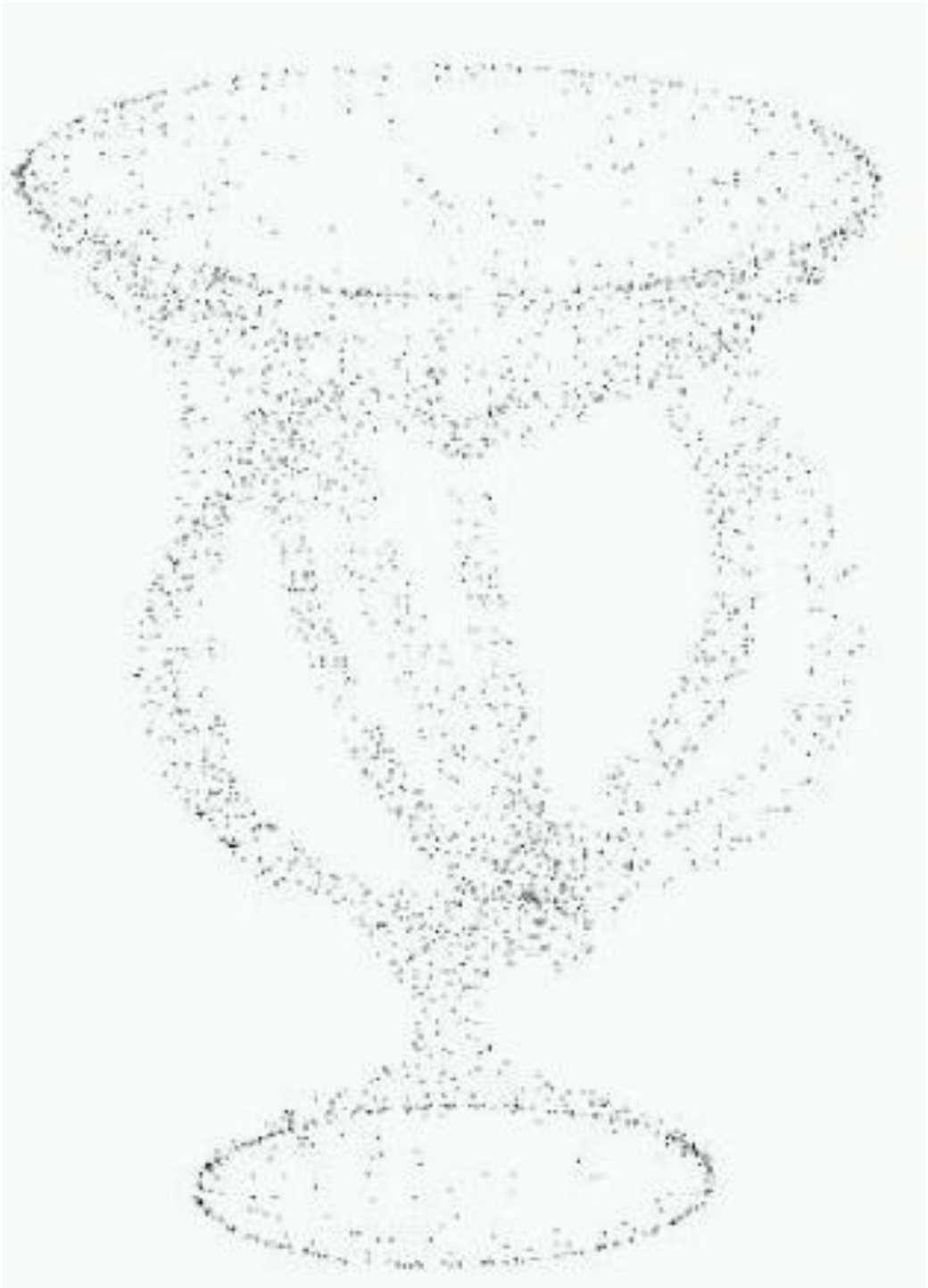
Reconstruction

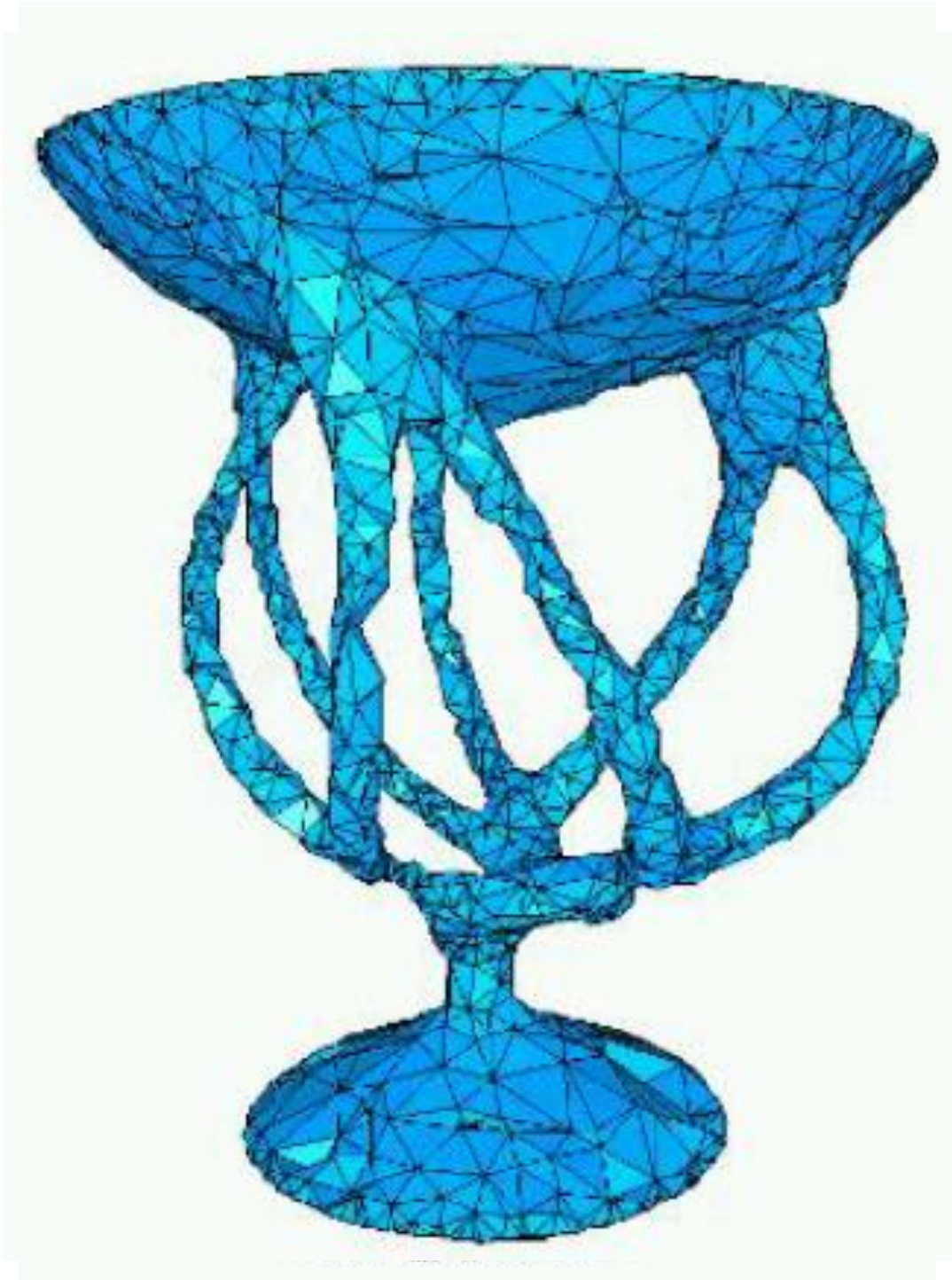
From points



Reconstruction

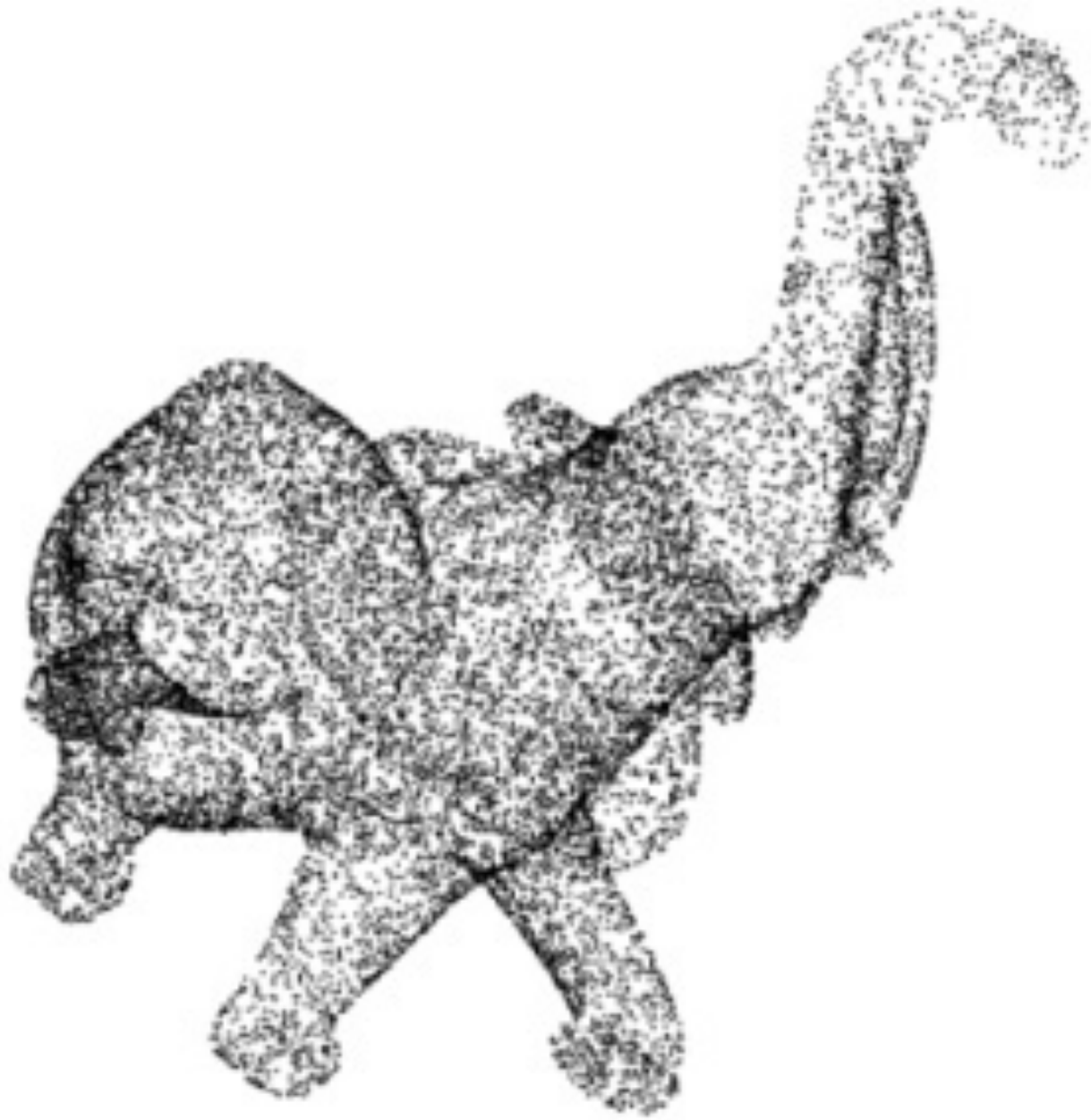
From points

to shape



Reconstruction

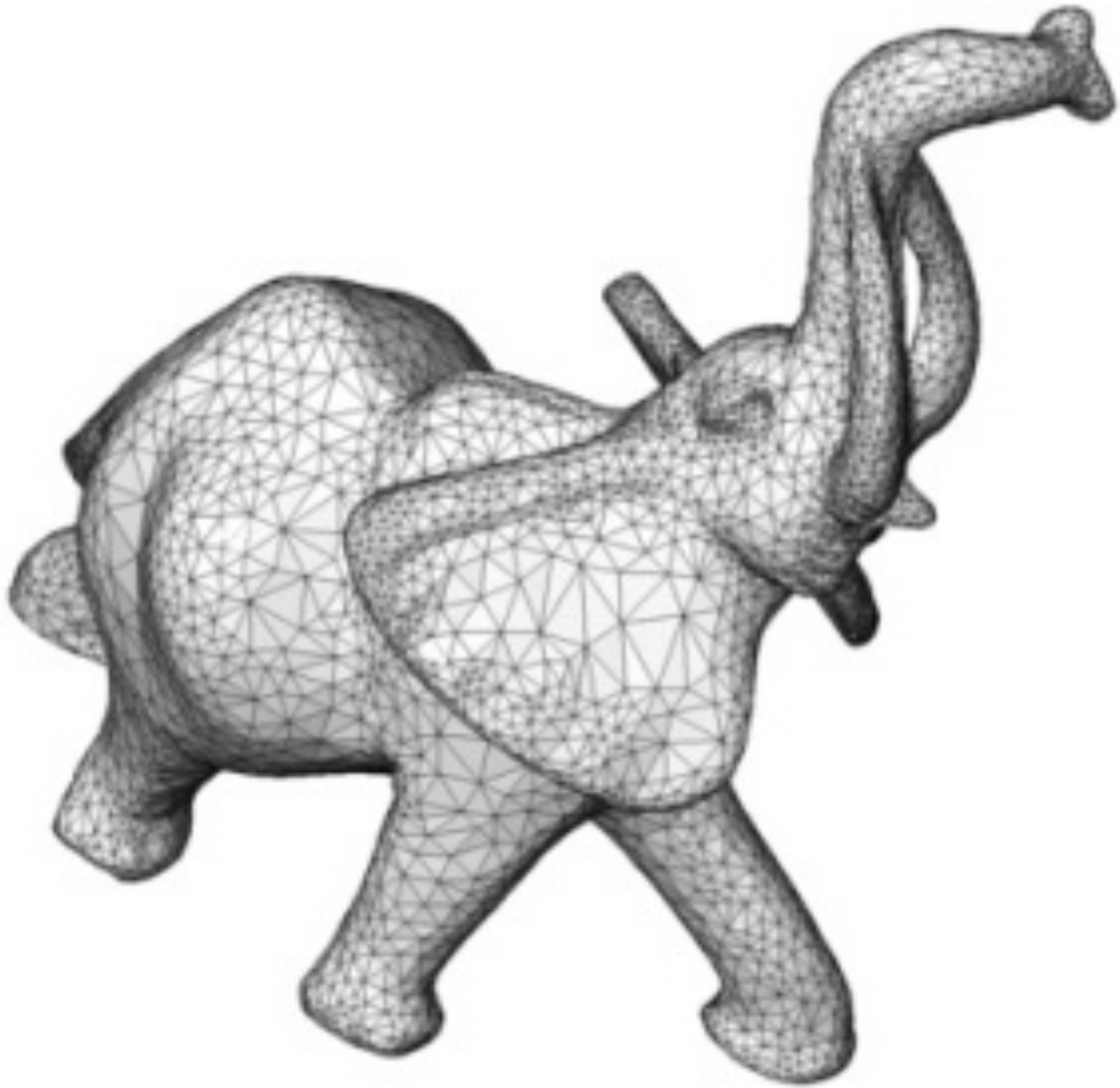
From points



Reconstruction

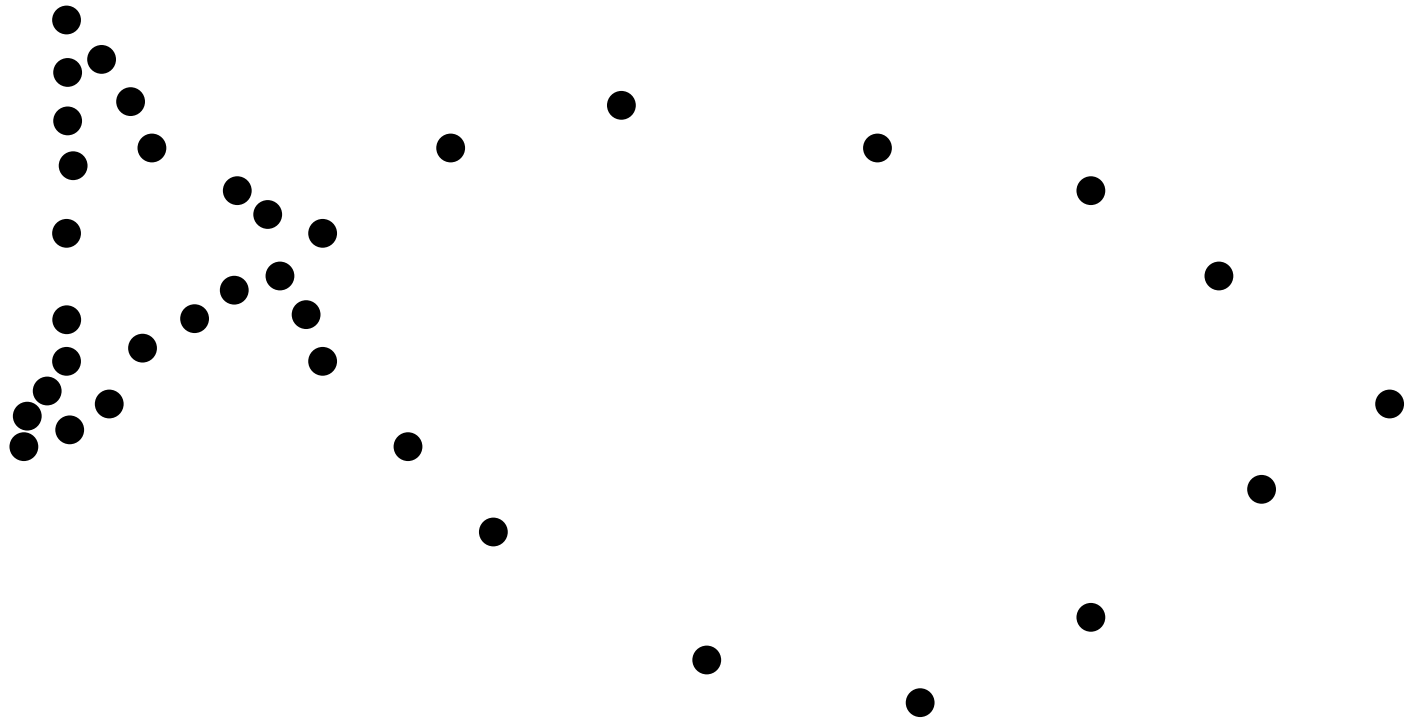
From points

to shape



Reconstruction

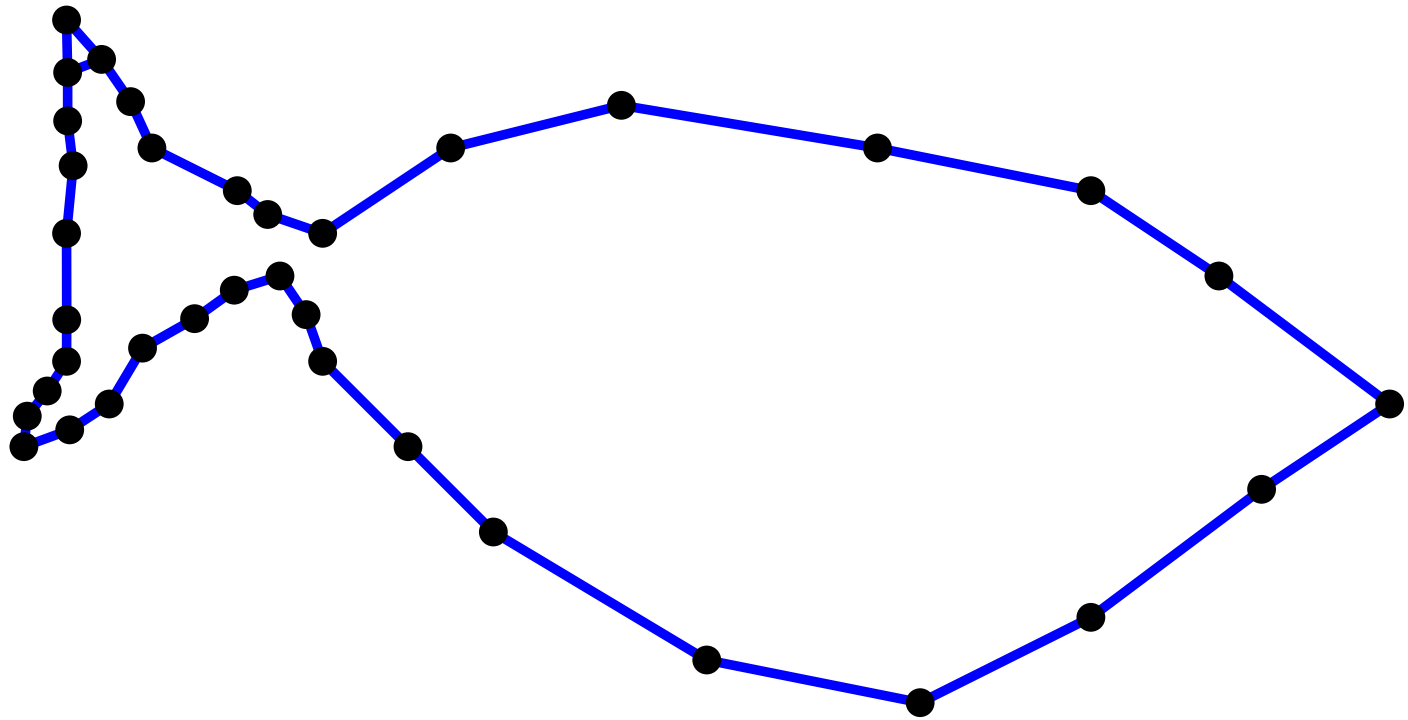
From points



Reconstruction

From points

to shape



Reconstruction

Context

Delaunay is a good start (wanted result $\subset$ Delaunay)

Crust 2D Algorithm

0.4 sample $\Rightarrow$ wanted result $\subset$ crust

