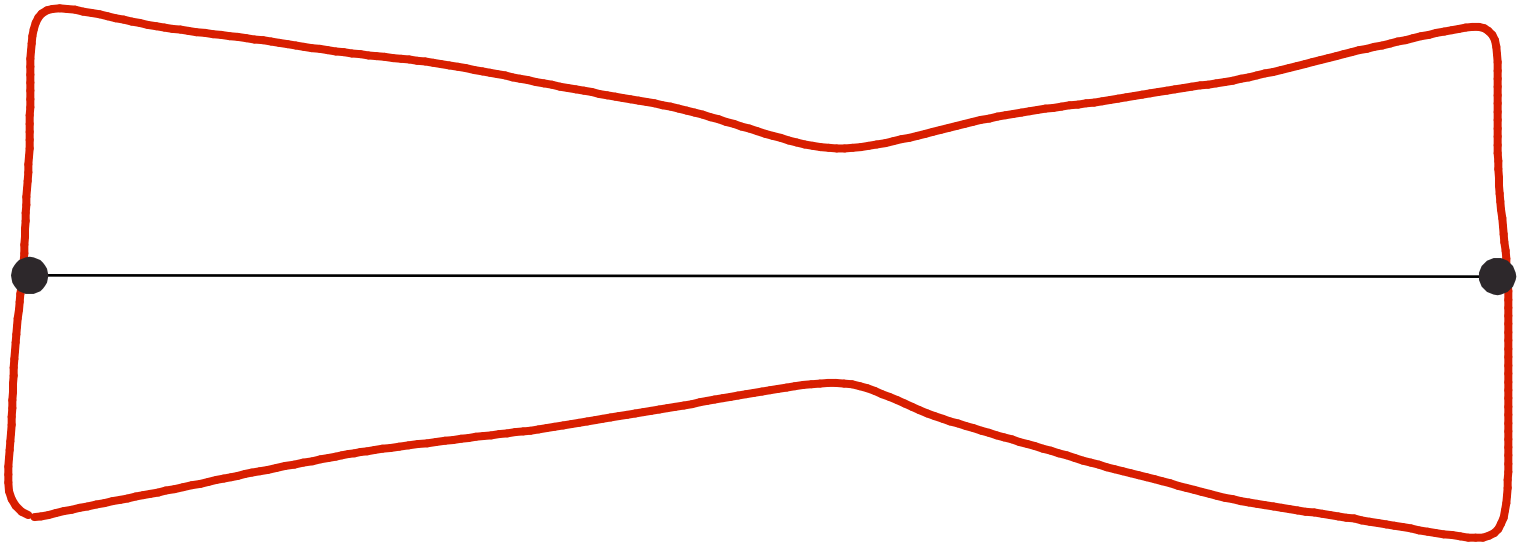
What happens if…



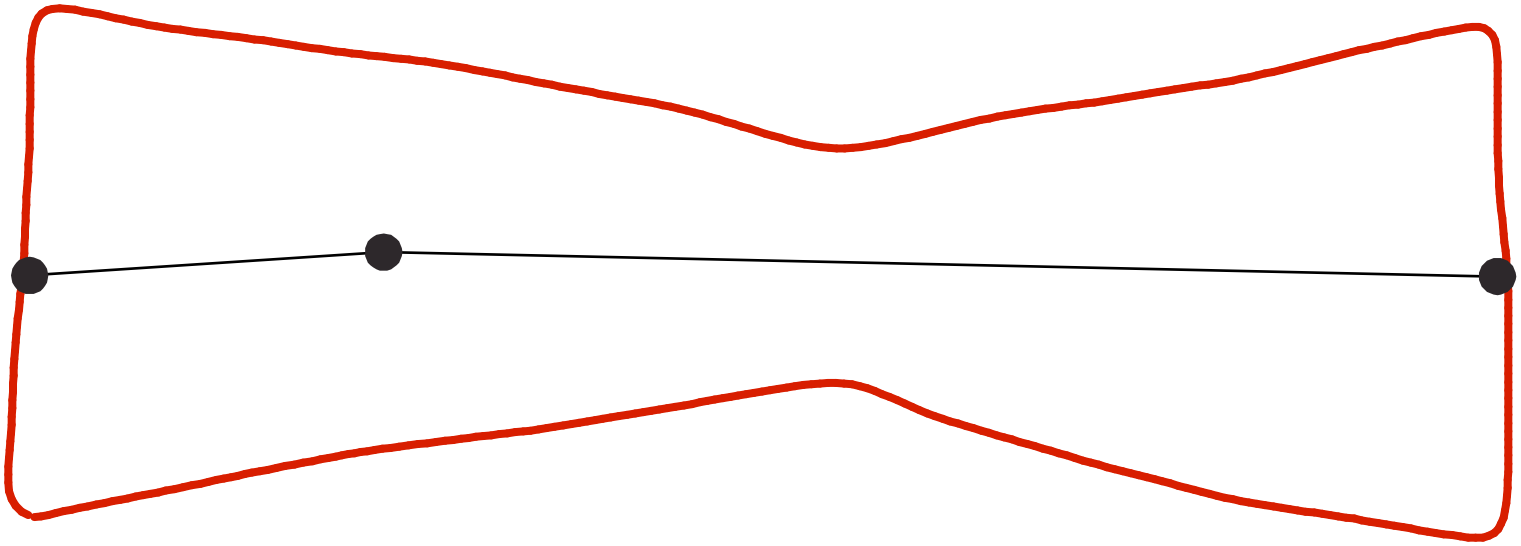
…the chordal axis is almost straight



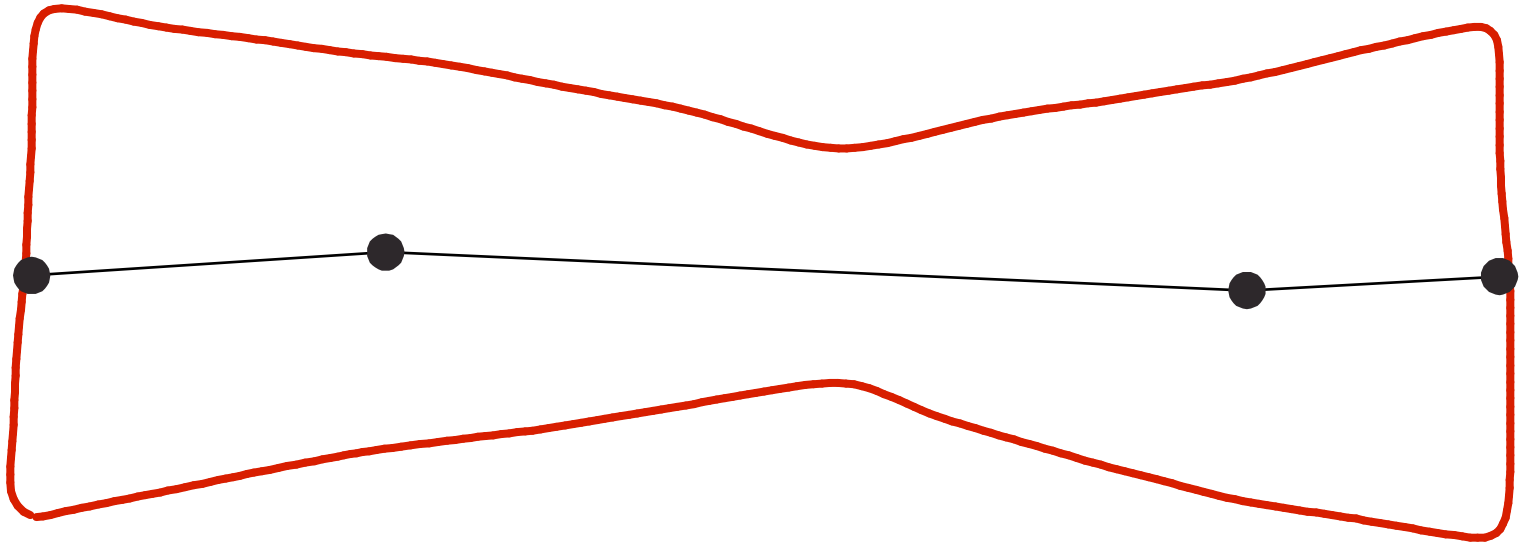
Result of Douglas-Peucker



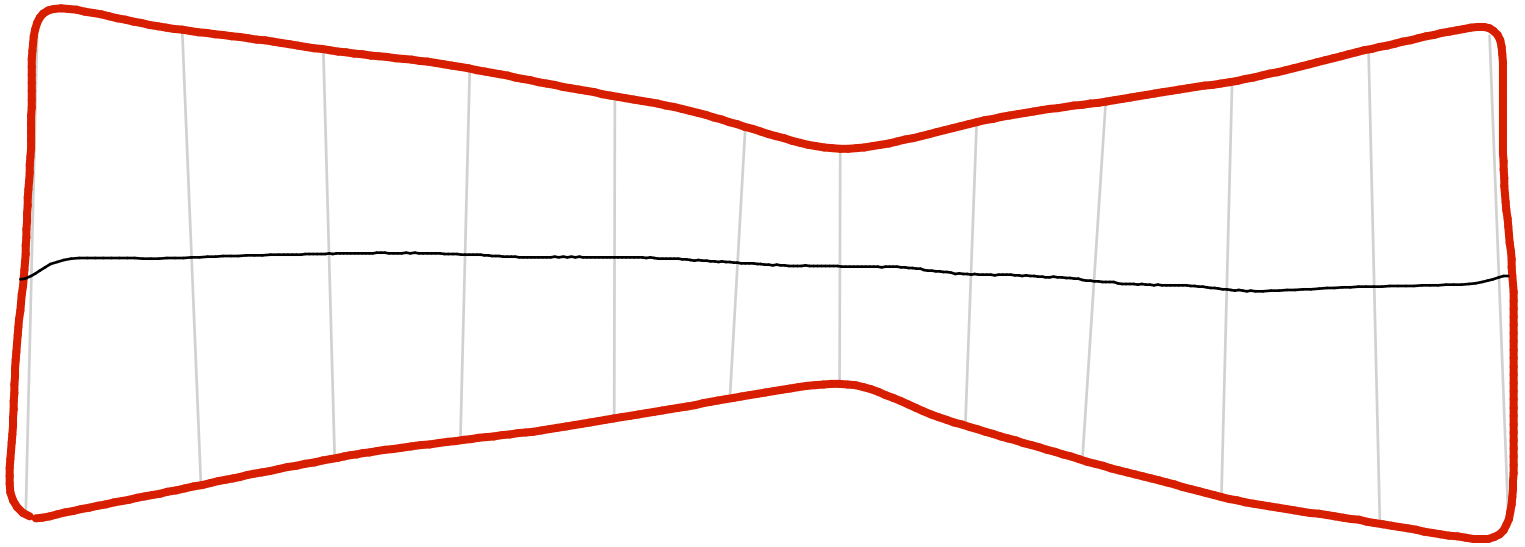
Result of Douglas-Peucker



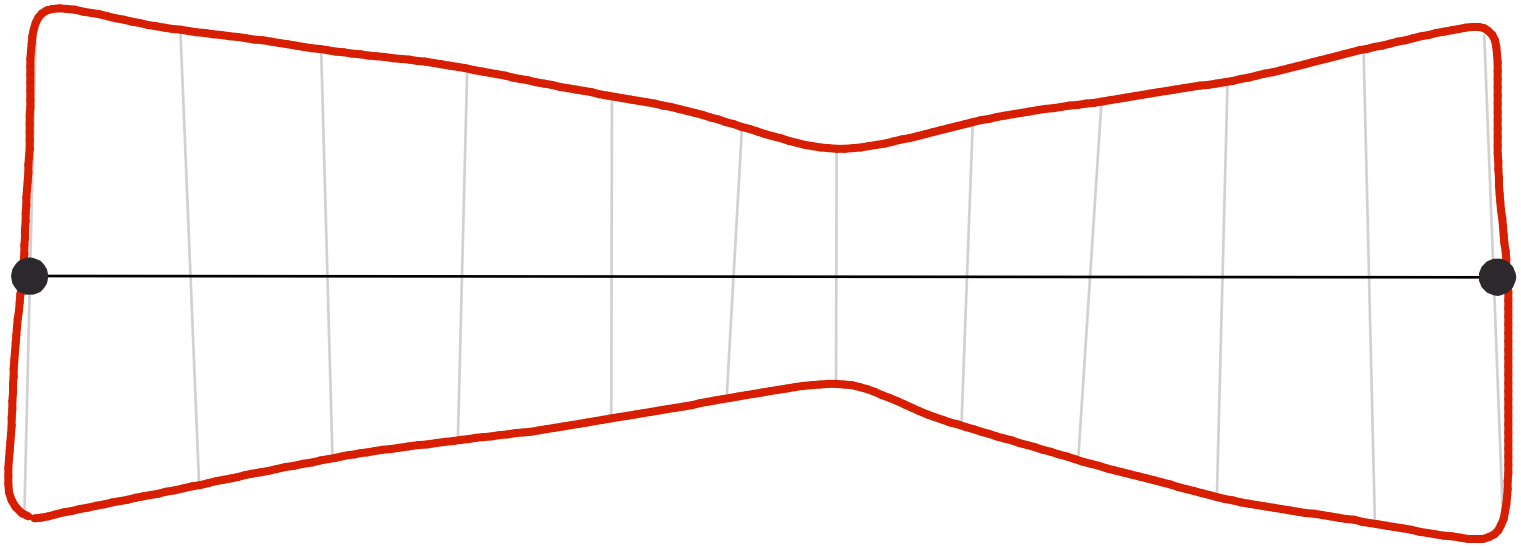
Result of Douglas-Peucker



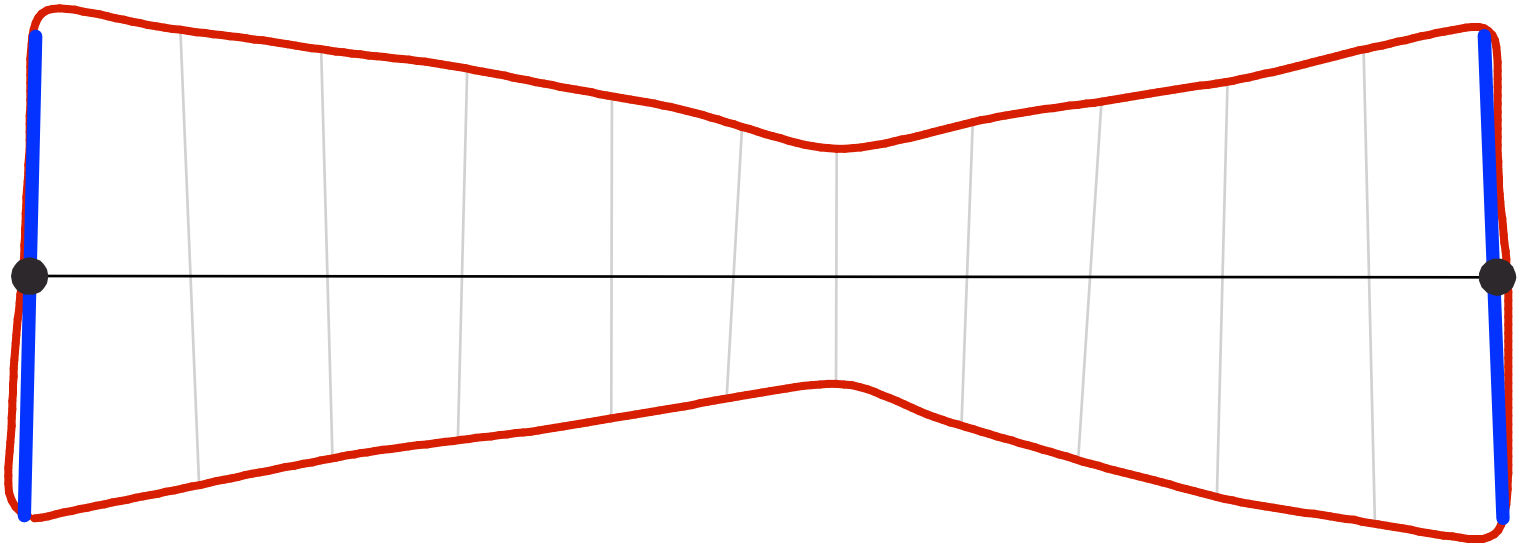
Use thickness (chords)



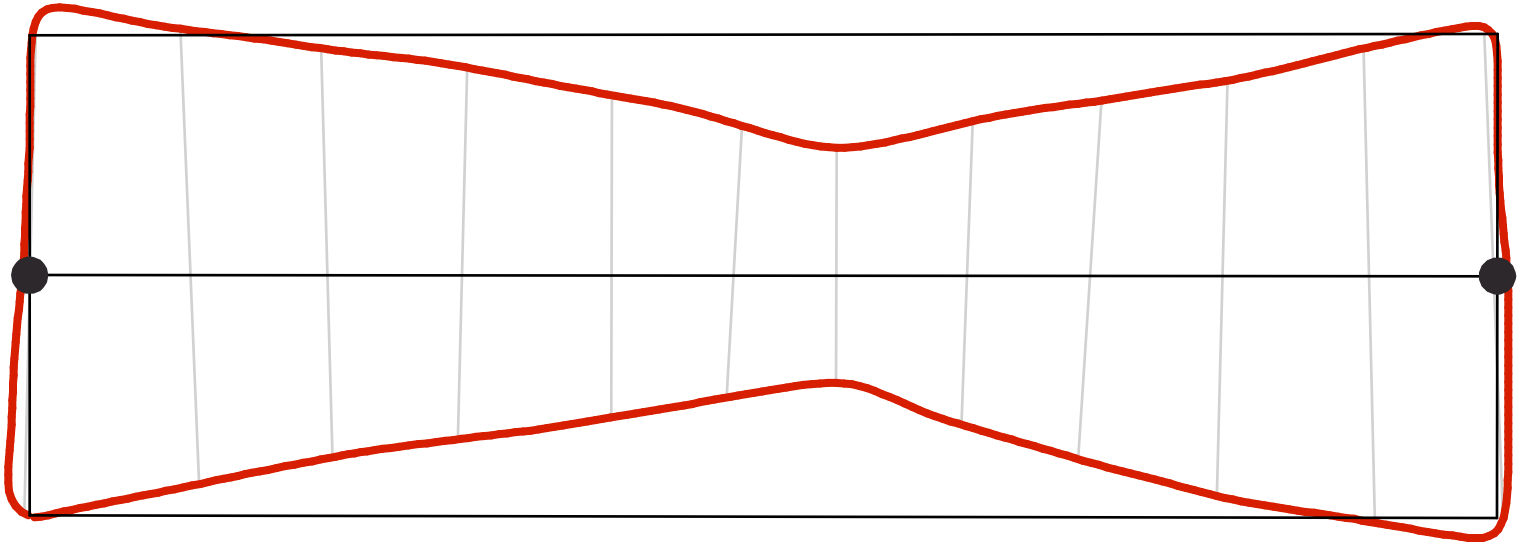
Fit line segment



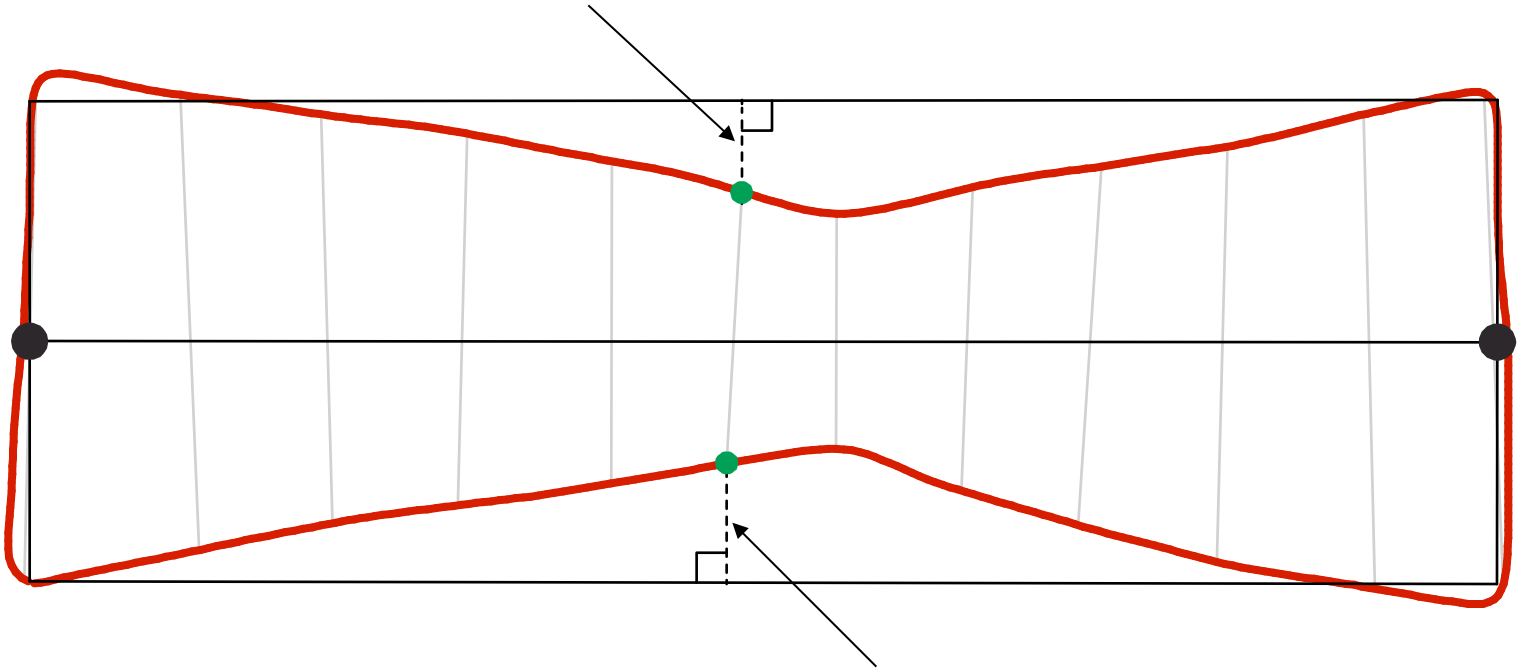
Fit trapezoid



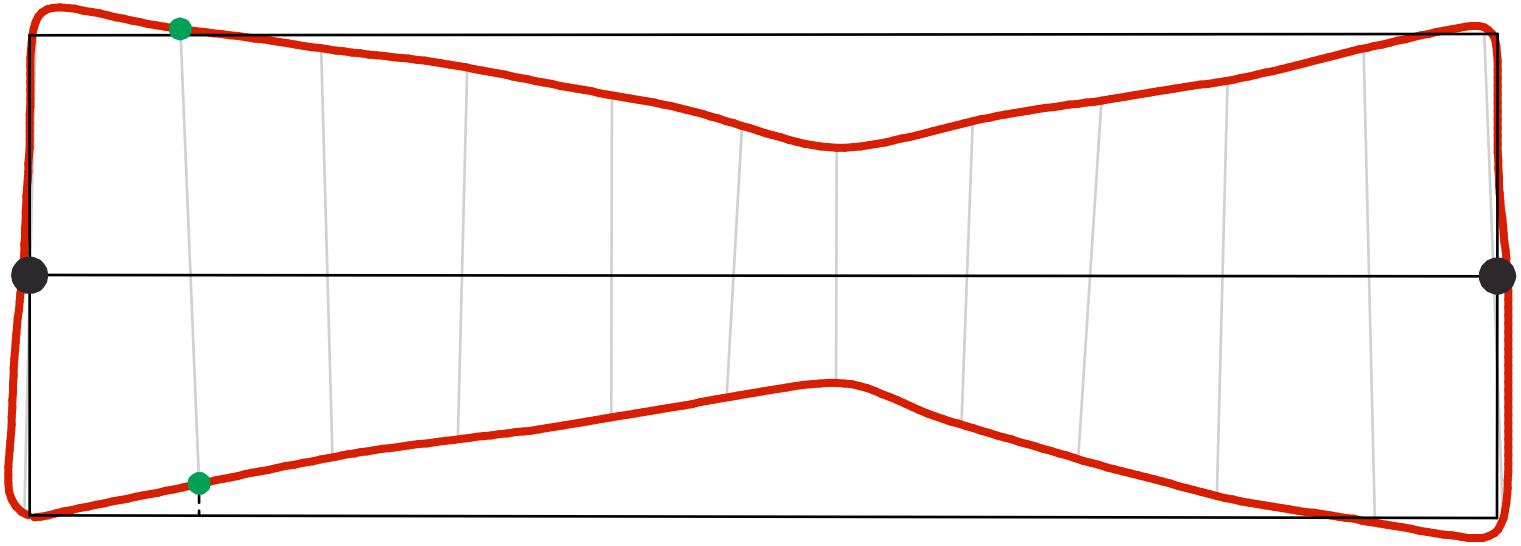
Fit trapezoid



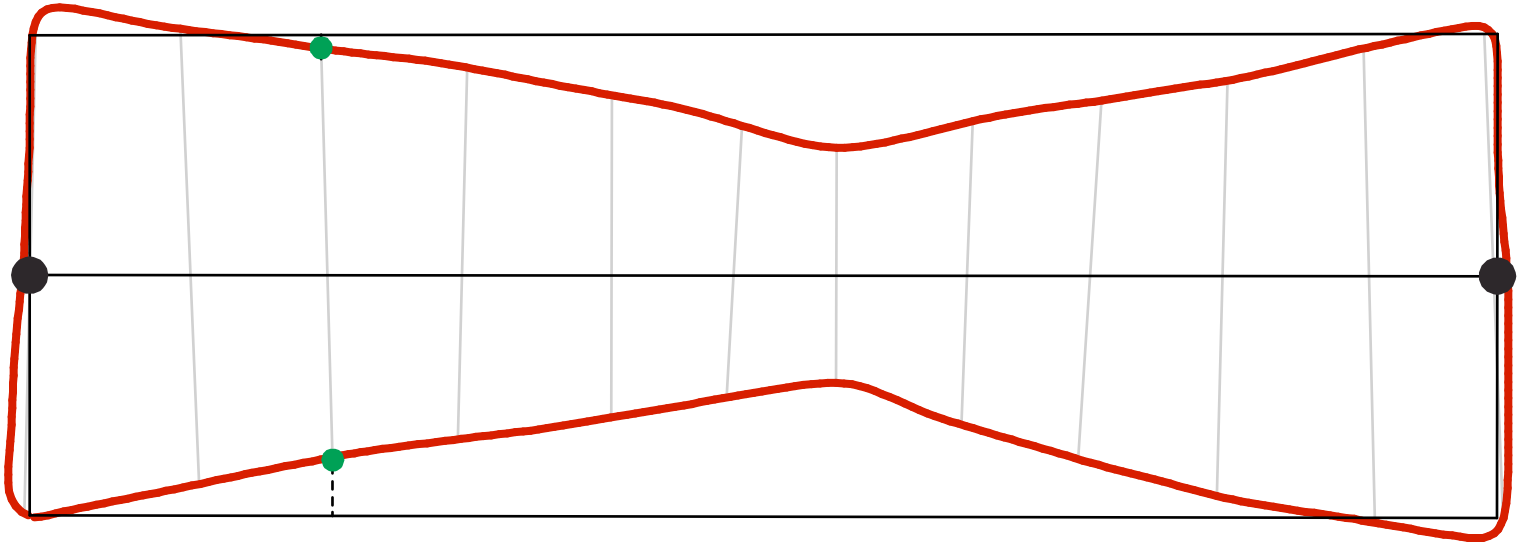
Cylindrical Douglas-Peucker error



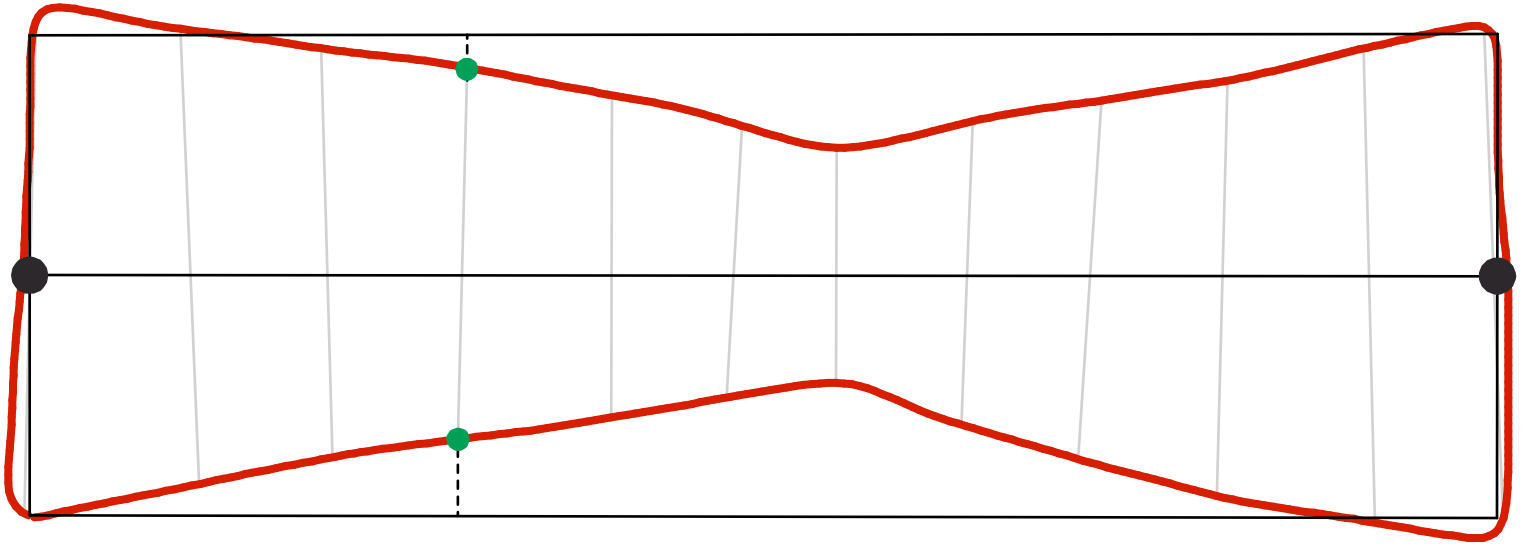
Cylindrical Douglas-Peucker error



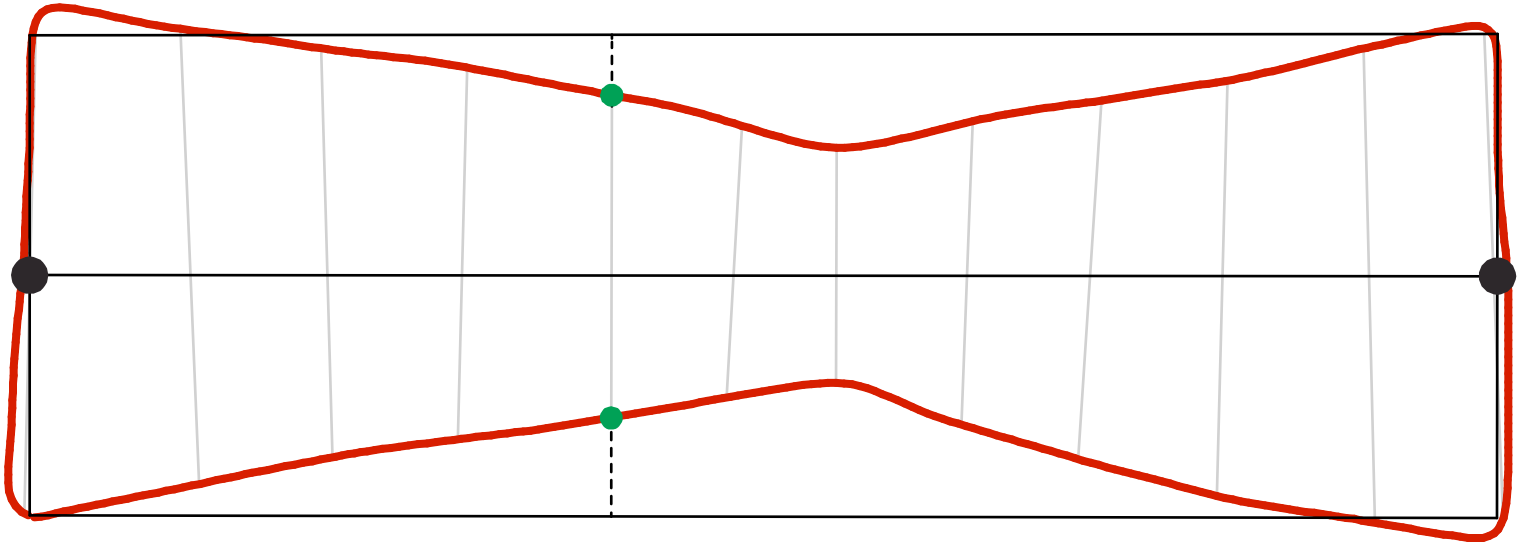
Cylindrical Douglas-Peucker error



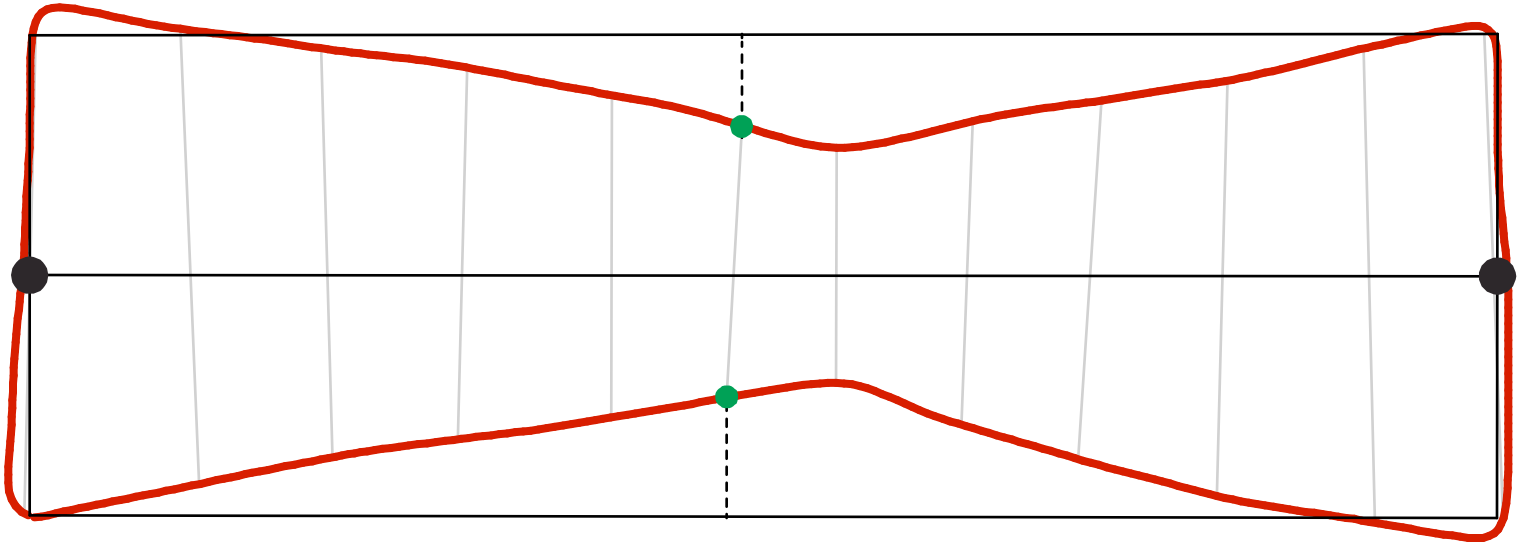
Cylindrical Douglas-Peucker error



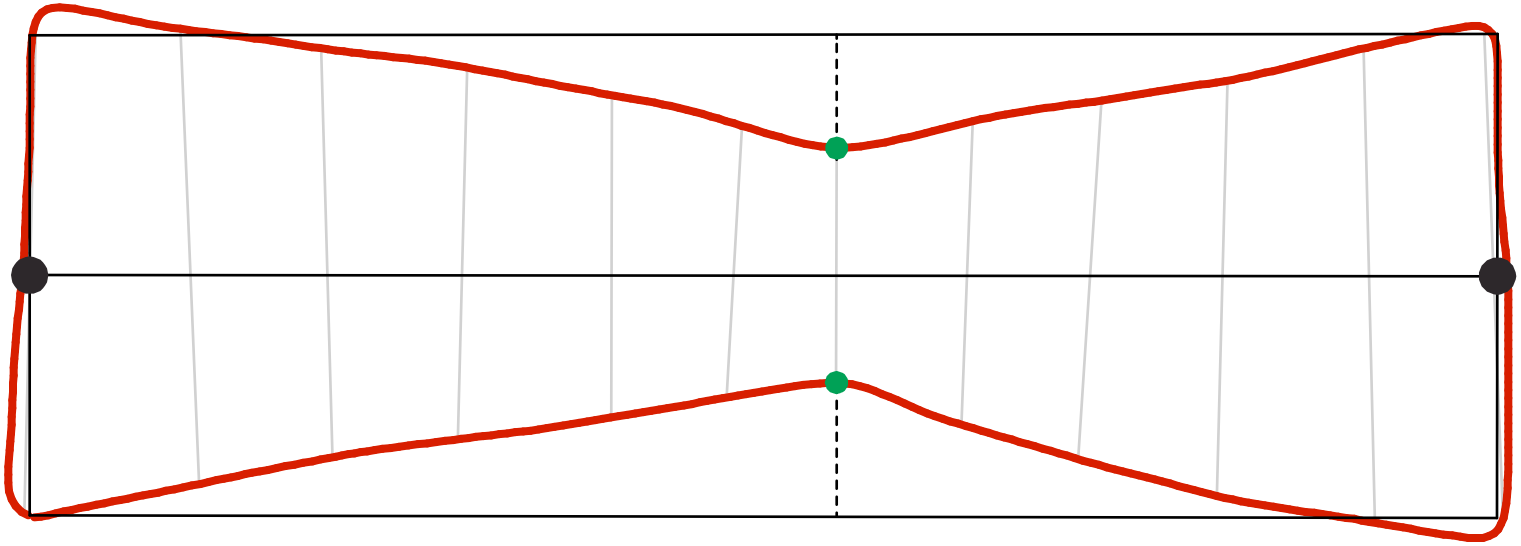