0.25 sample $\Rightarrow$ crust $\subset$ wanted result

3D

Reconstruction

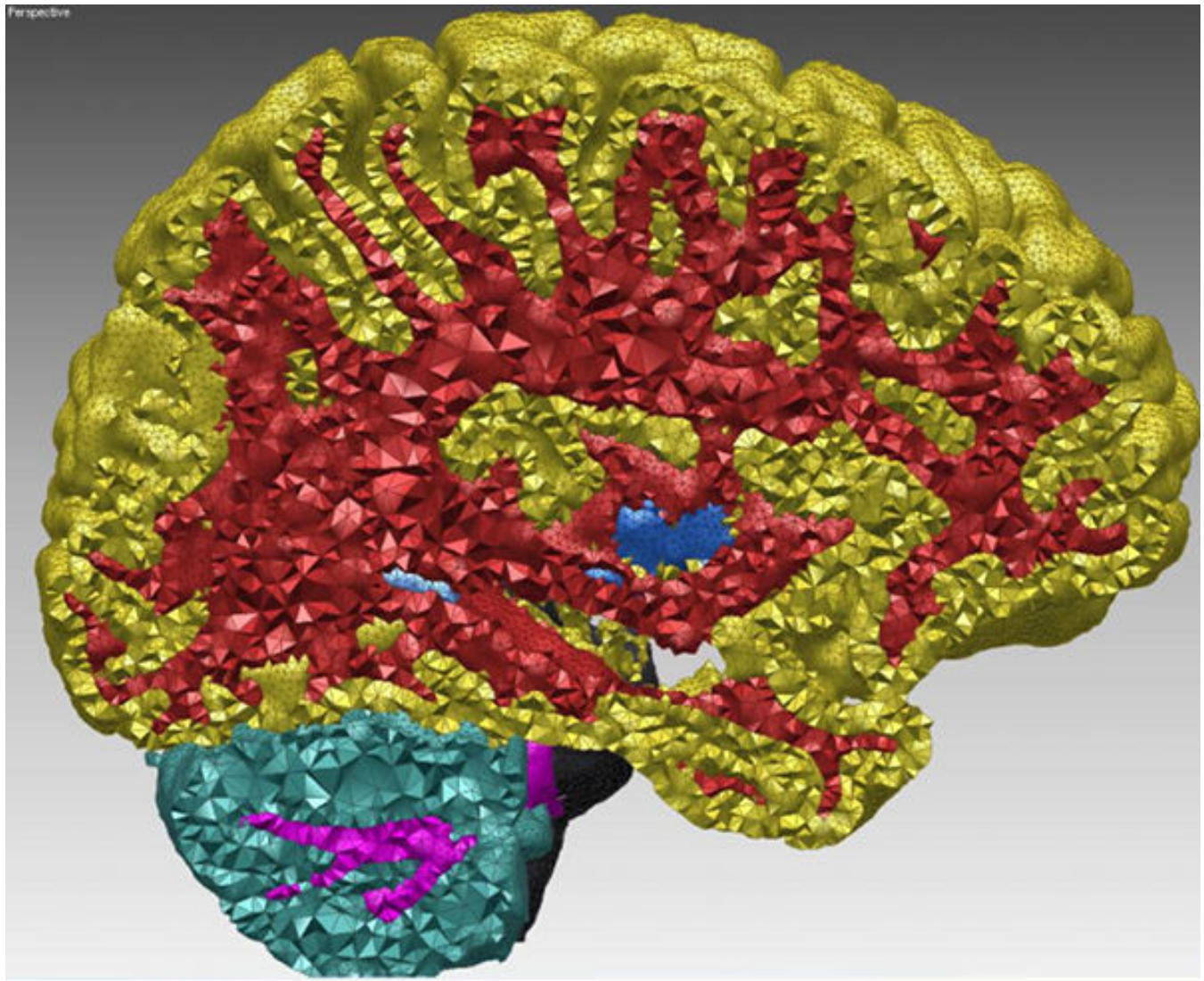
Context

Sensor Point set (no structure or unknown)

Reconstruction

Context

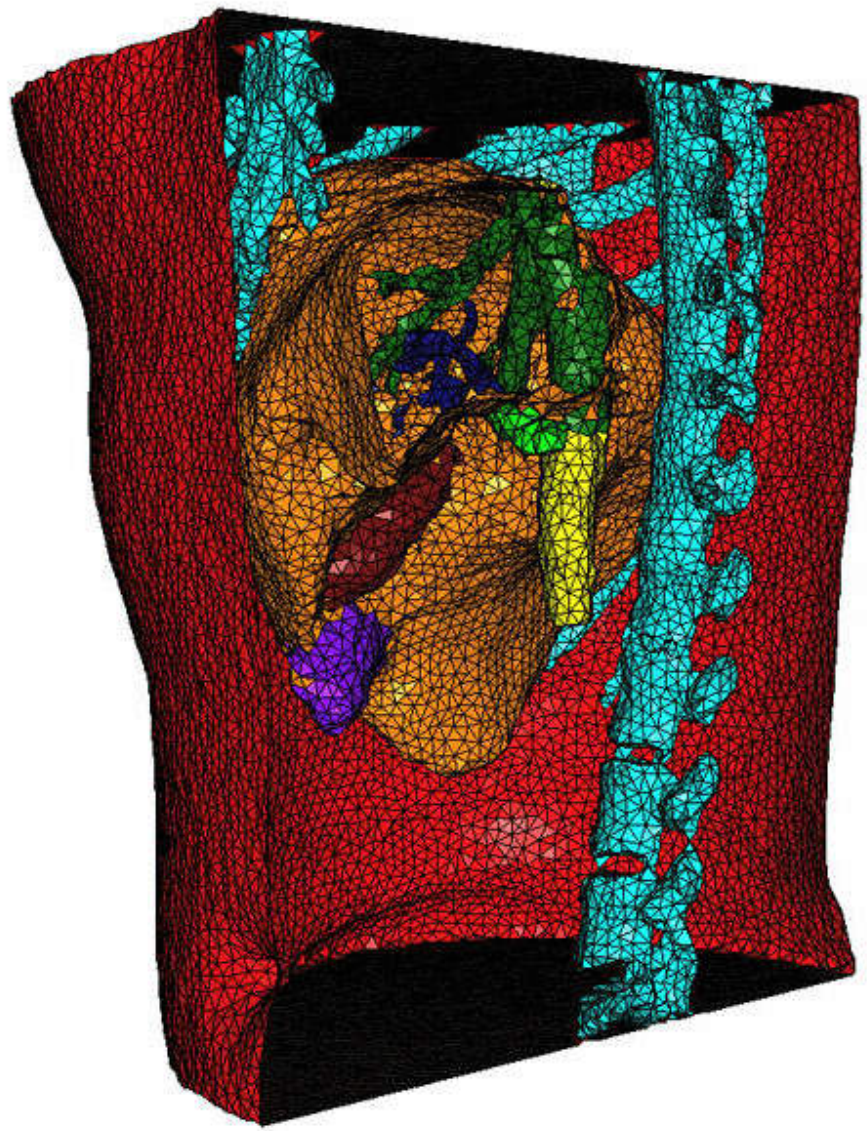
Medical Images



Reconstruction

Context

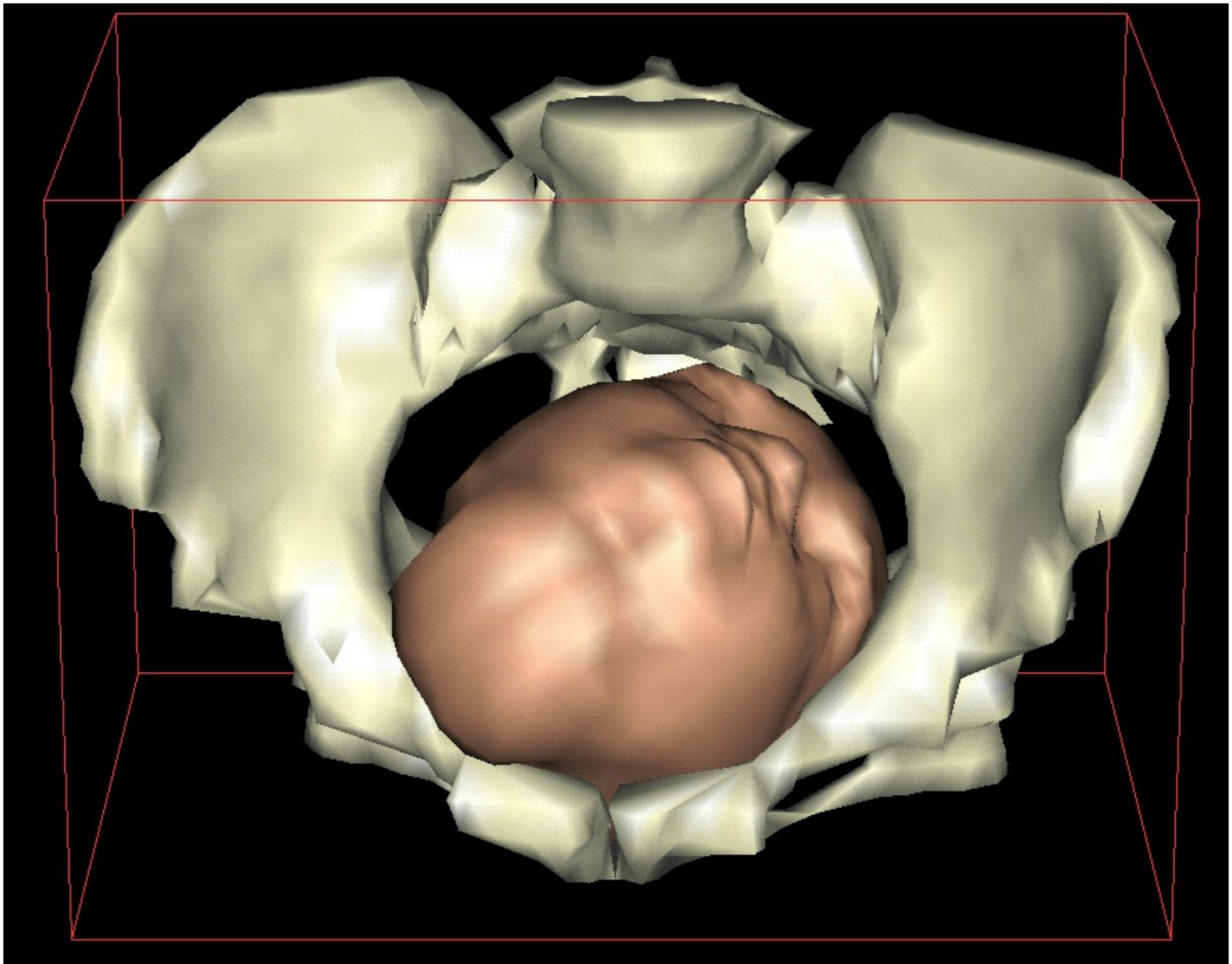
Medical Images



Reconstruction

Context

Childbirth simulation



Context

Childbirth simulation

Surgery planning

Radiotherapy planing

Endoscopy simulation

• • •

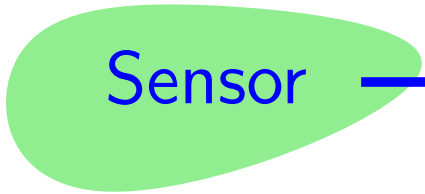
Reconstruction

Context

Scanner

Reconstruction

Context

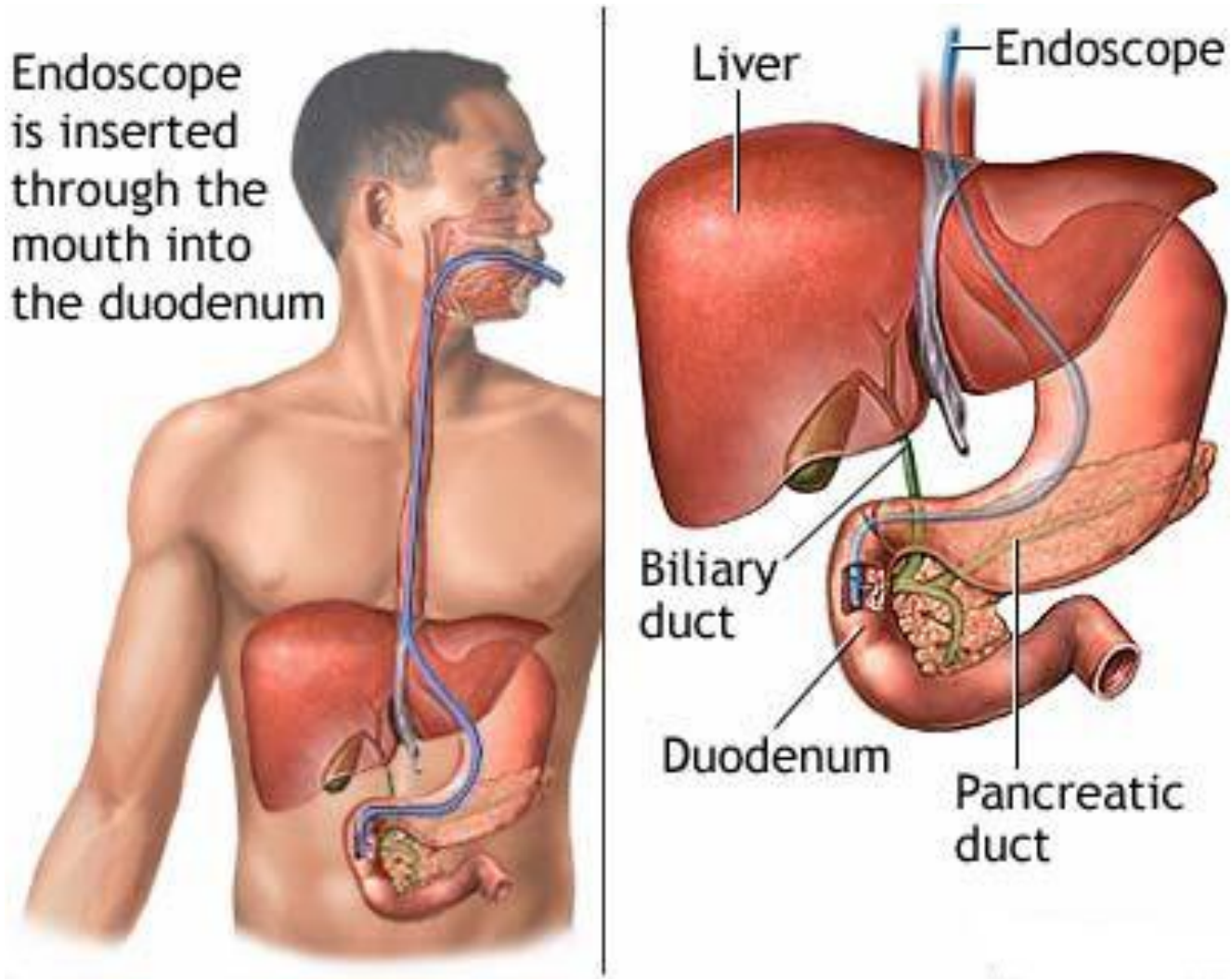


Point set (no structure or unknown)

Scanner

Endoscope

• • •



Reconstruction

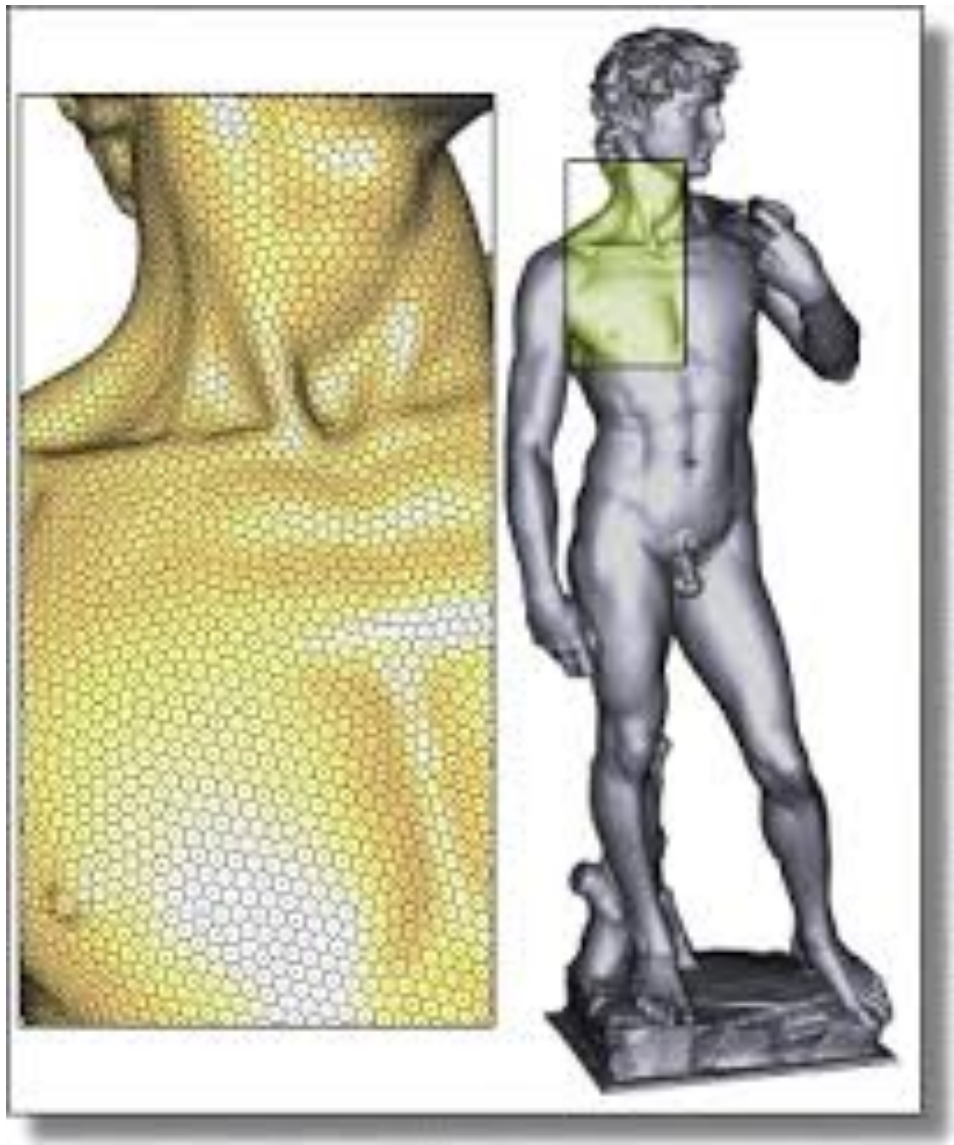
Context

Cultural heritage

Reconstruction

Context

Cultural heritage



Reconstruction

Context

Reconstruction

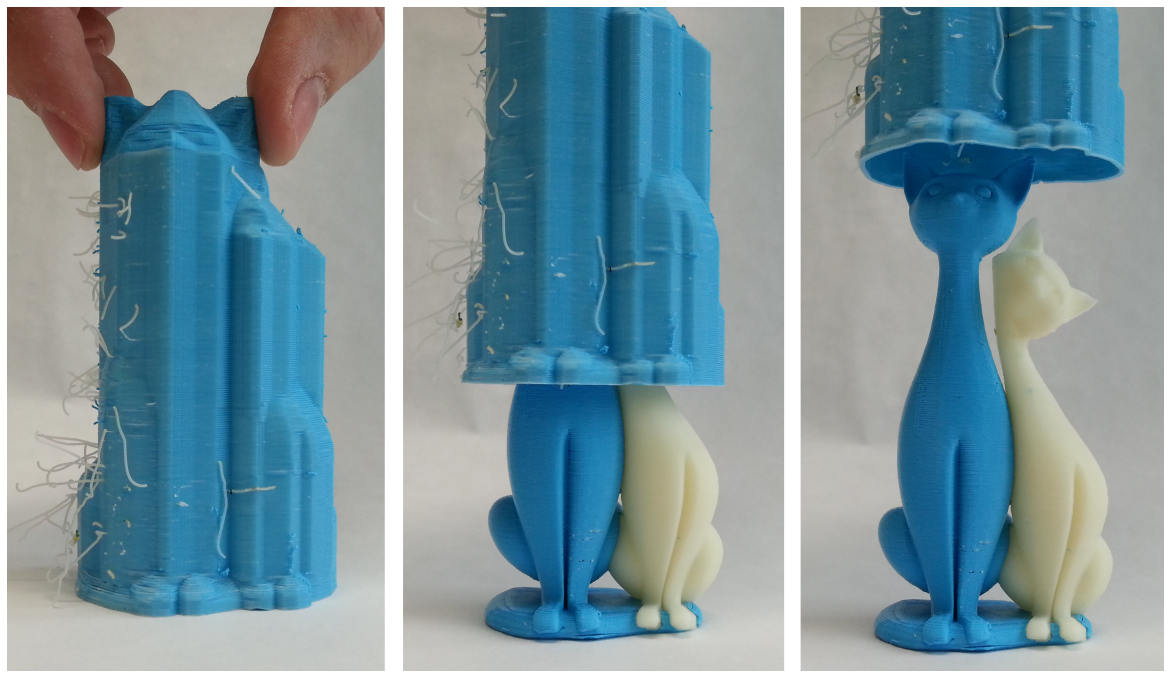
Context

Reverse engineering

Reverse engineering

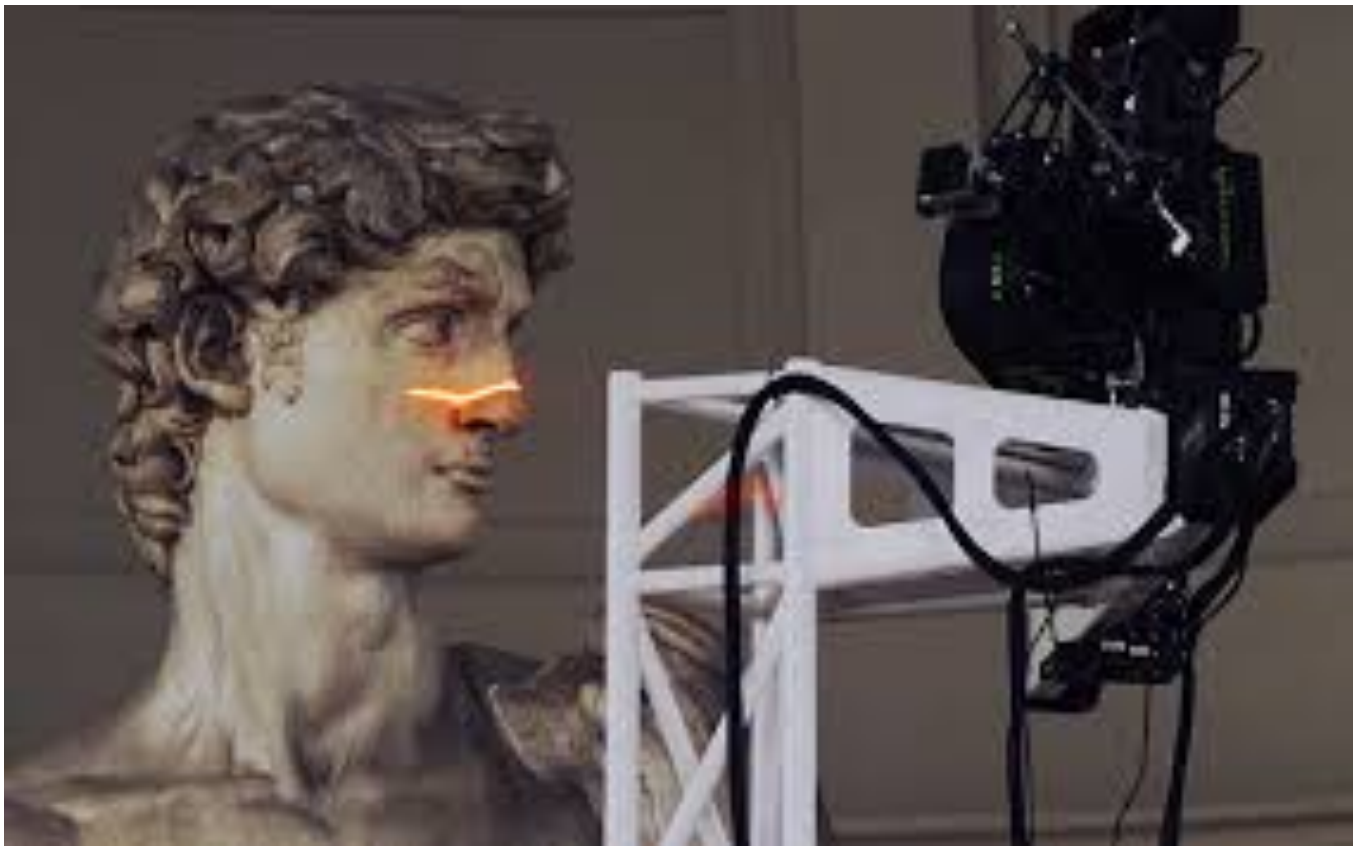
Prototyping (3D print)

Quality control



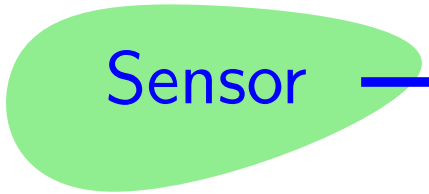
Reconstruction

Context



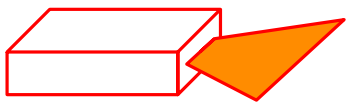
Reconstruction

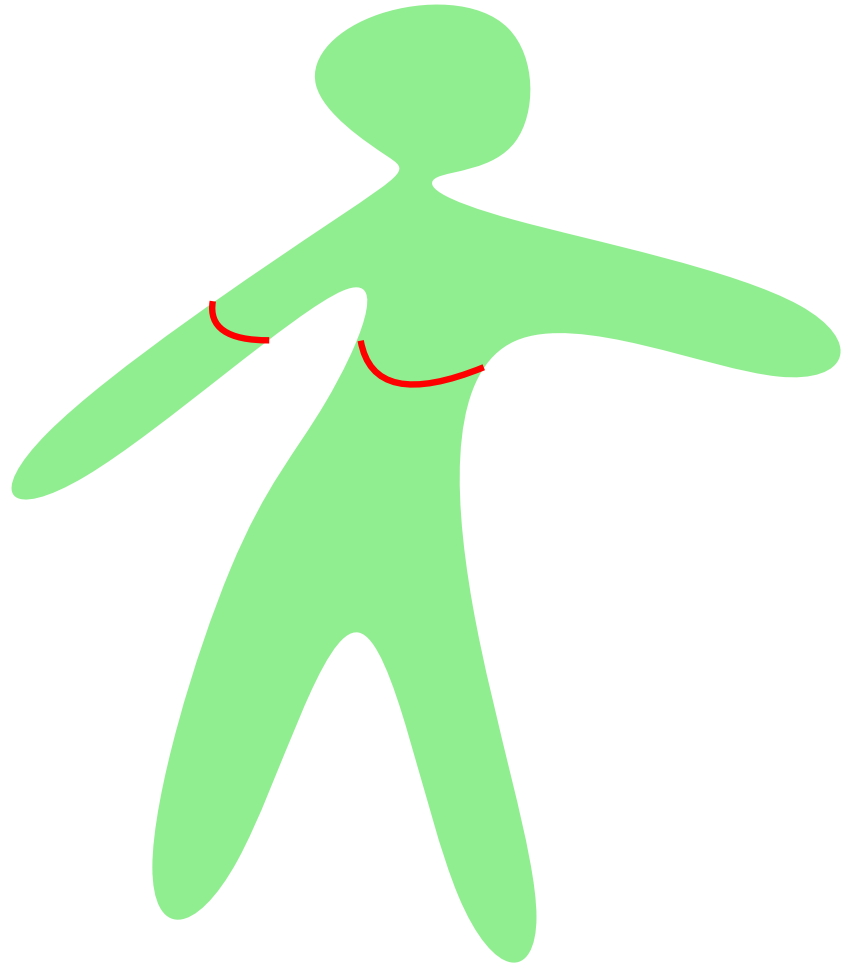
Context



Point set (no structure or unknown)

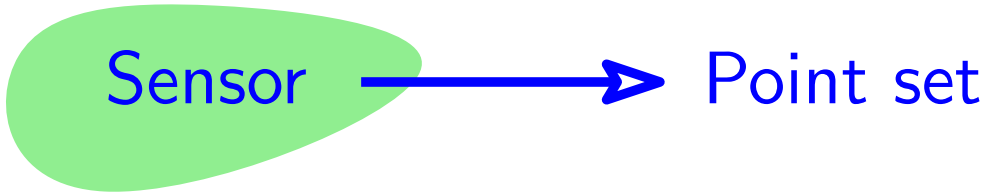
Laser illuminate in a plane





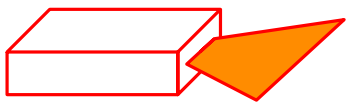
Reconstruction

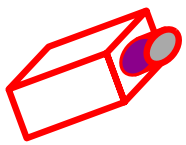
Context

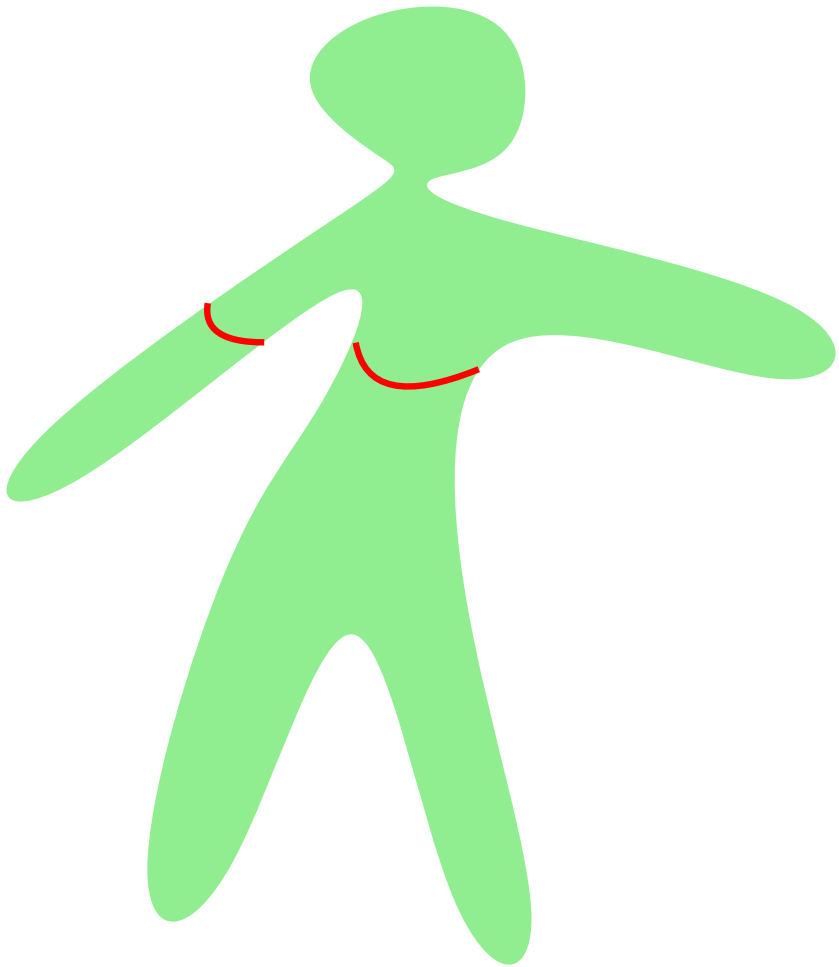


Laser illuminate in a plane

Camera

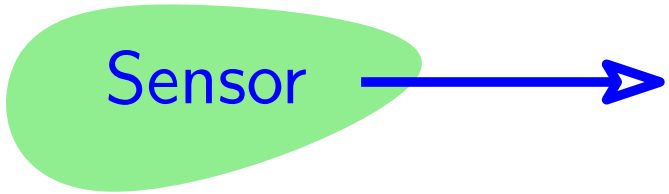






Reconstruction

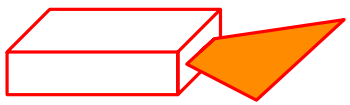
Context

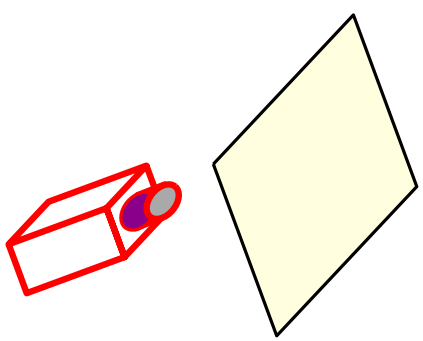


Point set (no structure or unknown)