Cylindrical Douglas-Peucker error



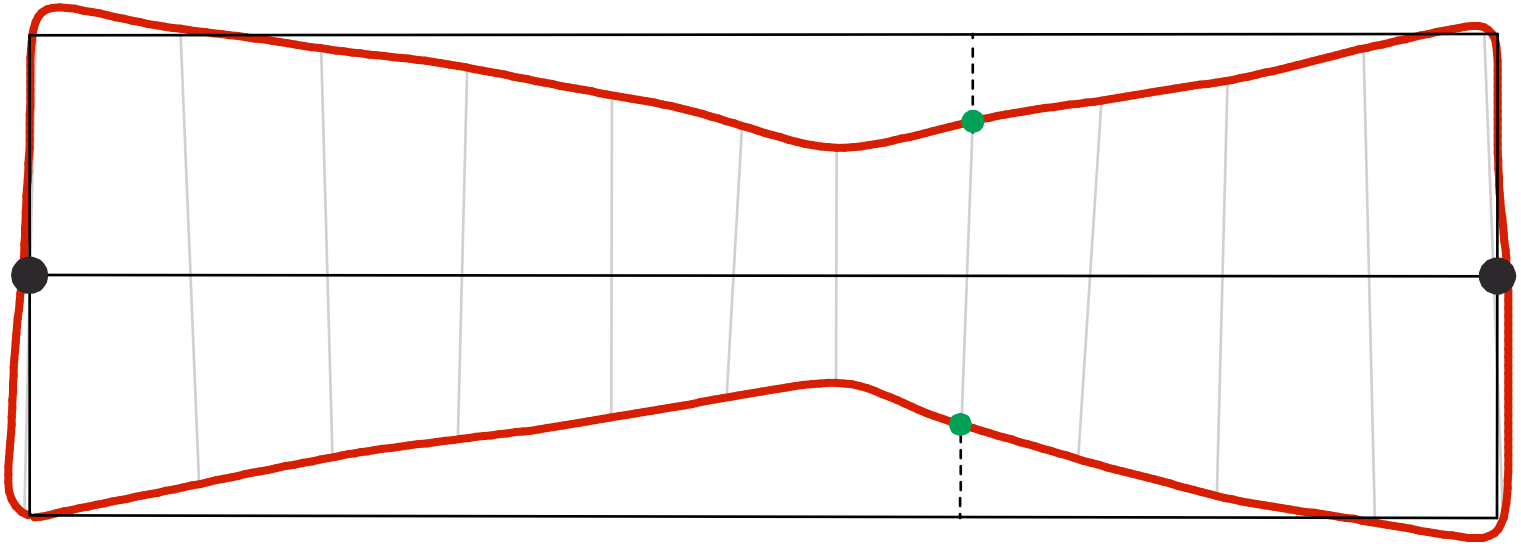
Cylindrical Douglas-Peucker error



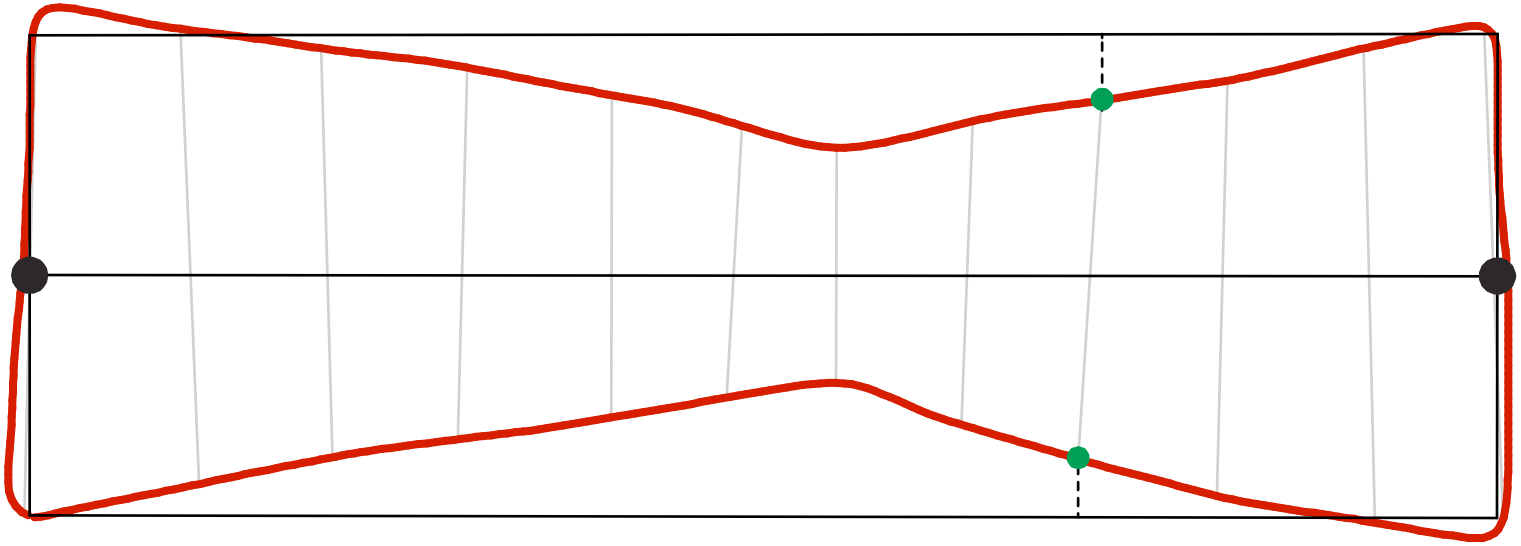
Cylindrical Douglas-Peucker error



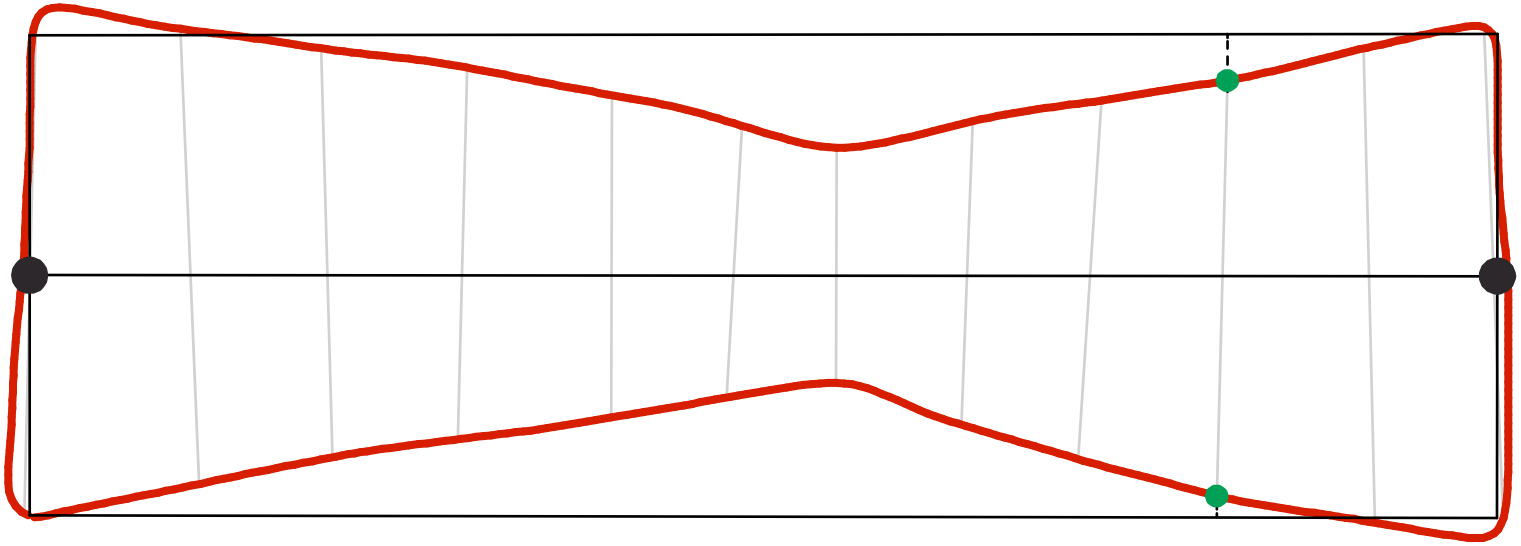
Cylindrical Douglas-Peucker error



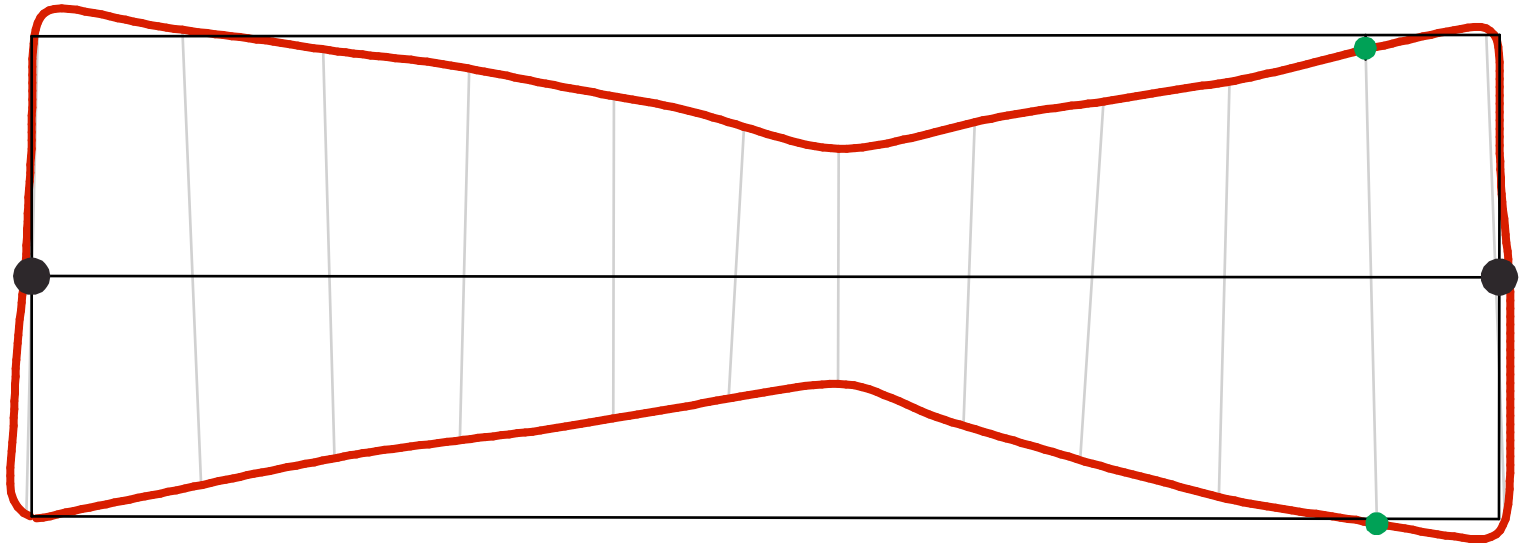
Cylindrical Douglas-Peucker error



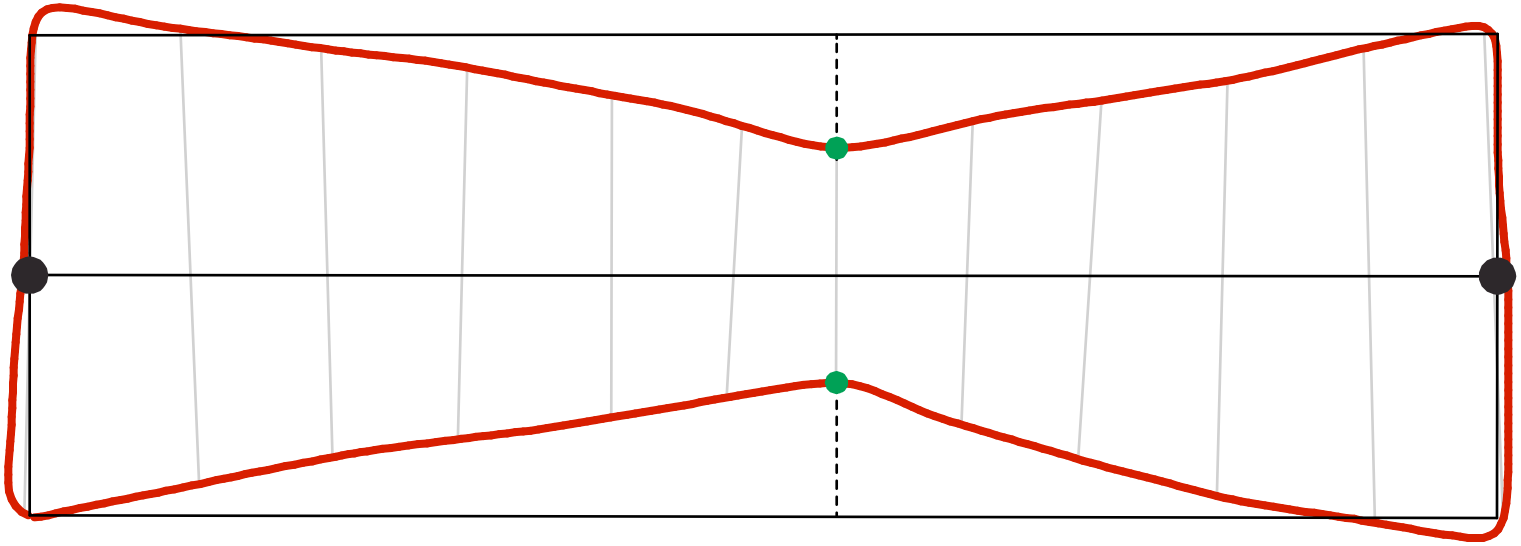
Cylindrical Douglas-Peucker error



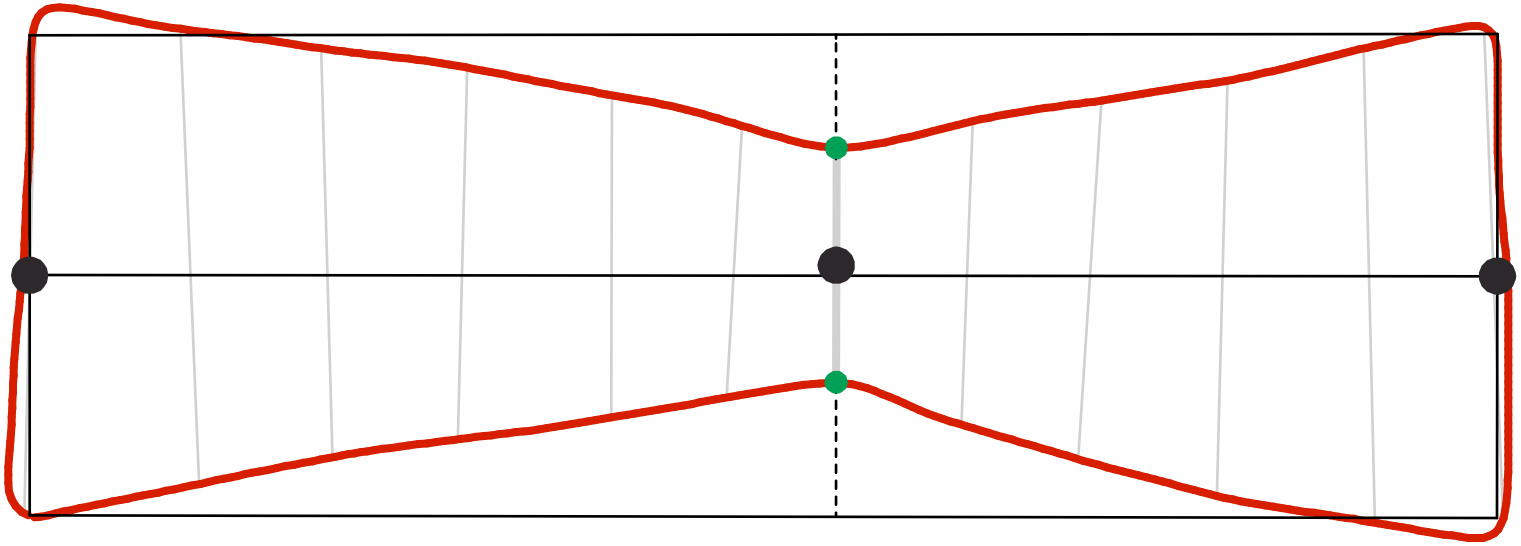
Cylindrical Douglas-Peucker error



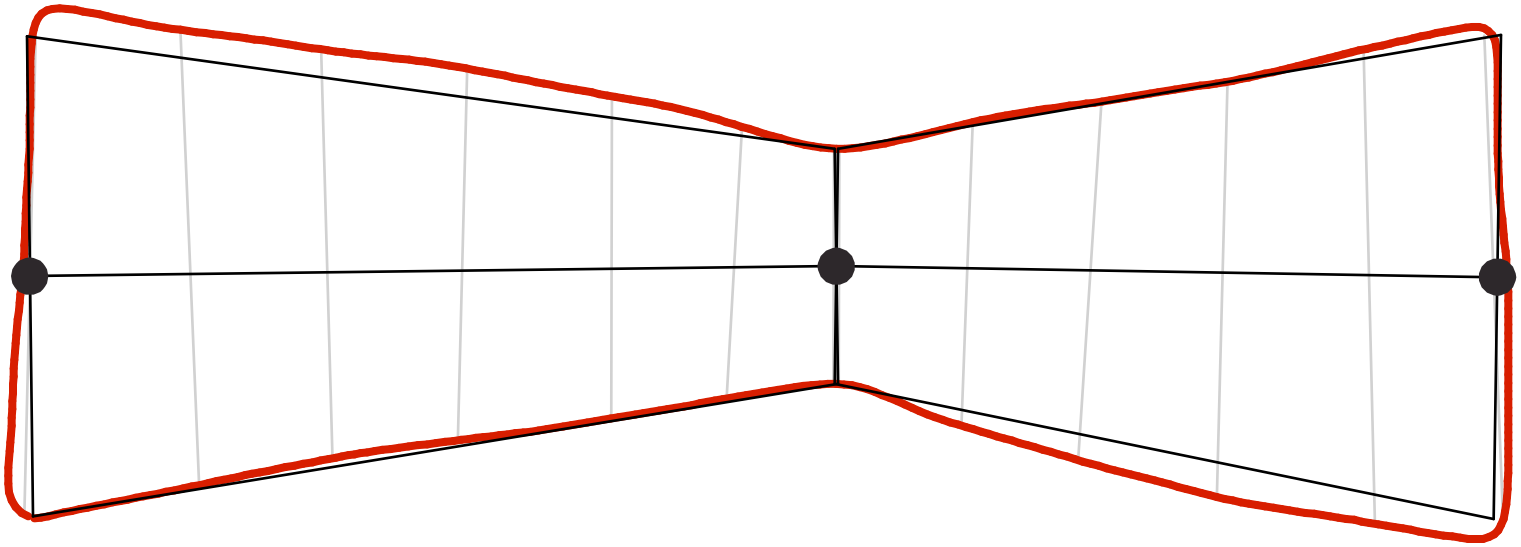
Cylindrical Douglas-Peucker error



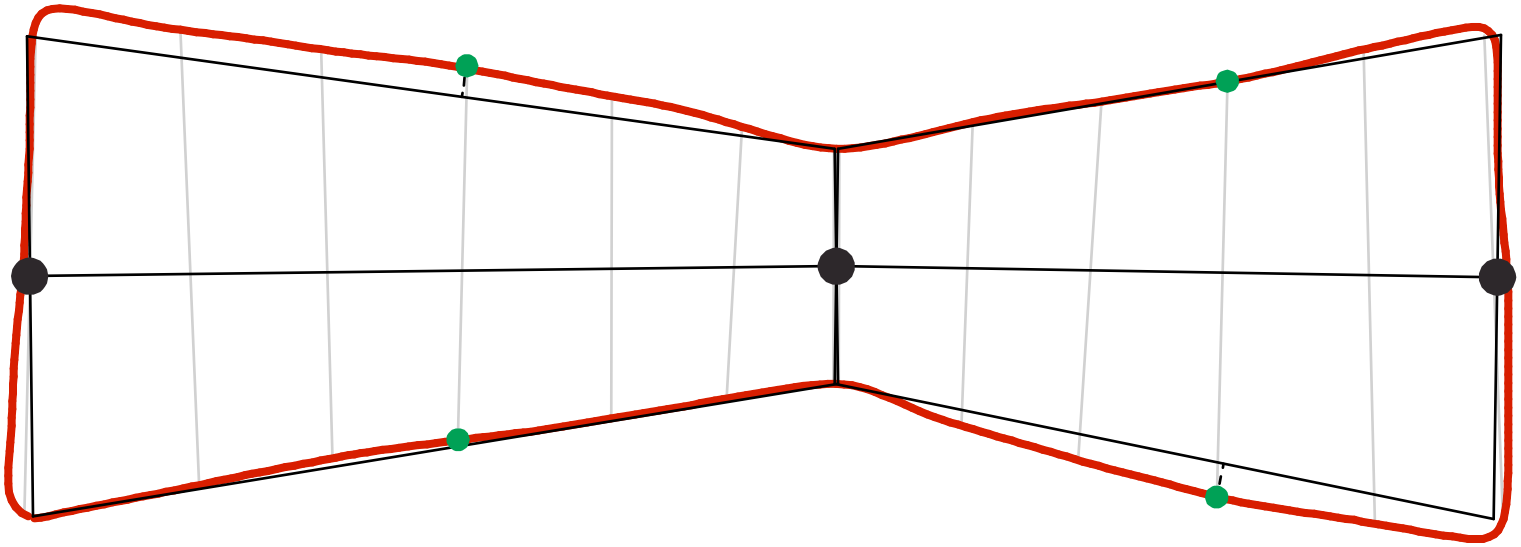
Add new point



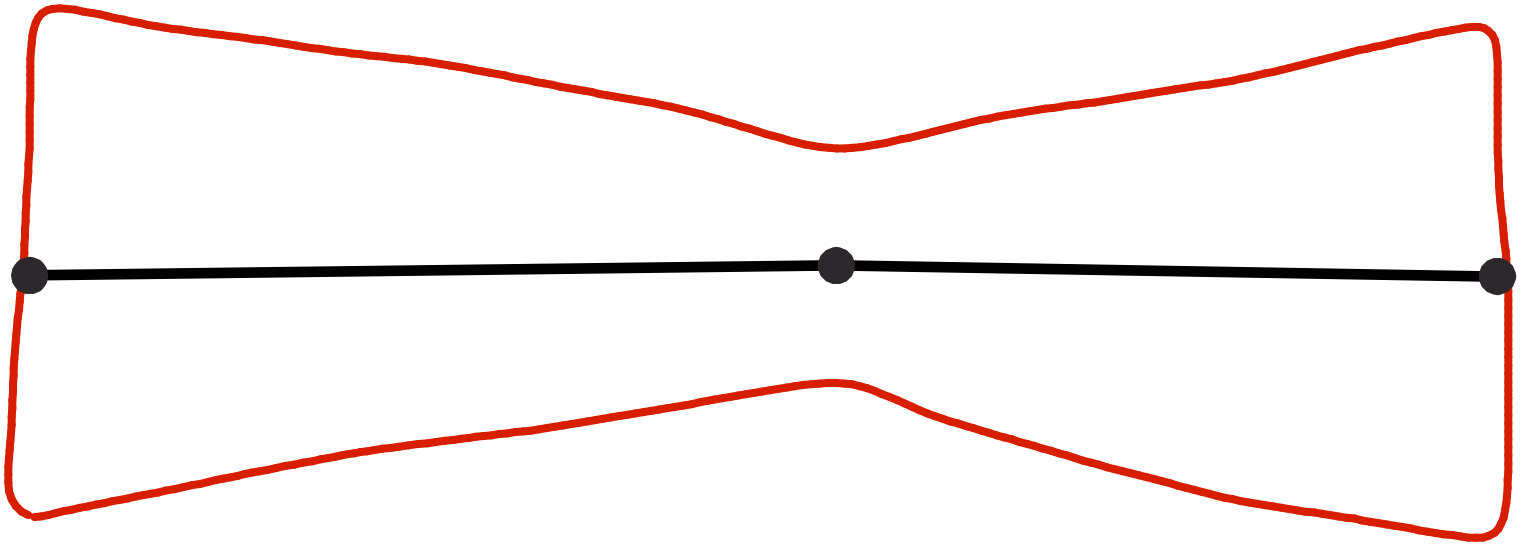
Fit trapezoids



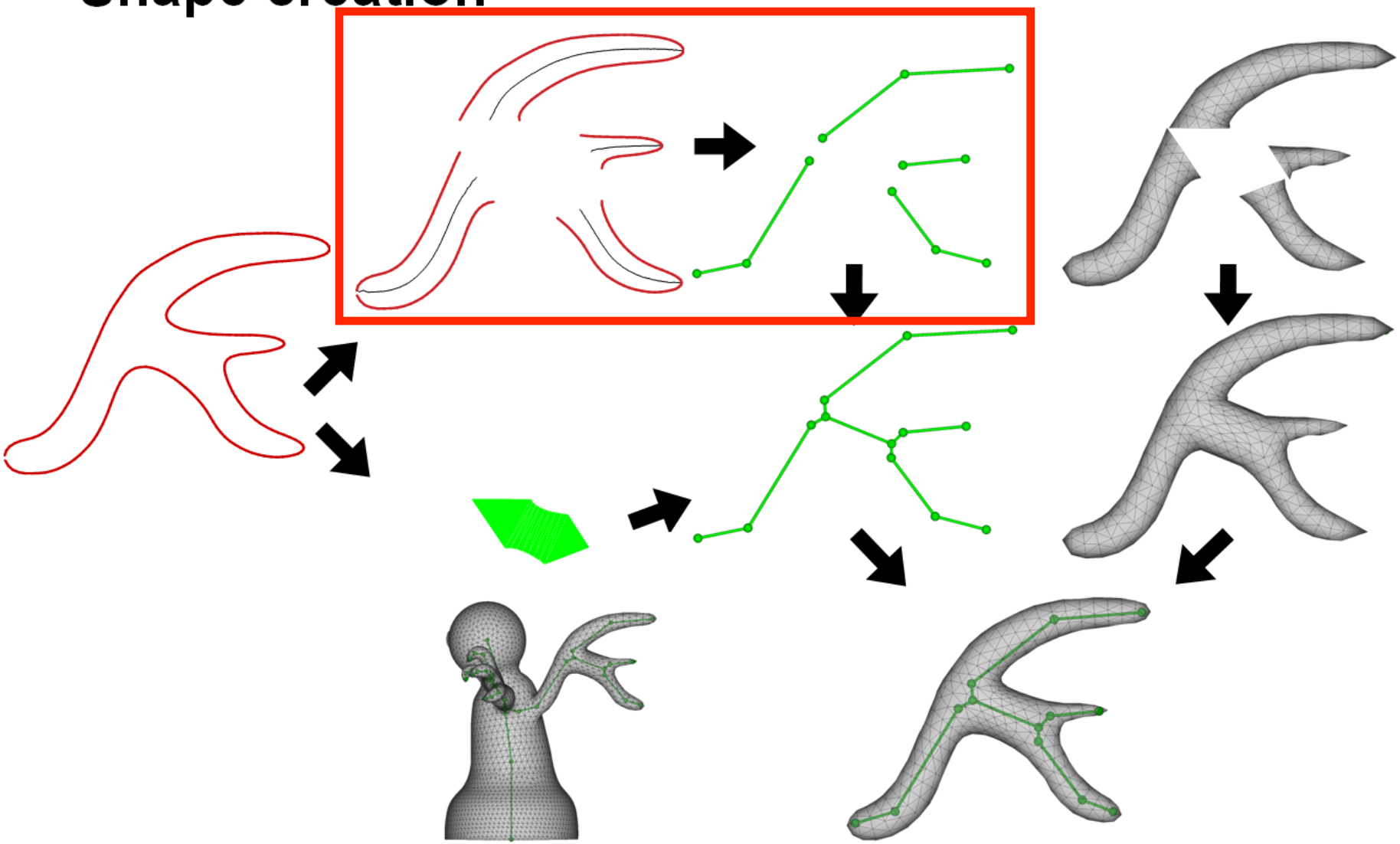
Error below threshold



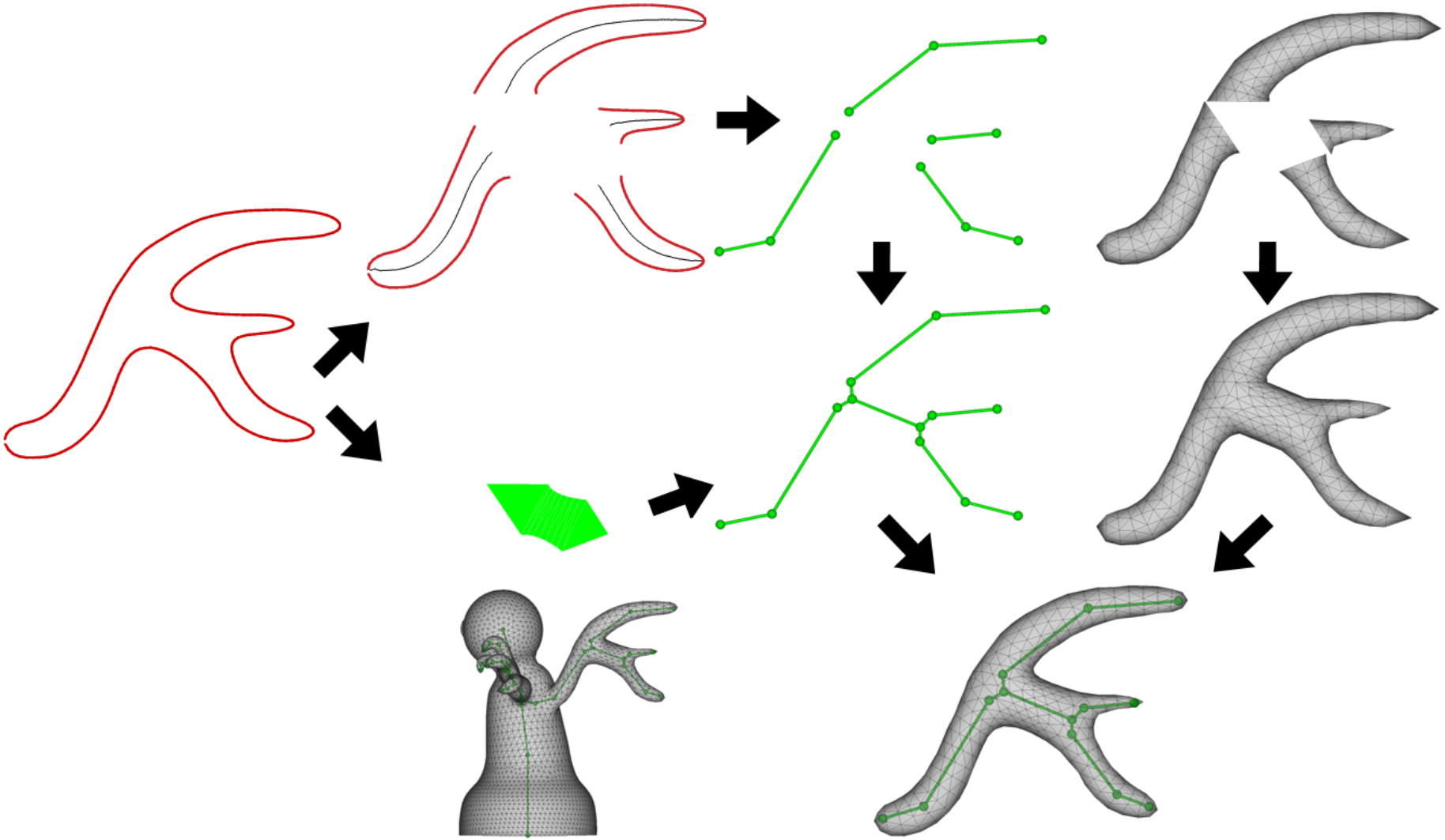
Bones



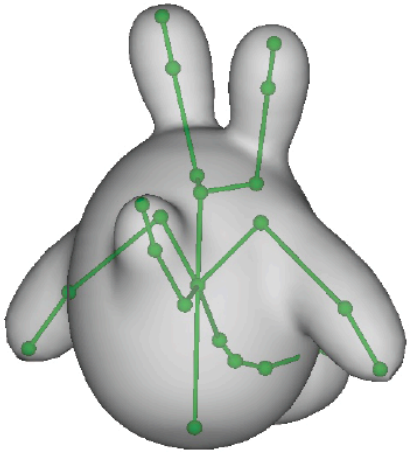
Shape creation

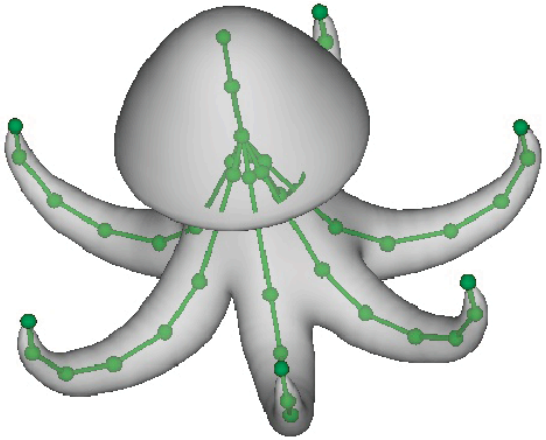


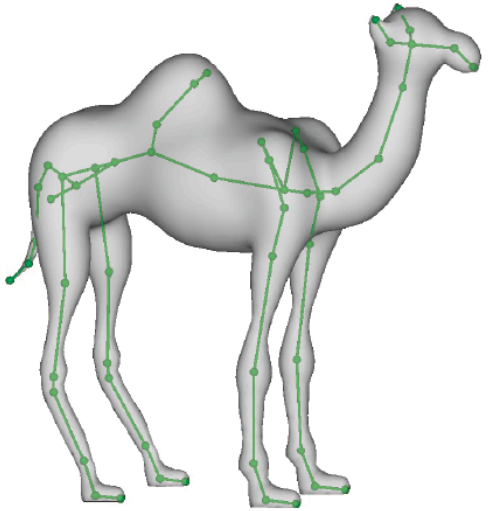
Shape creation

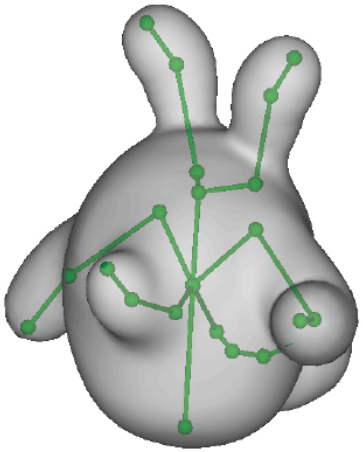