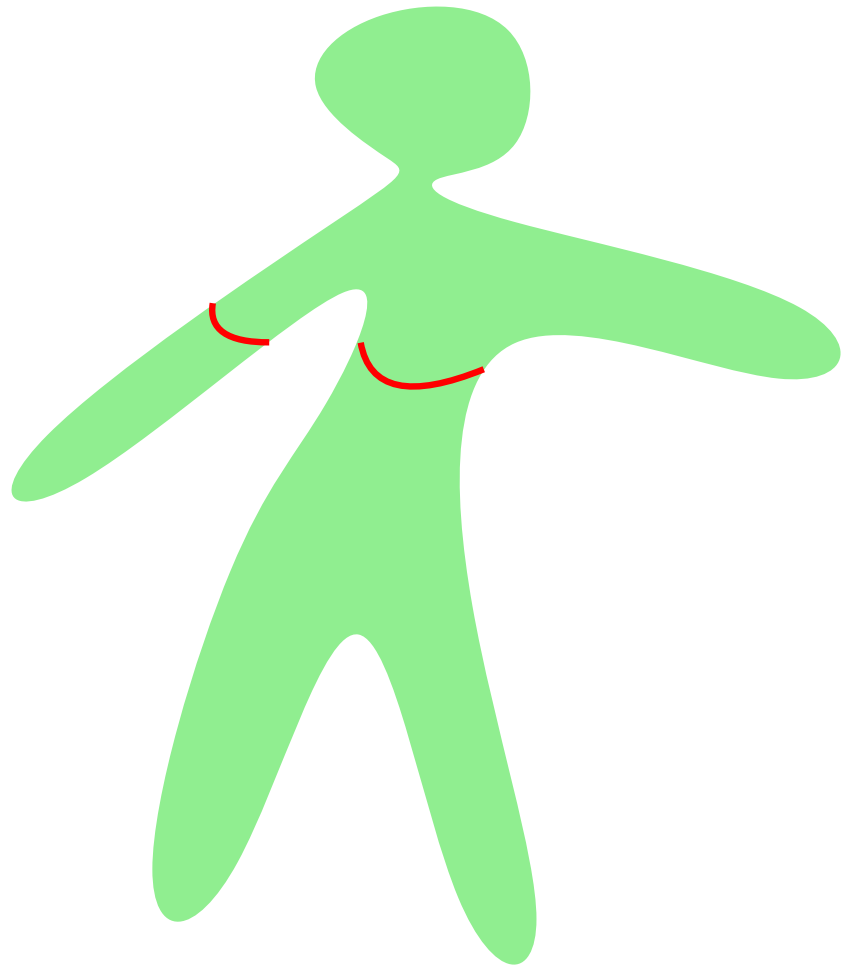
Laser illuminate in a plane

Camera





Image



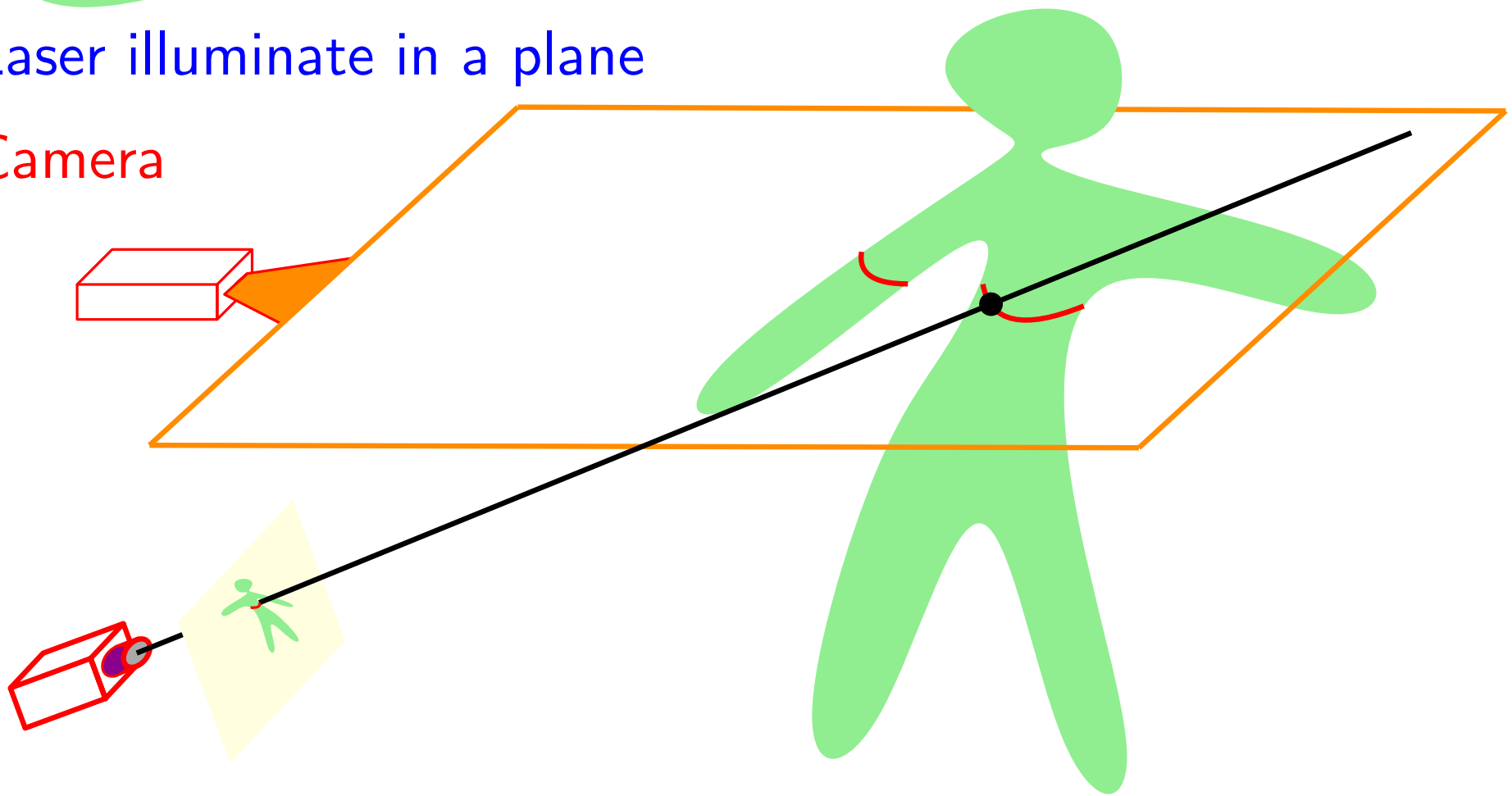
Reconstruction

Context

Sensor → Point set (no structure or unknown)

Laser illuminate in a plane

Camera

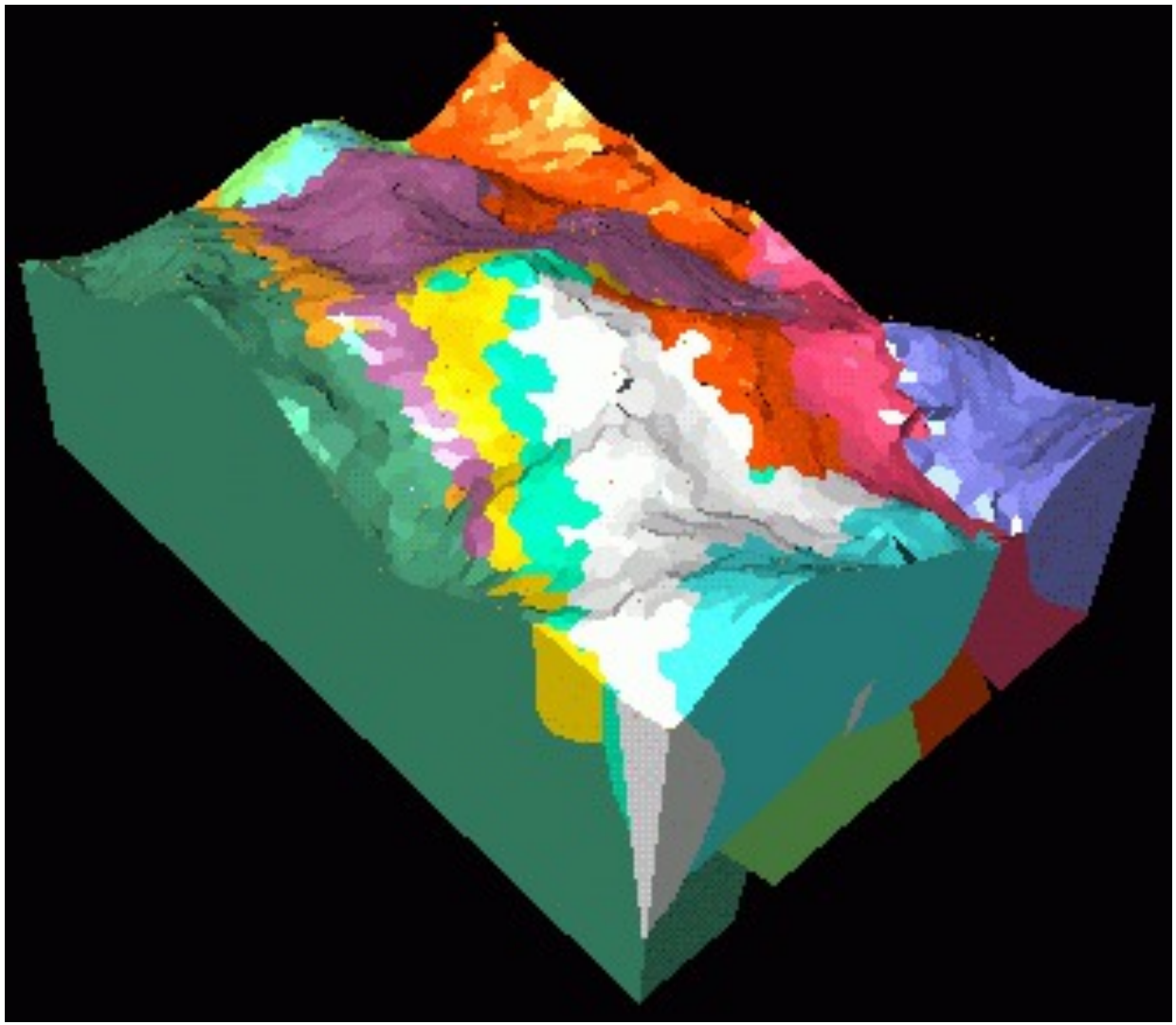


Get 3D position

Reconstruction

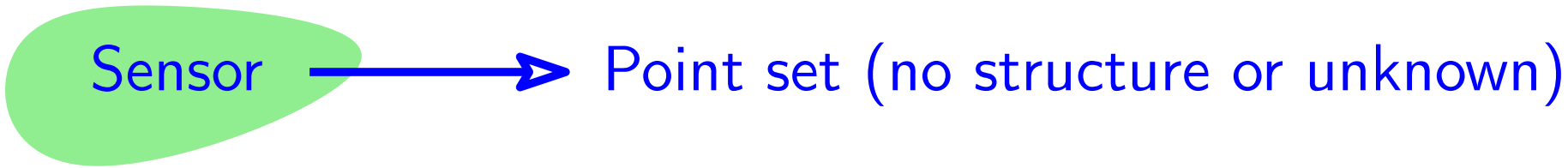
Context

Geology

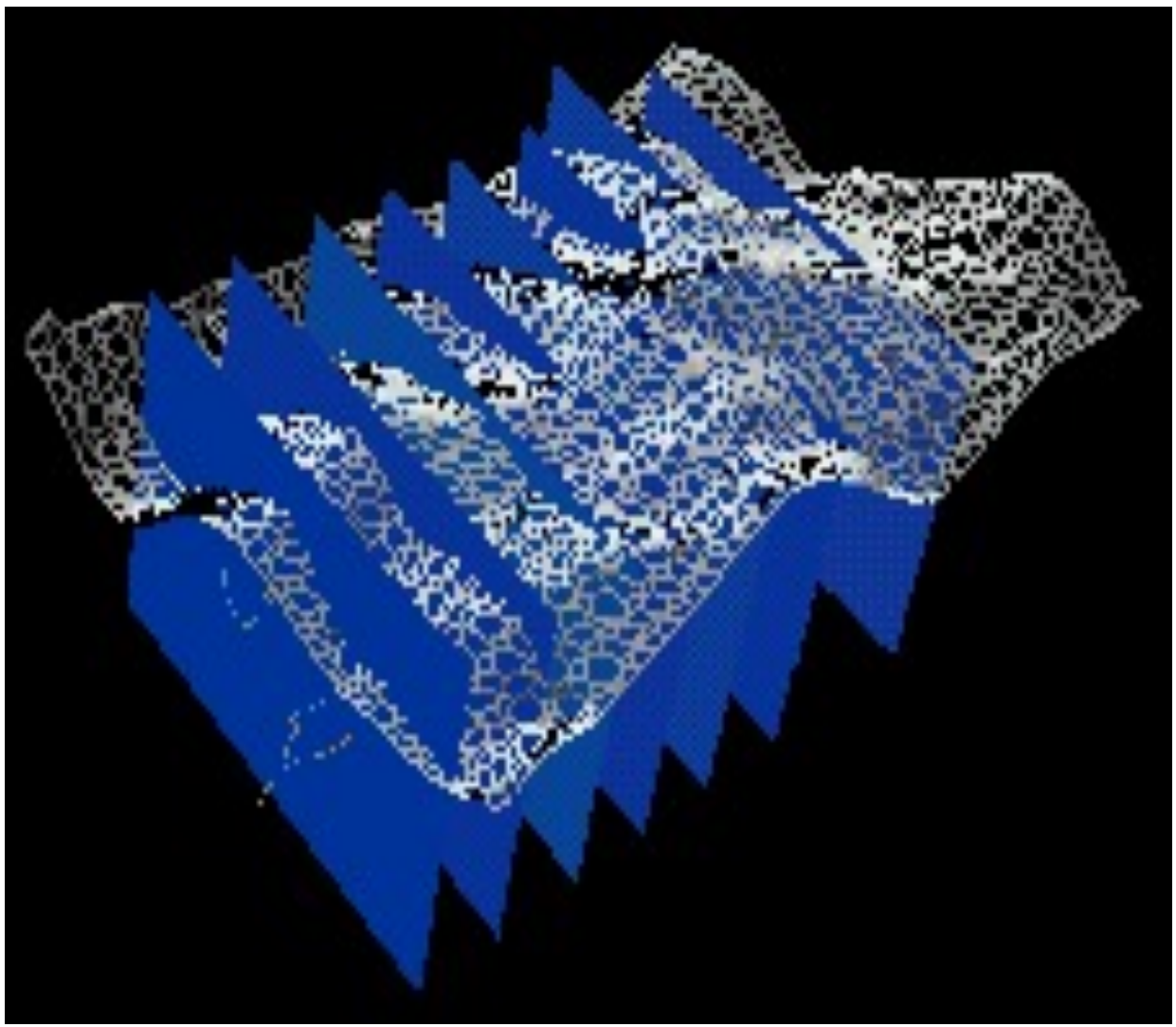


Reconstruction

Context

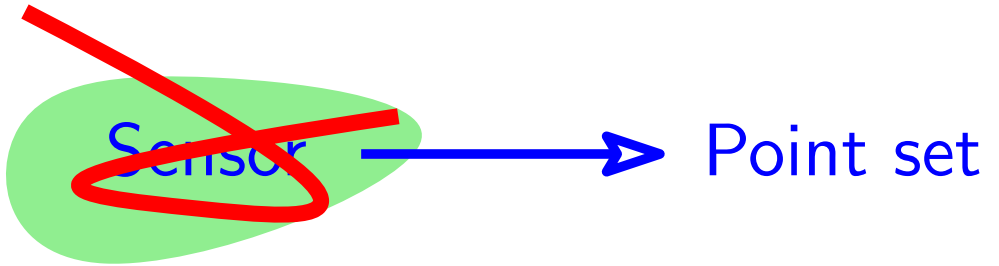


Geology



Reconstruction

Context

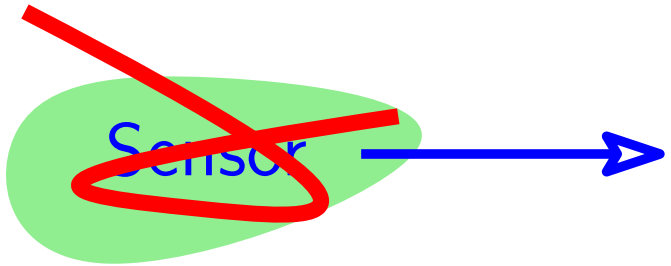


Point set (no structure or unknown)