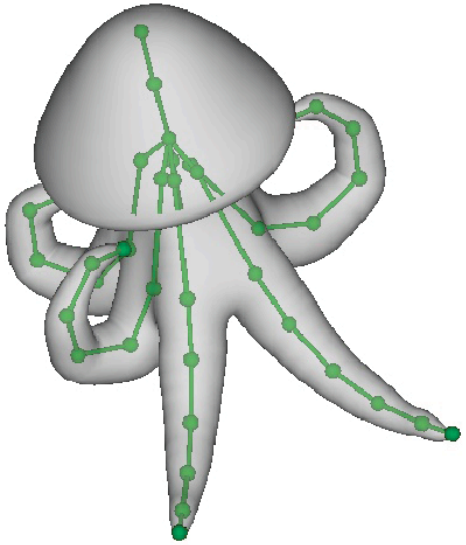
Results

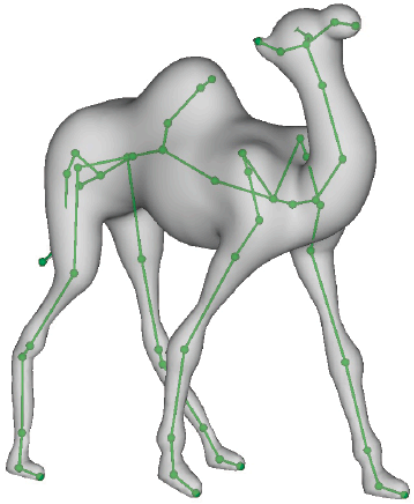




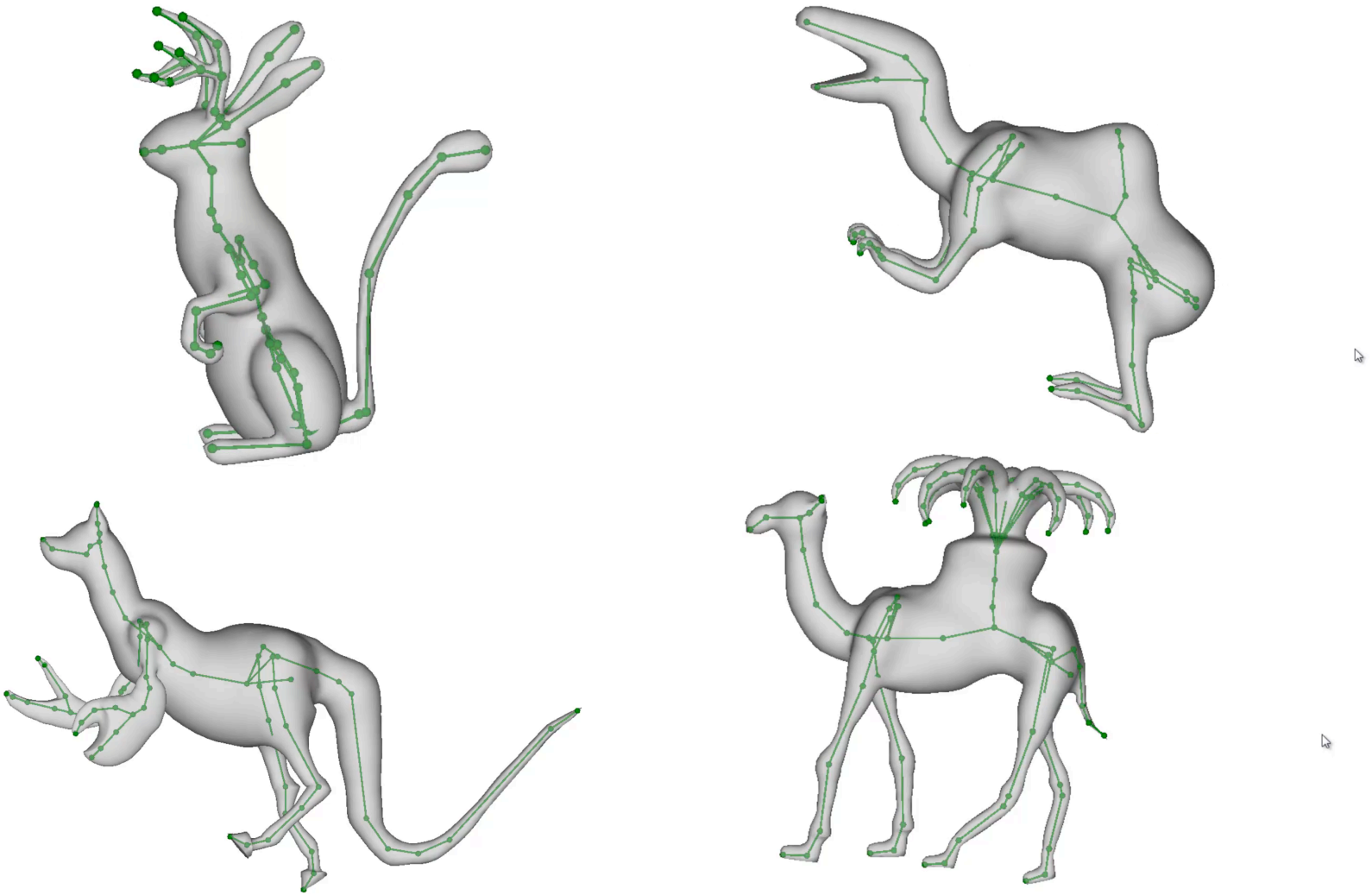




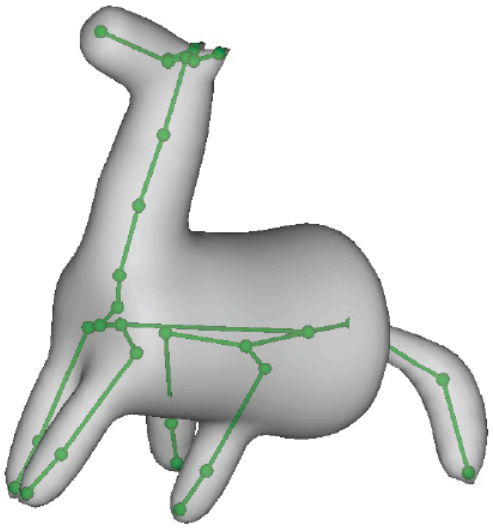


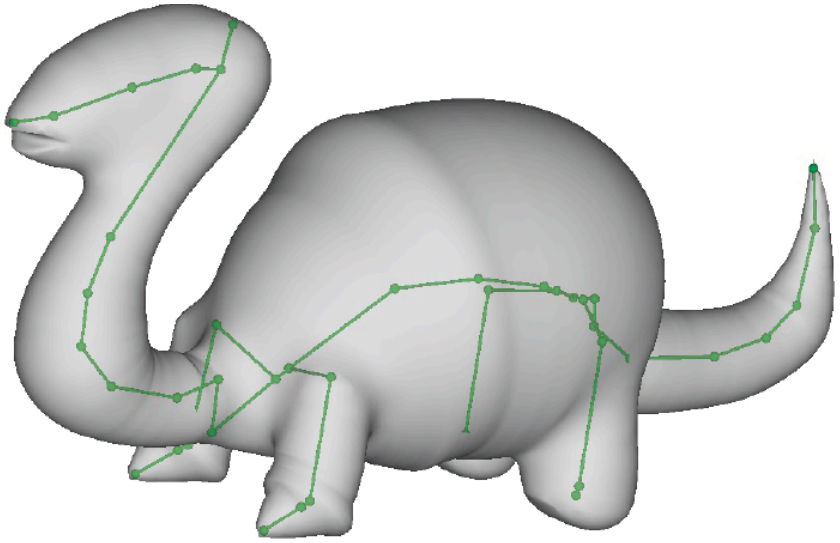


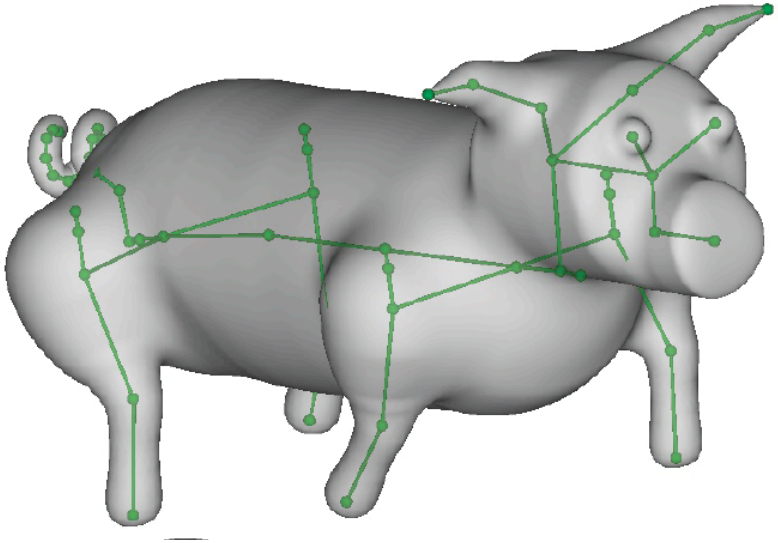
Results (reusing existing models)

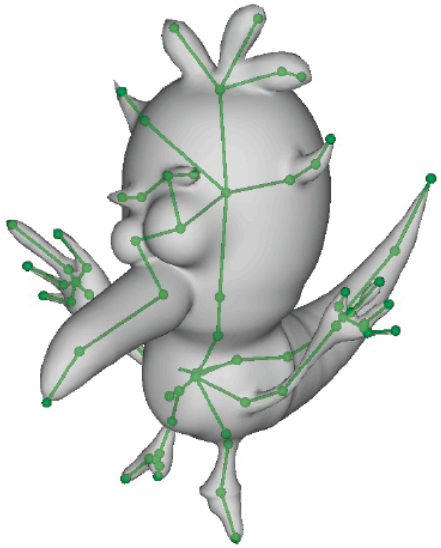


Results (1st time users)





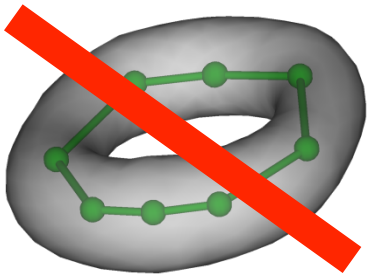




Limitations

Limitations

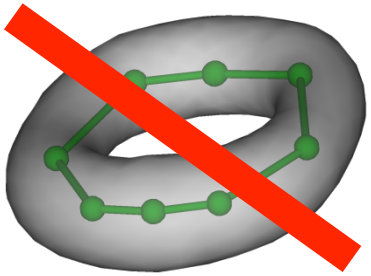
Only acyclic skeletons

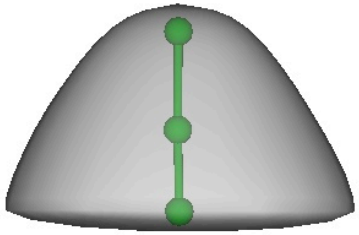


Limitations

Only acyclic skeletons

Objects without strong, stable axial symmetry





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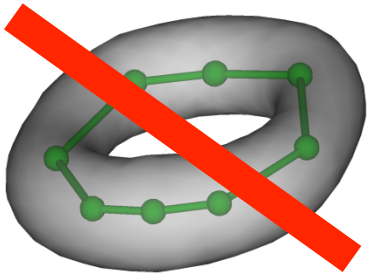

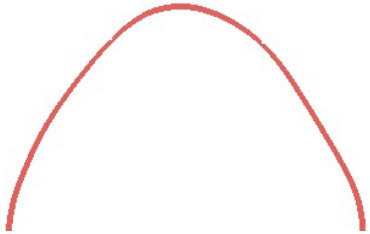

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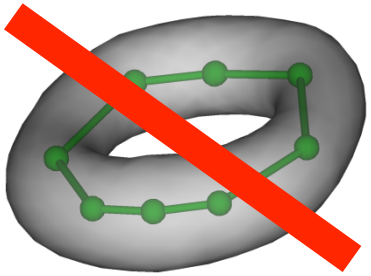

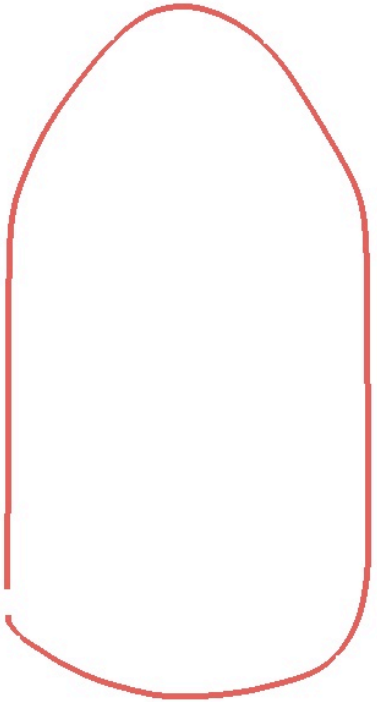

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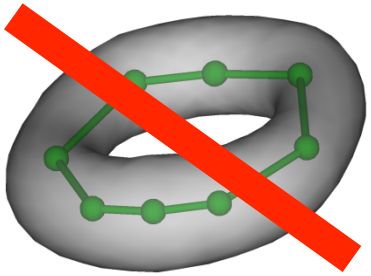