Abstract 3D problem that we can solve in 2D section

Reconstruction

Context

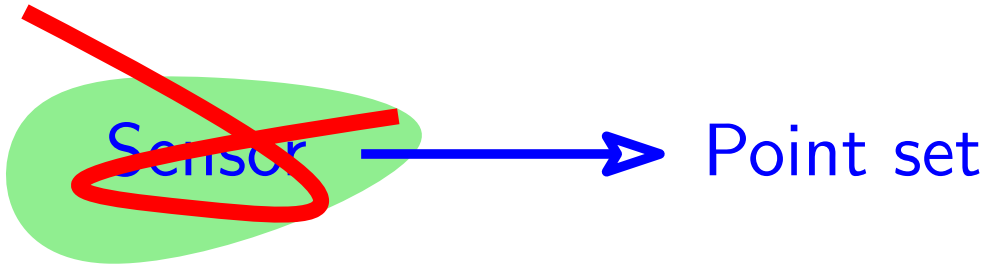


Point set (no structure or unknown)

Abstract 3D problem that we can solve in 2D section

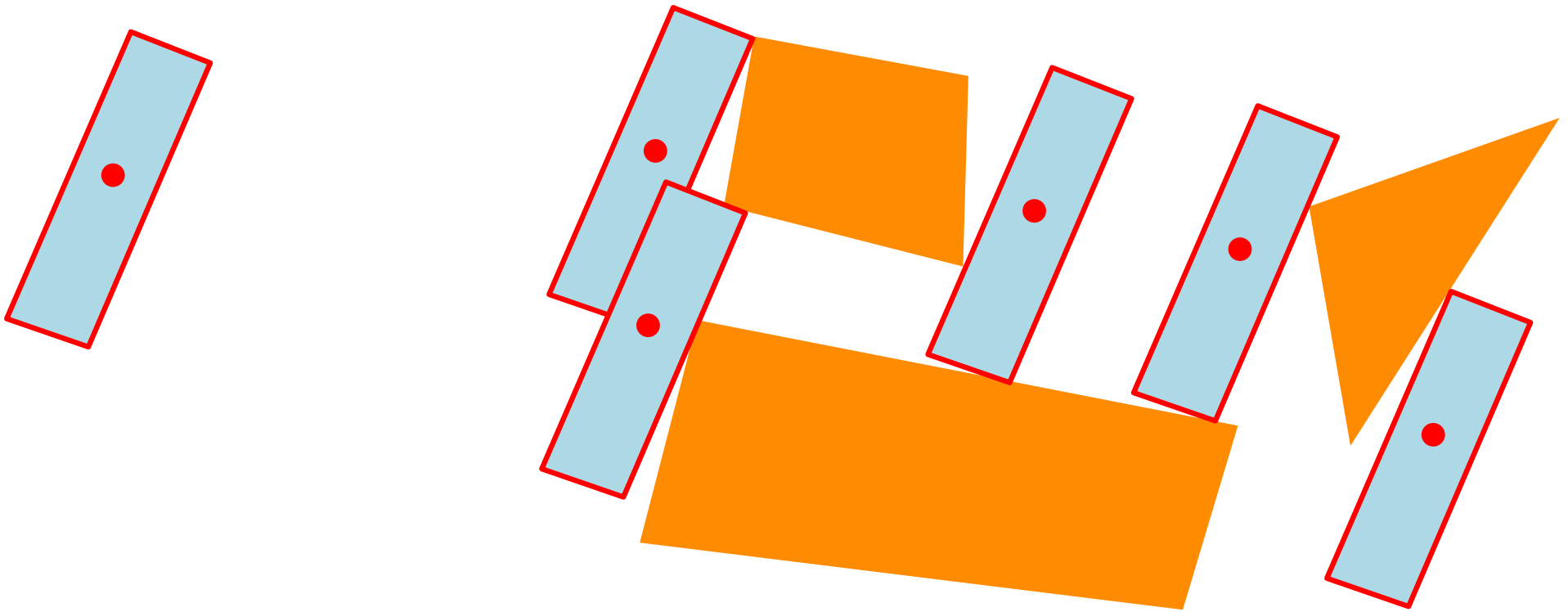
Reconstruction

Context



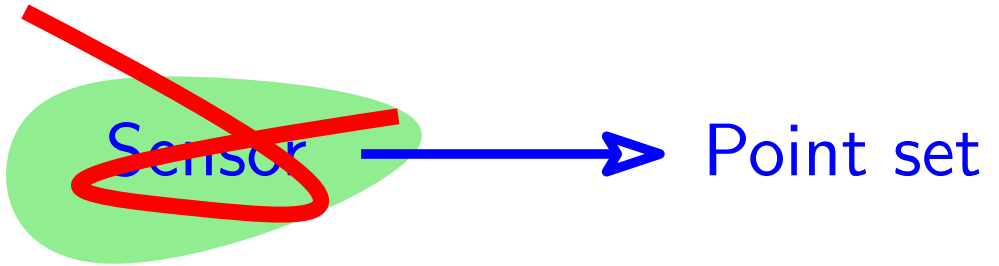
Point set (no structure or unknown)

Abstract 3D problem that we can solve in 2D section



Reconstruction

Context

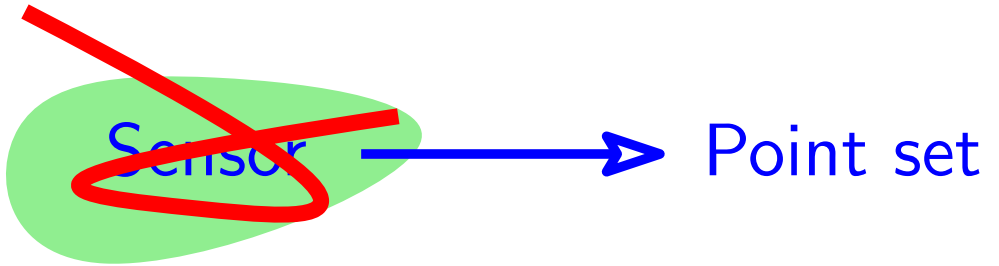


Point set (no structure or unknown)

Abstract 3D problem that we can solve in 2D section

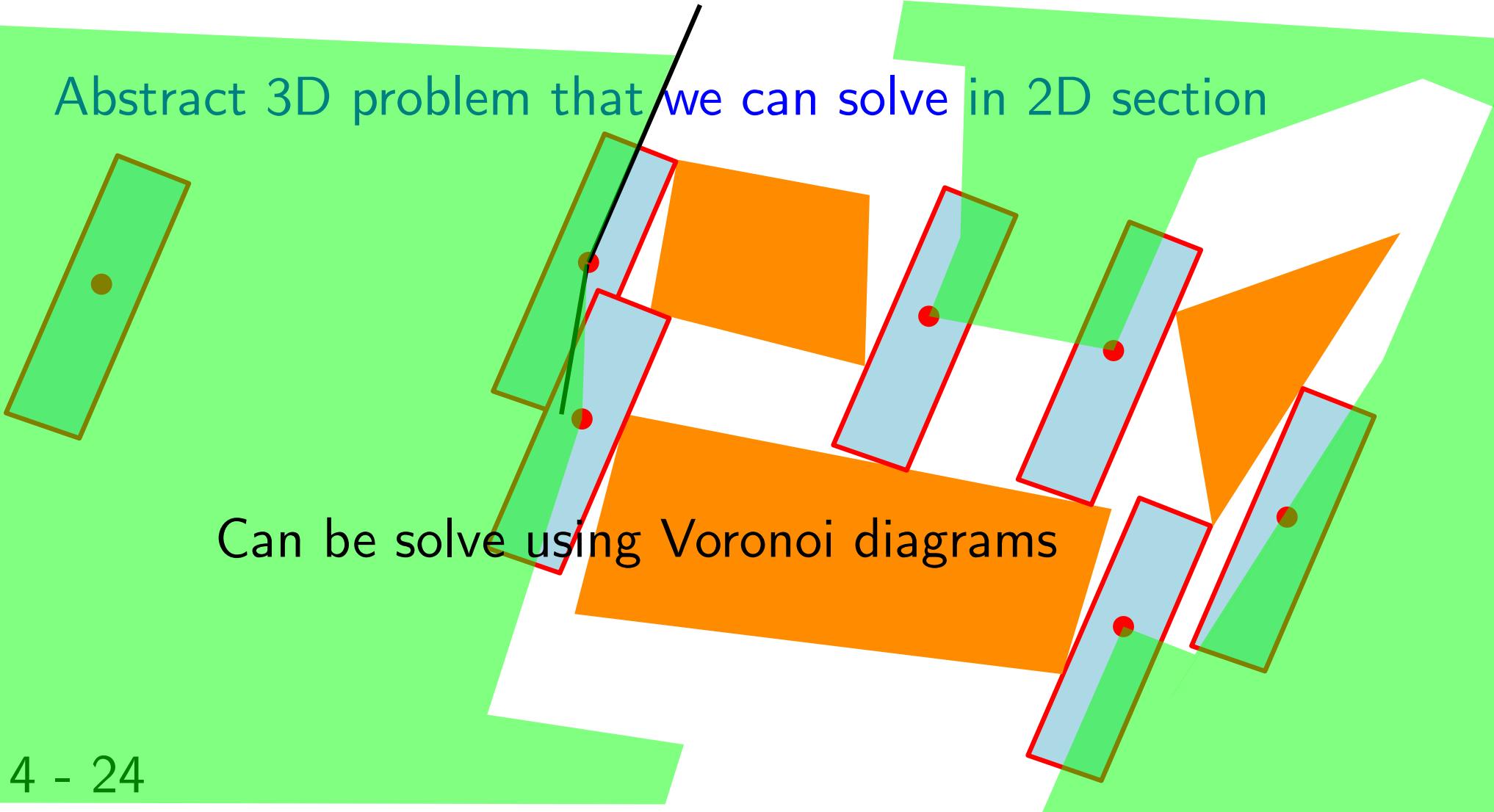
Reconstruction

Context



Point set (no structure or unknown)

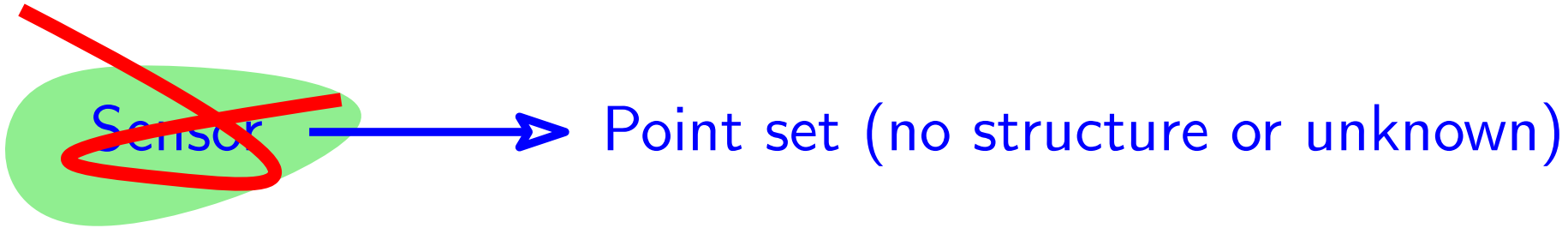
Abstract 3D problem that we can solve in 2D section