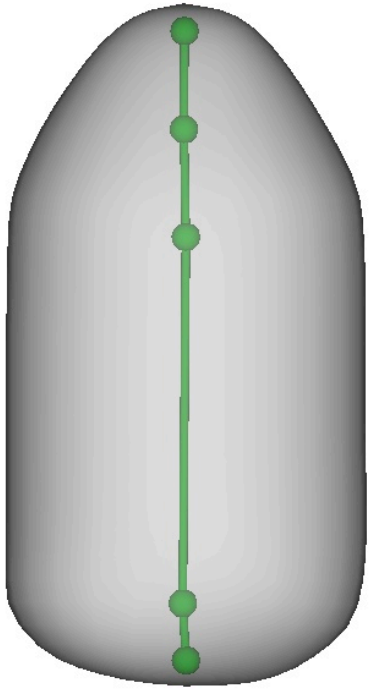

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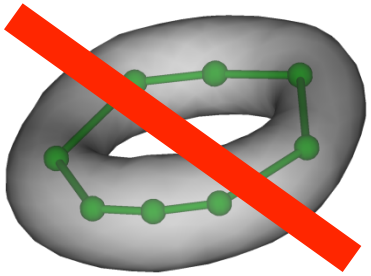

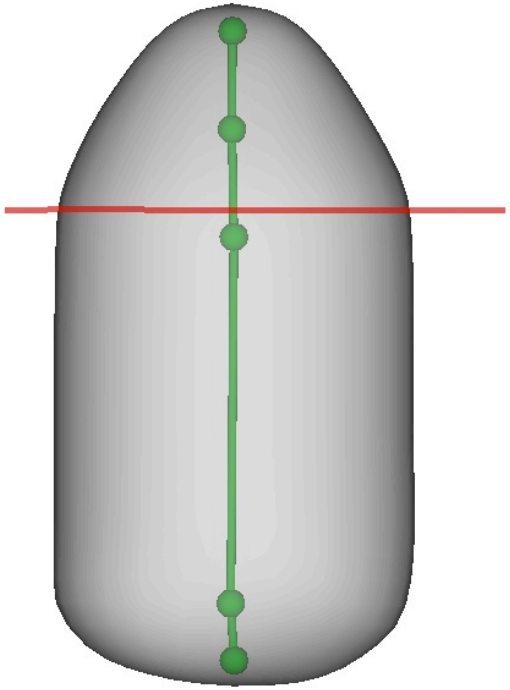

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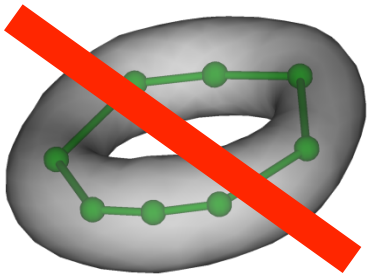

Limitations & Future work

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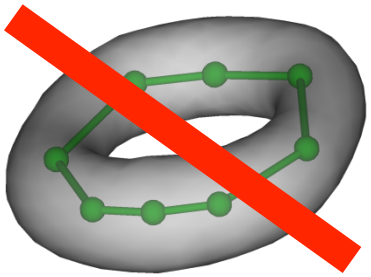

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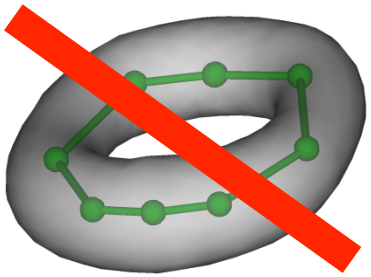