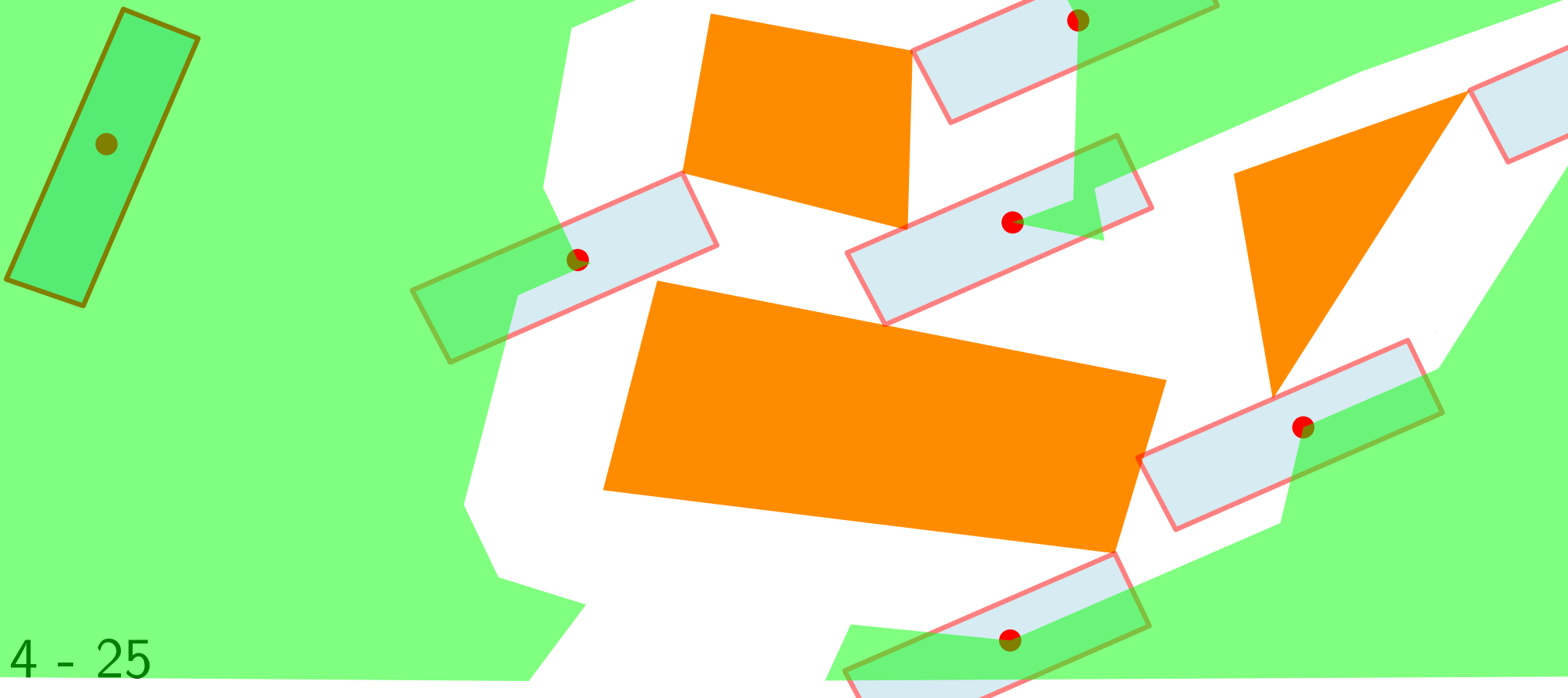
Can be solve using Voronoi diagrams

Reconstruction

Context

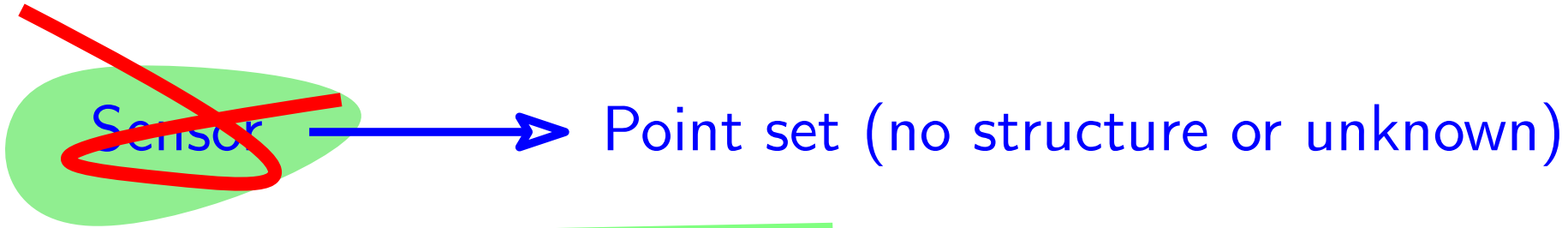


Abstract 3D problem that we can solve in 2D section

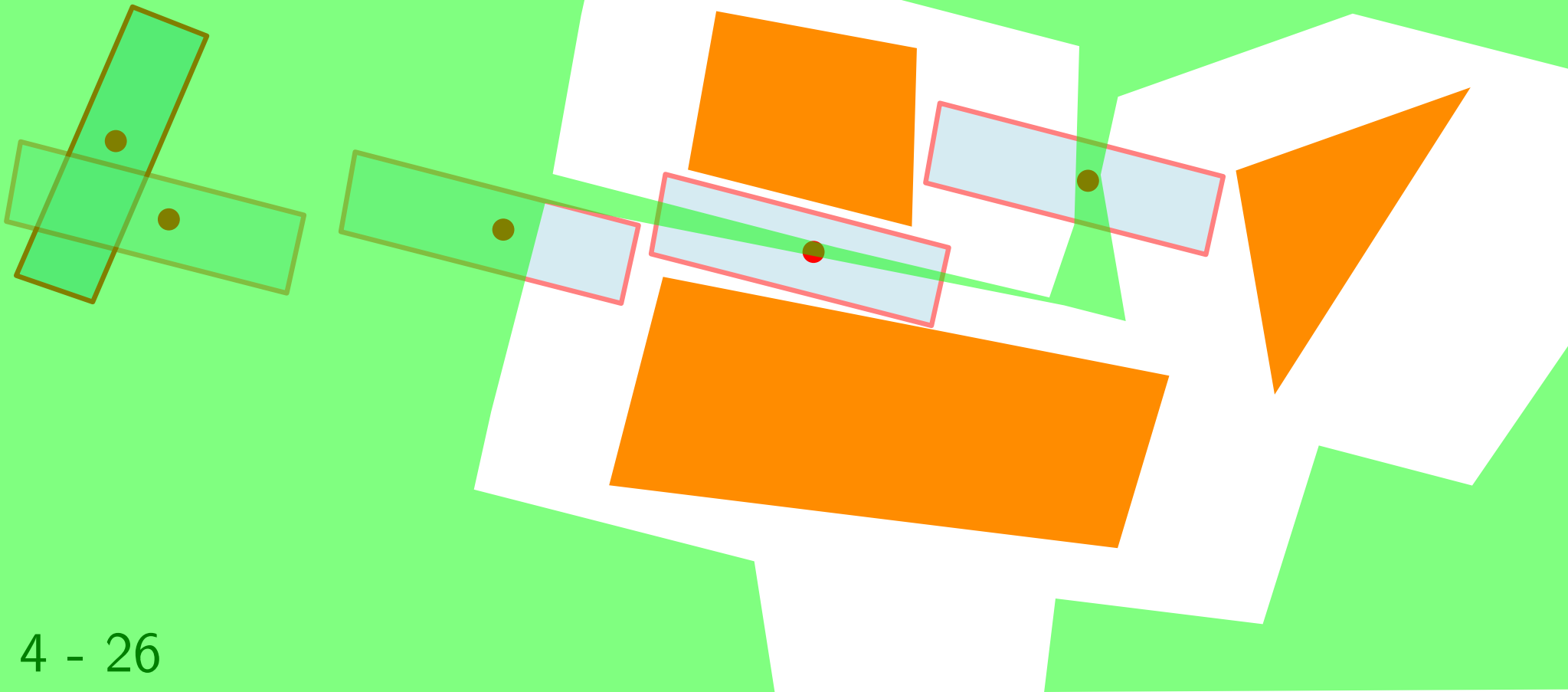


Reconstruction

Context

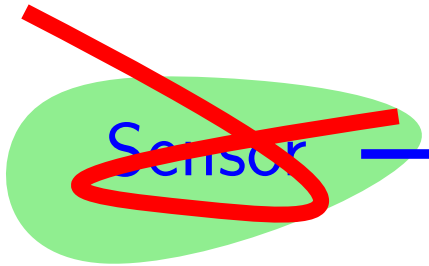


Abstract 3D problem that we can solve in 2D section



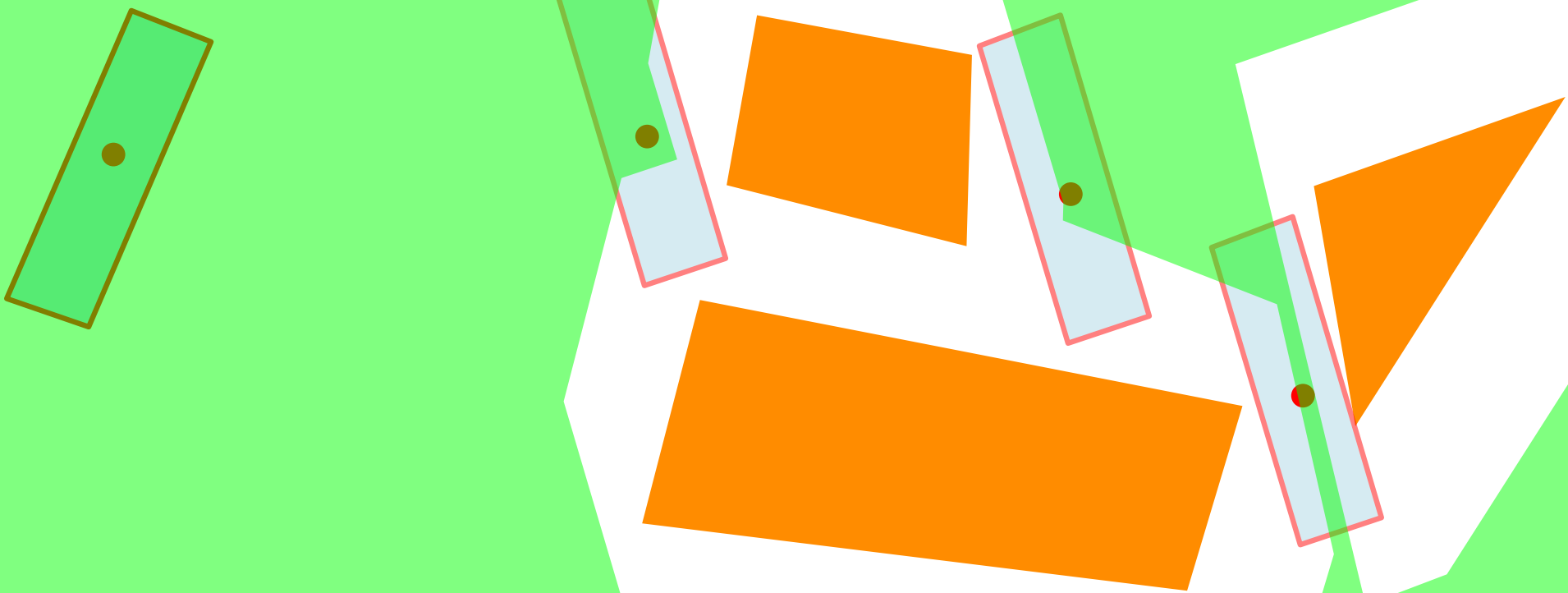
Reconstruction

Context



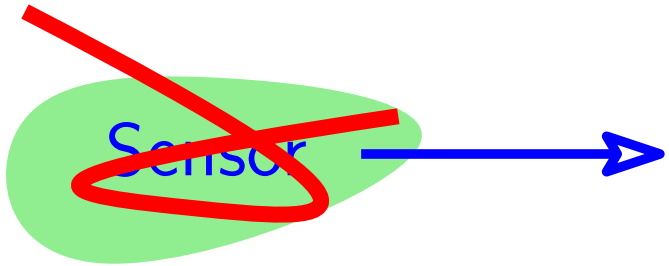
Sensor → Point set (no structure or unknown)

Abstract 3D problem that we can solve in 2D section



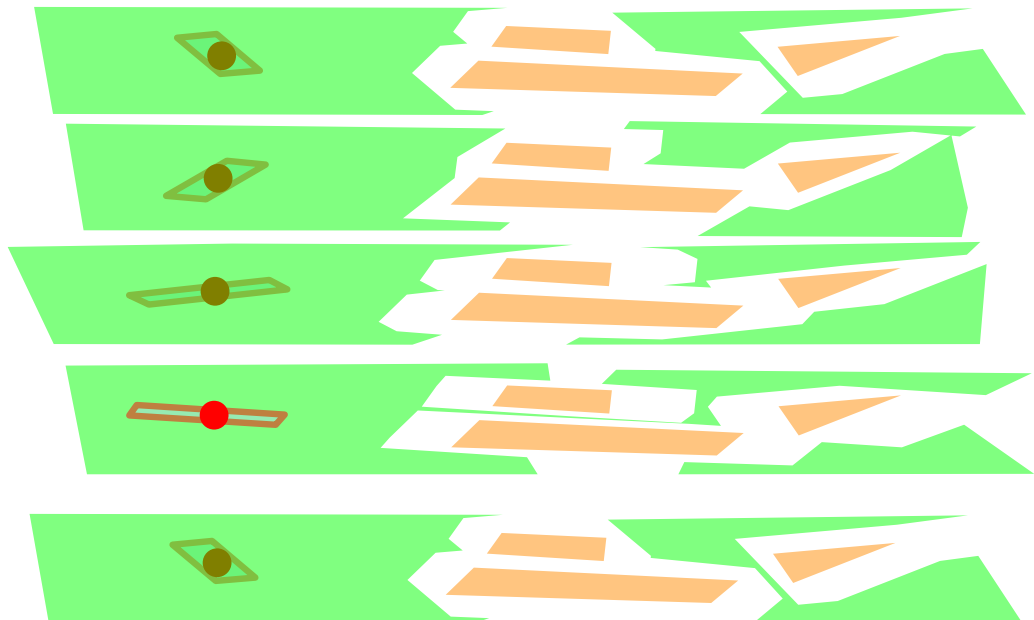
Reconstruction

Context



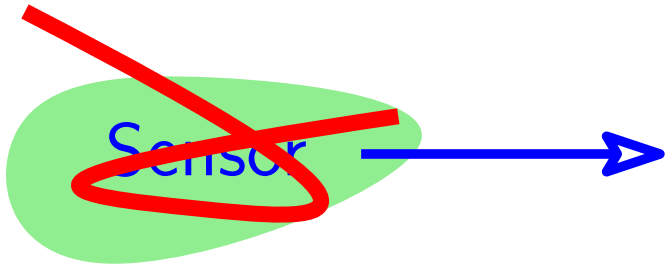
Point set (no structure or unknown)

Abstract 3D problem that we can solve in 2D section



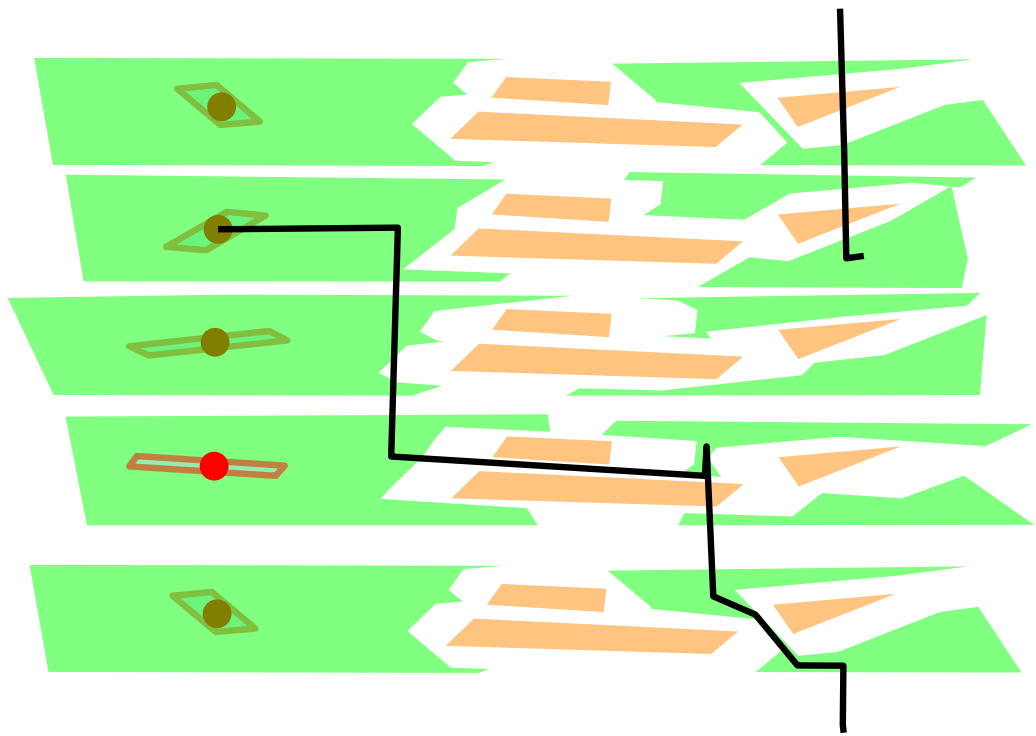
Reconstruction

Context



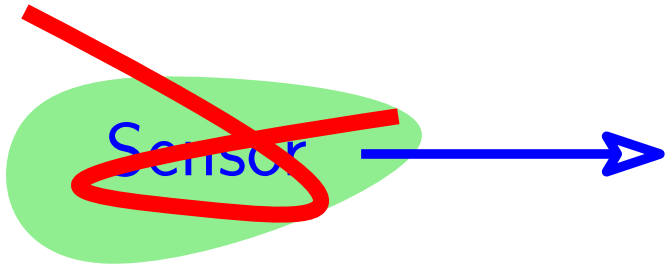
Point set (no structure or unknown)

Abstract 3D problem that we can solve in 2D section



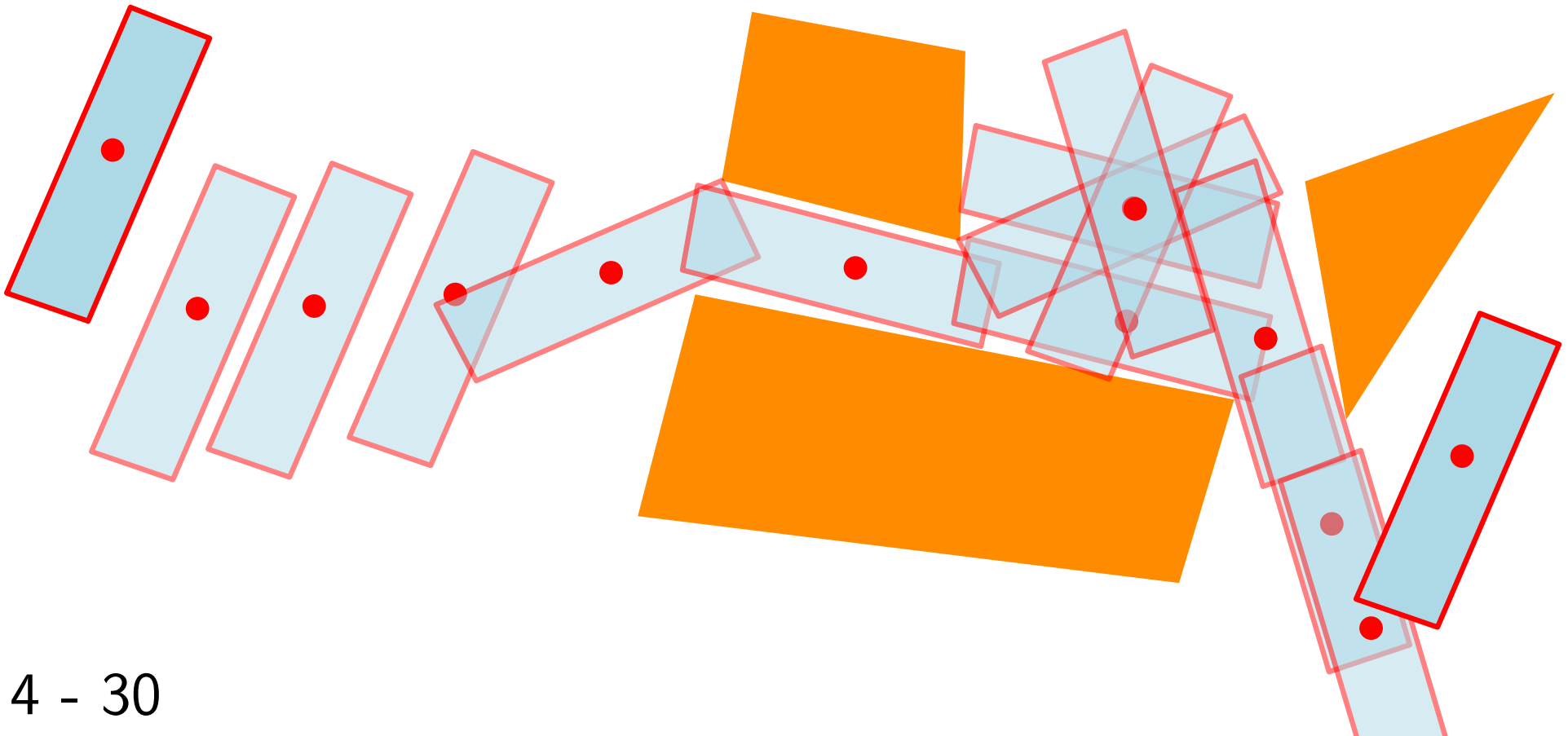
Reconstruction

Context



Point set (no structure or unknown)

Abstract 3D problem that we can solve in 2D section



Reconstruction

Delaunay is a good start

Medial axis of a curve (surface in 3D)