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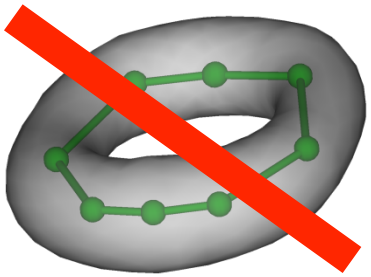

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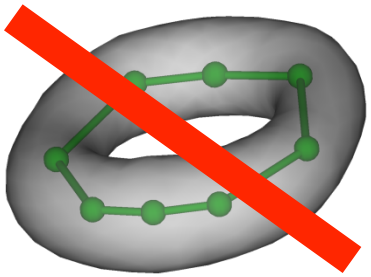

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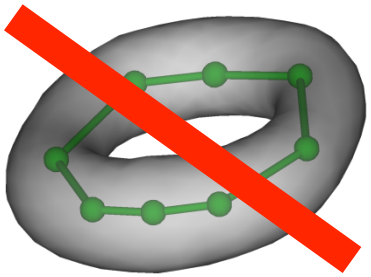

Adapt for improved skinning methods

Limitations & Future work

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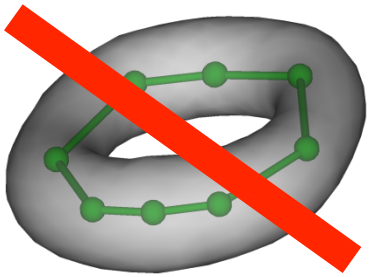

Adapt for improved skinning methods

Include animation in the unified pipeline

Thank you!