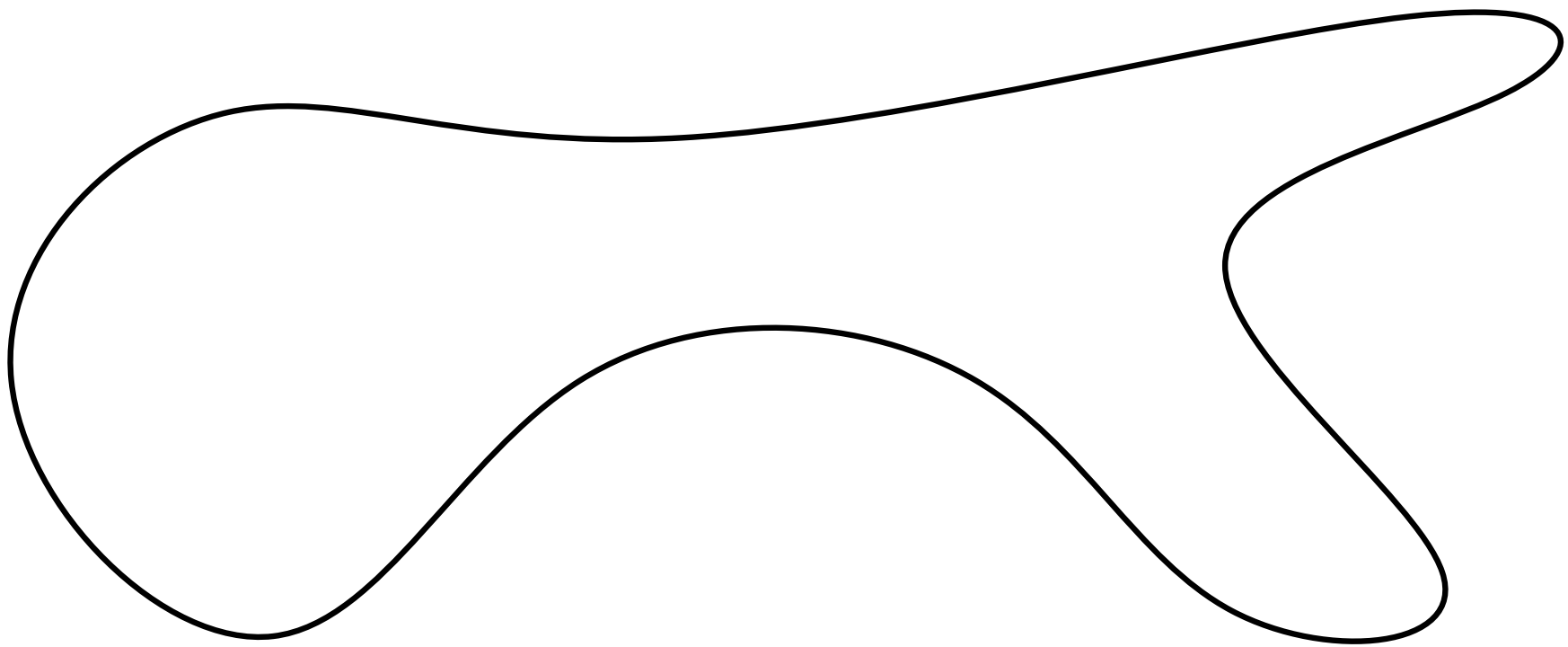
Locus of center of bitangent spheres

Reconstruction

Delaunay is a good start

Medial axis of a curve (surface in 3D)

Locus of center of bitangent spheres

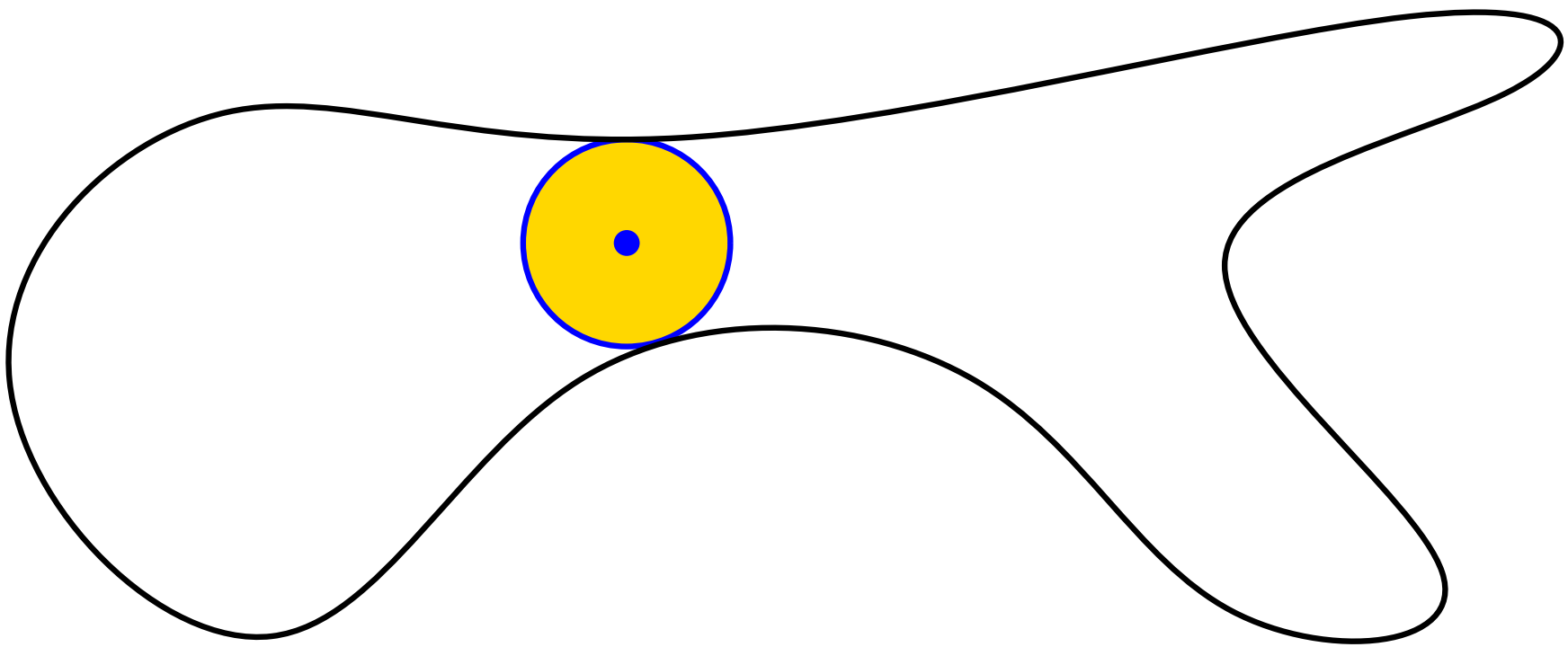


Reconstruction

Delaunay is a good start

Medial axis of a curve (surface in 3D)

Locus of center of bitangent spheres

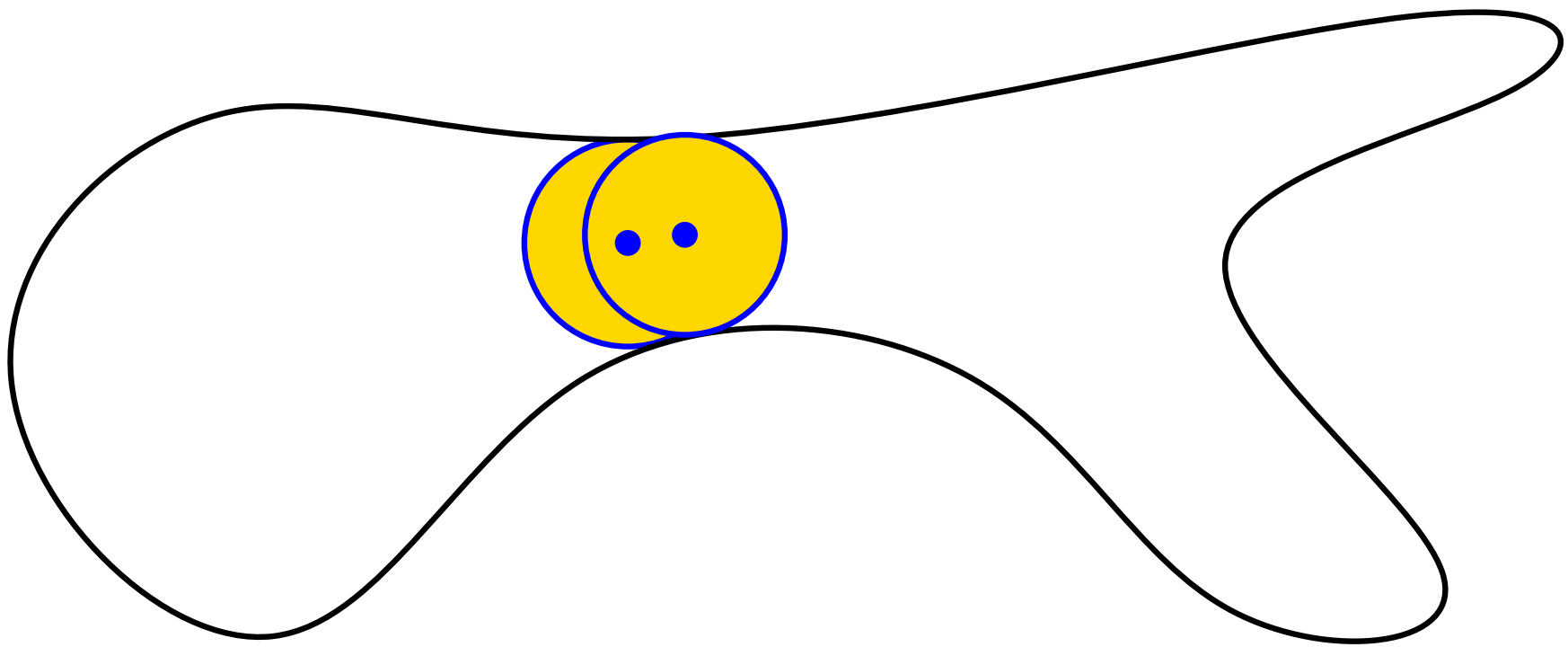


Reconstruction

Delaunay is a good start

Medial axis of a curve (surface in 3D)

Locus of center of bitangent spheres

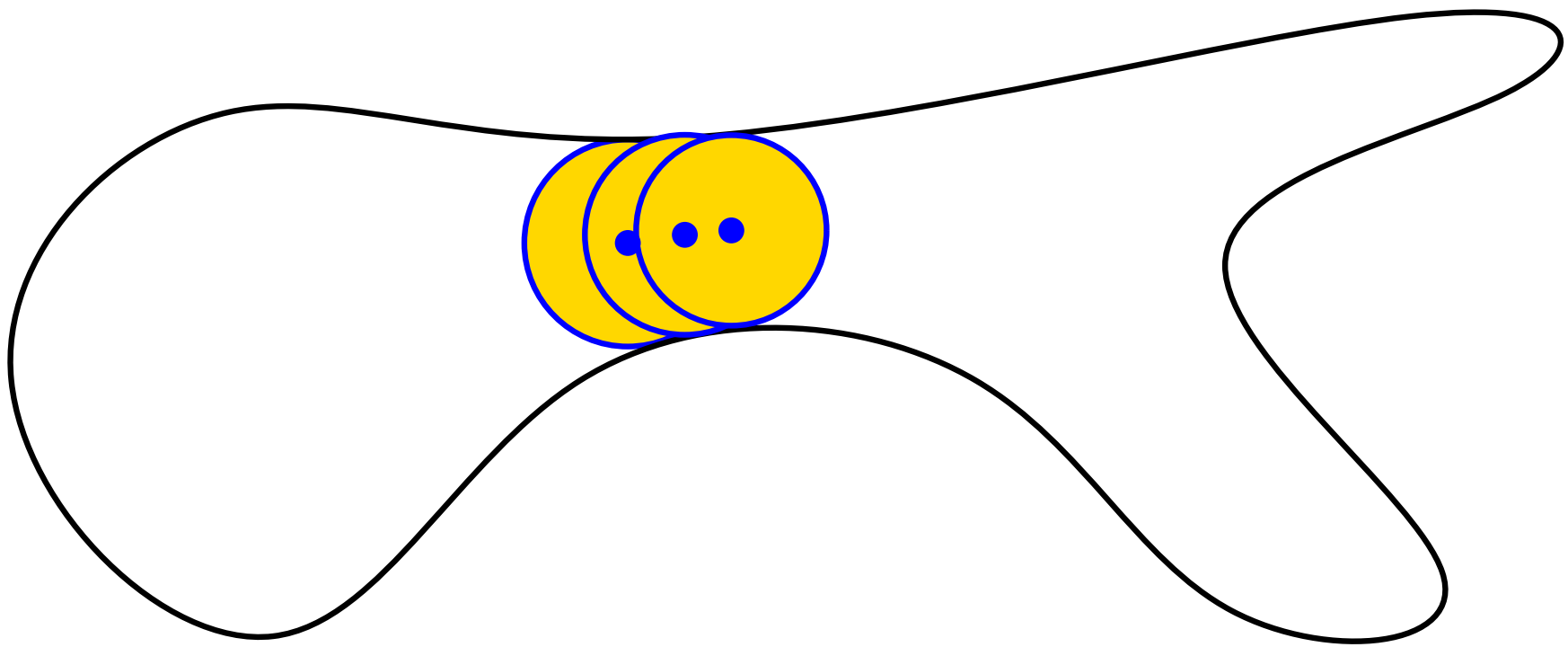


Reconstruction

Delaunay is a good start

Medial axis of a curve (surface in 3D)

Locus of center of bitangent spheres

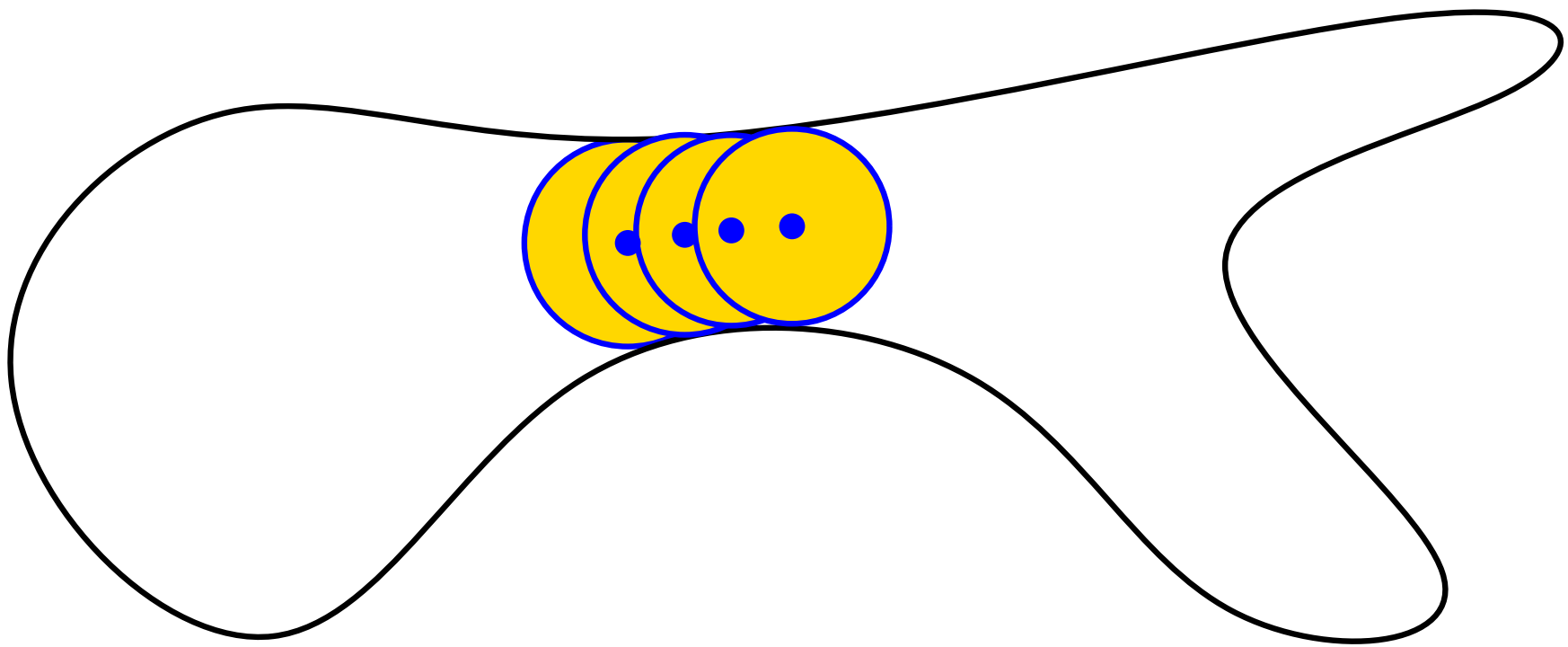


Reconstruction

Delaunay is a good start

Medial axis of a curve (surface in 3D)

Locus of center of bitangent spheres

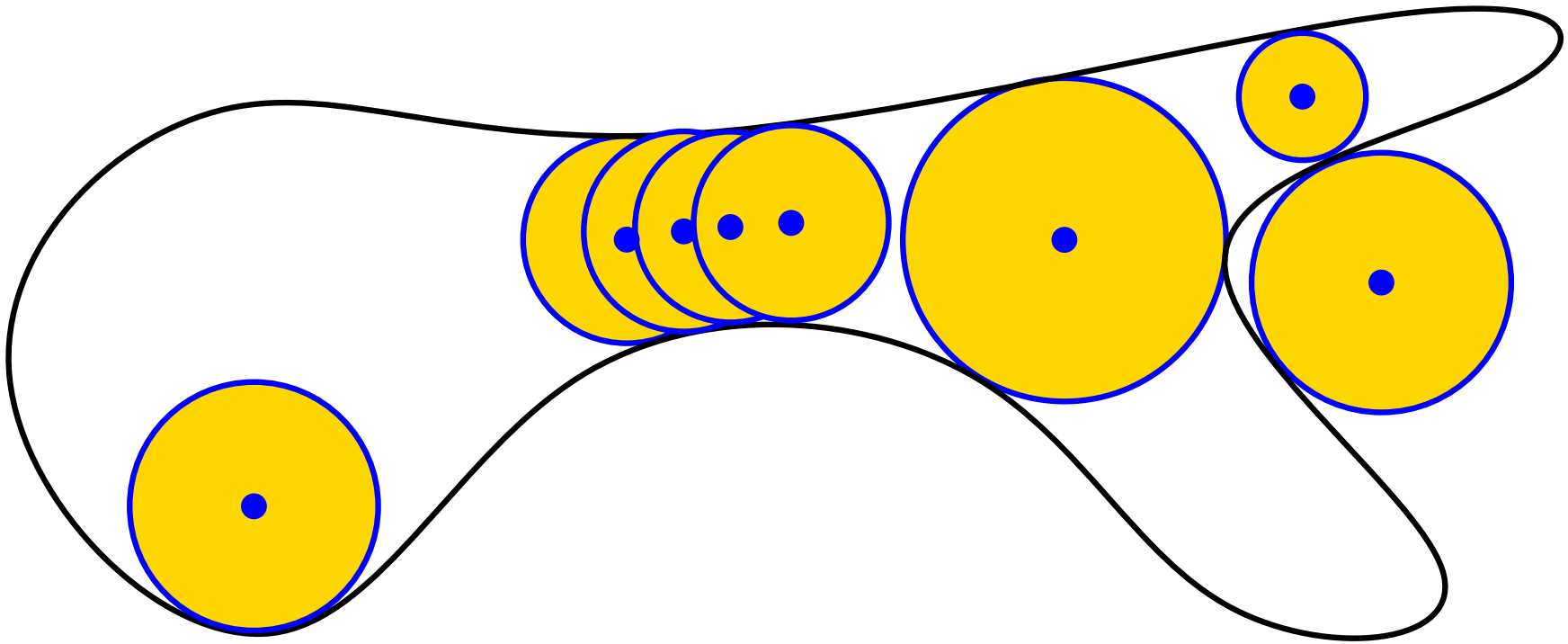


Reconstruction

Delaunay is a good start

Medial axis of a curve (surface in 3D)

Locus of center of bitangent spheres

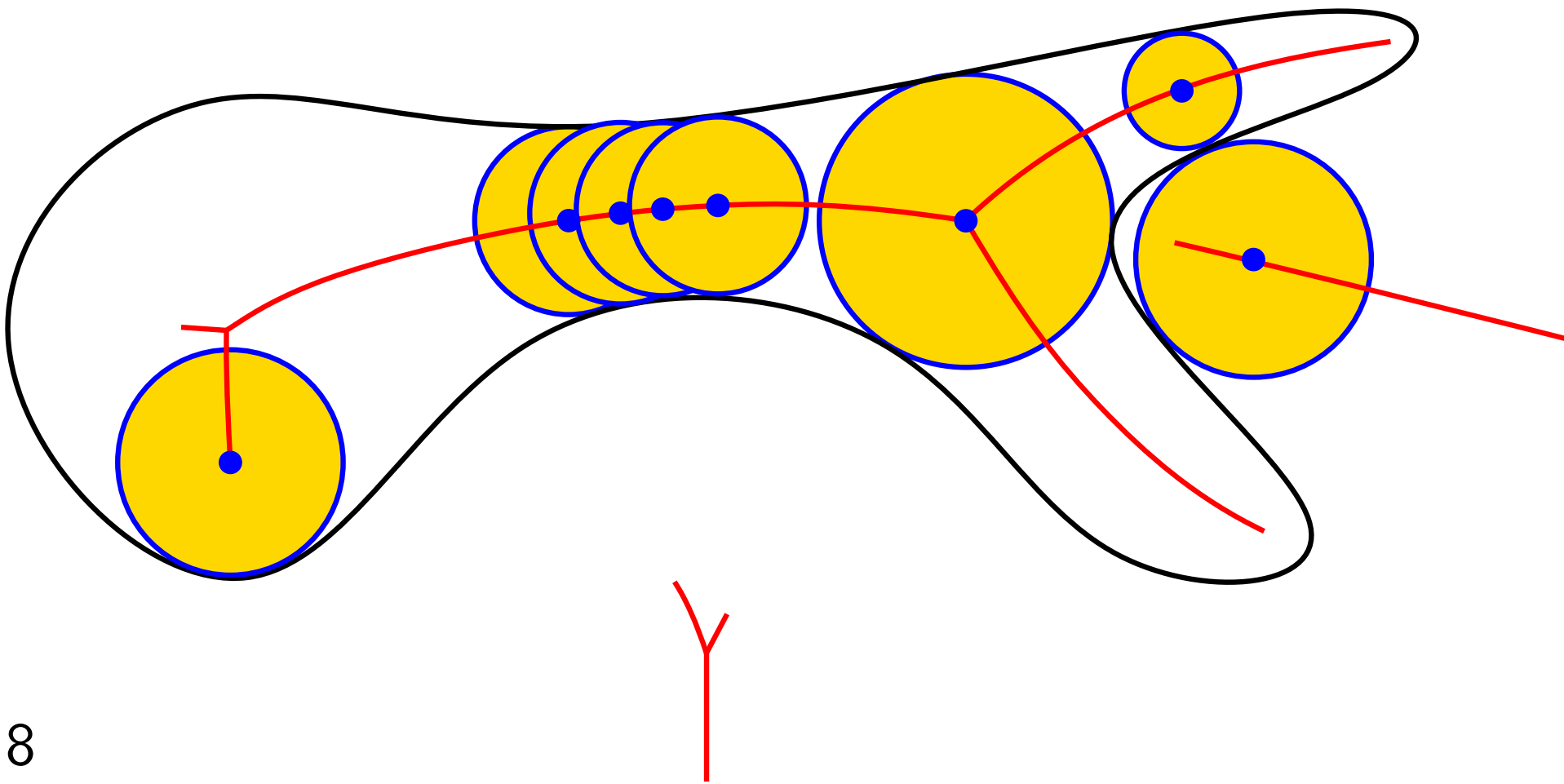


Reconstruction

Delaunay is a good start

Medial axis of a curve (surface in 3D)

Locus of center of bitangent spheres

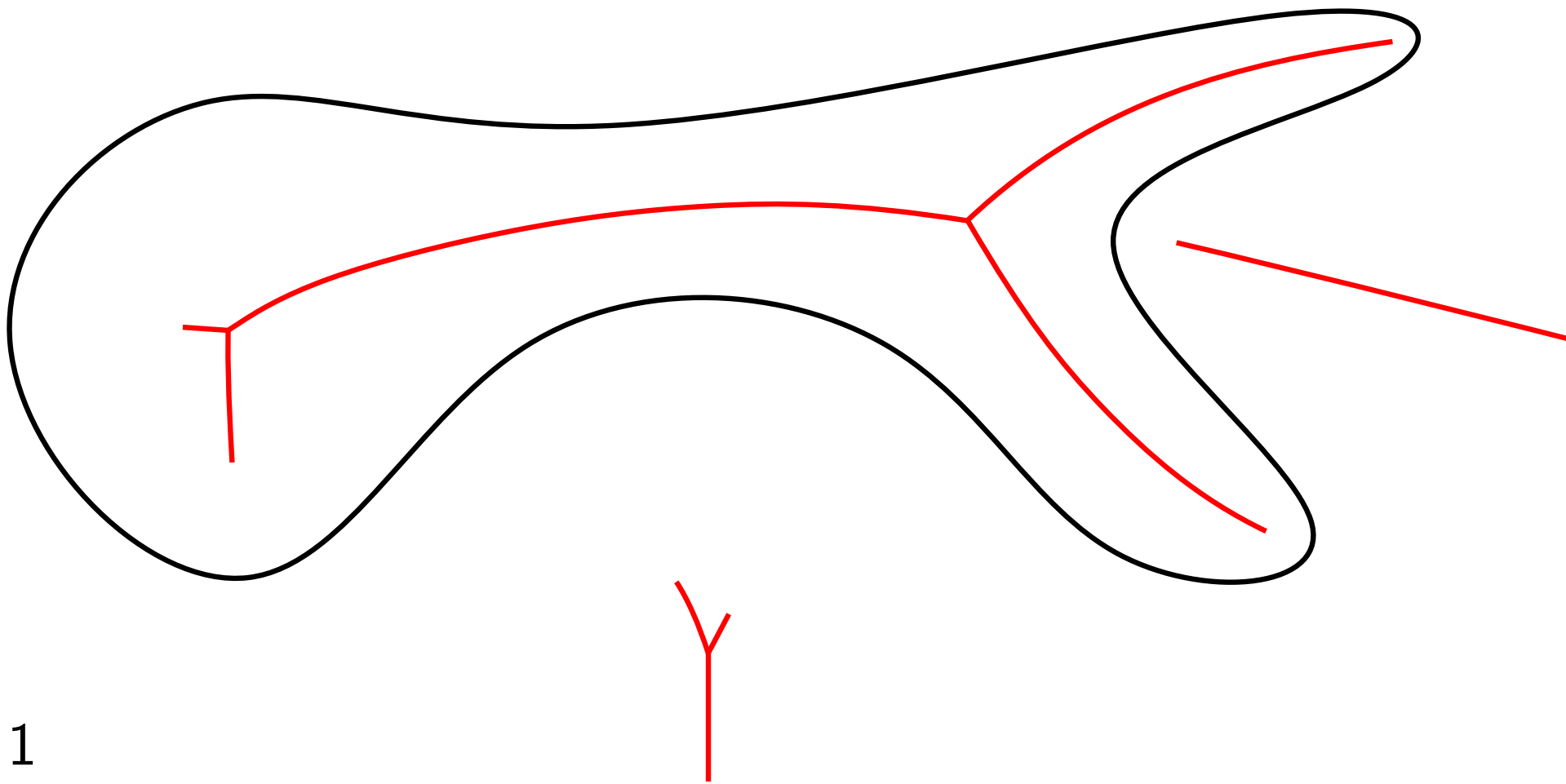


Reconstruction

Delaunay is a good start

ϵ-sample of a curve

Local feature size:

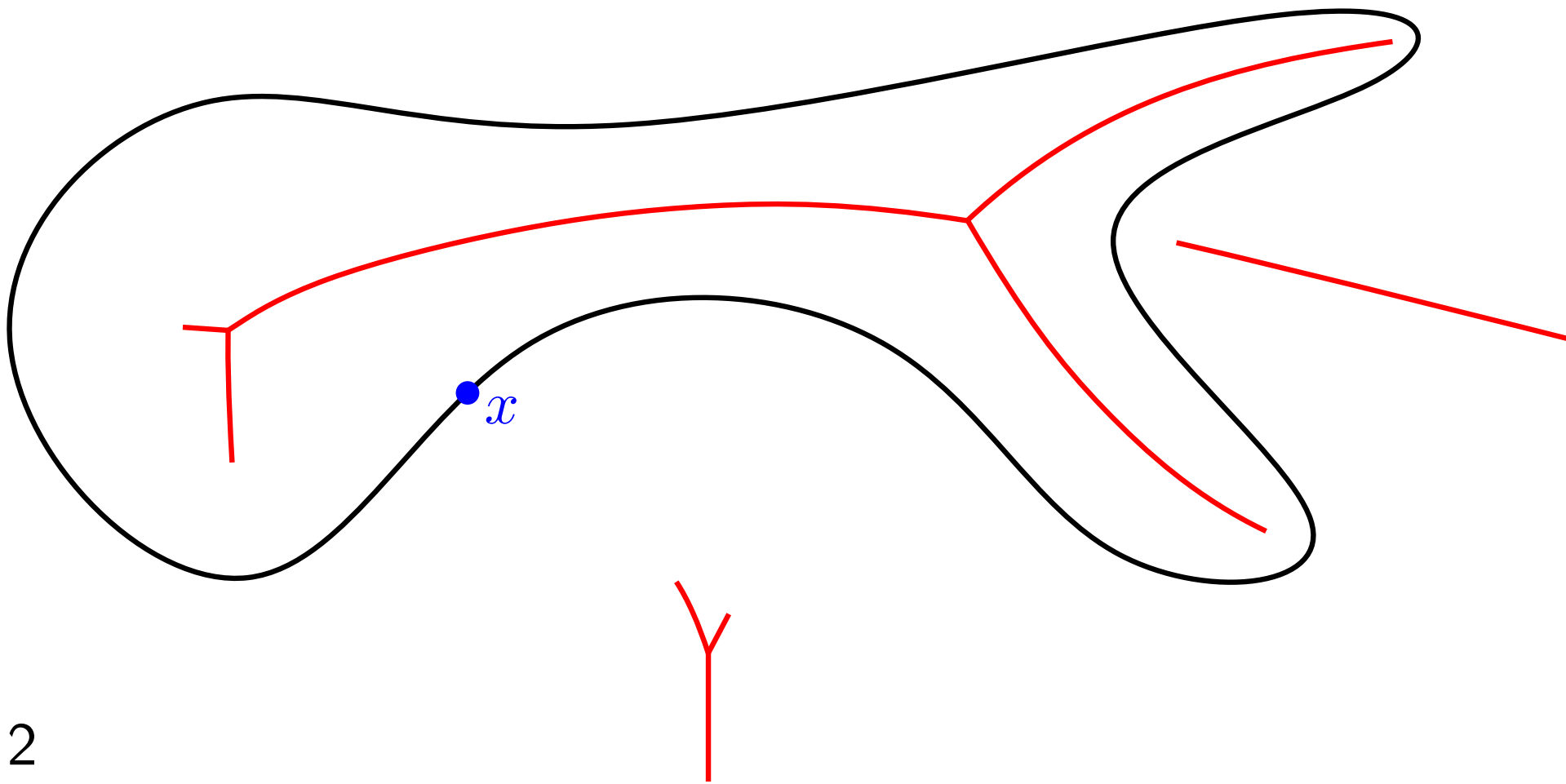


Reconstruction

Delaunay is a good start

ϵ-sample of a curve

Local feature size: lfs$(x) =$

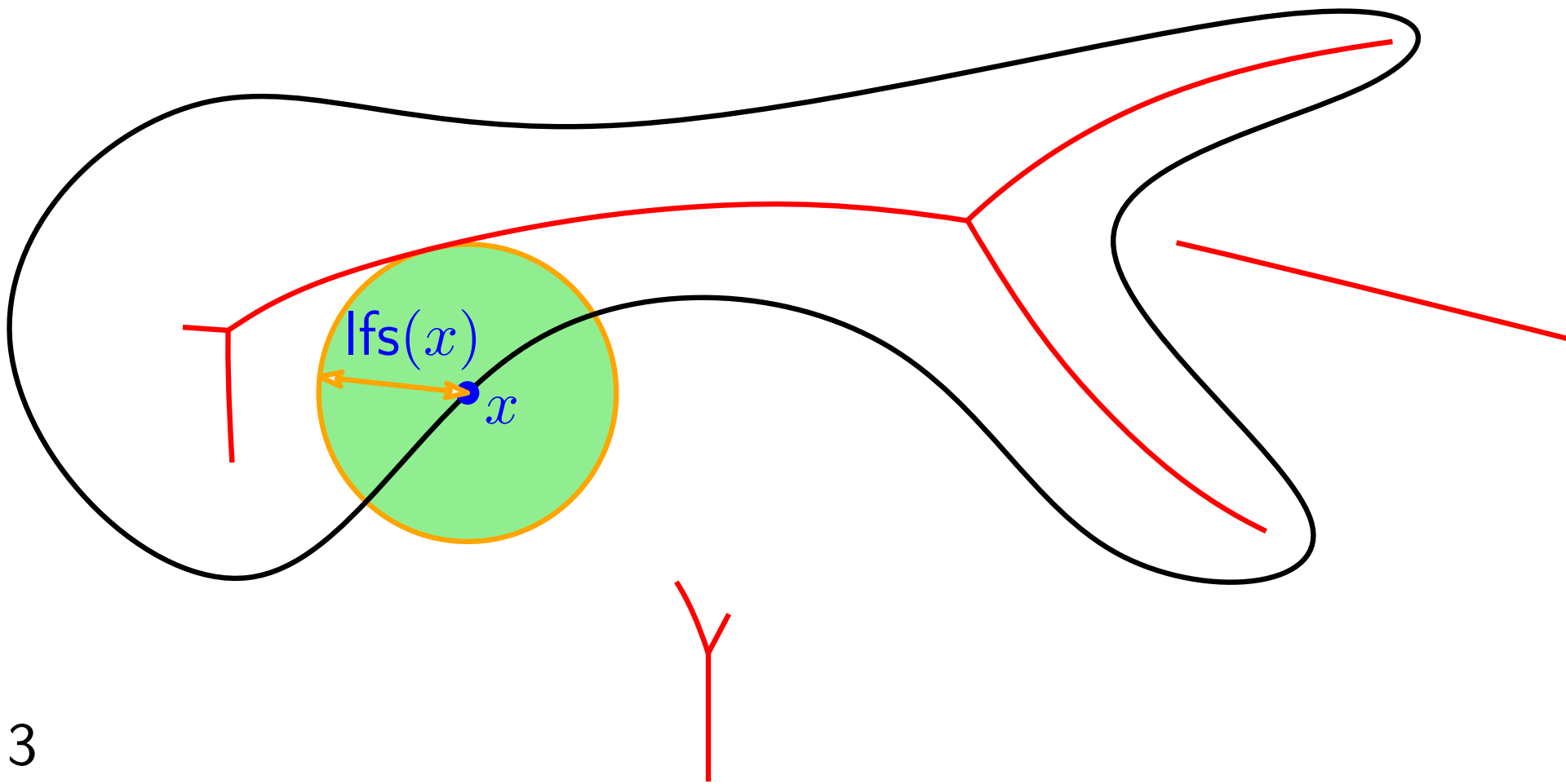


Reconstruction

Delaunay is a good start

ϵ-sample of a curve

Local feature size: lfs(x) = distance(x, medial axis)



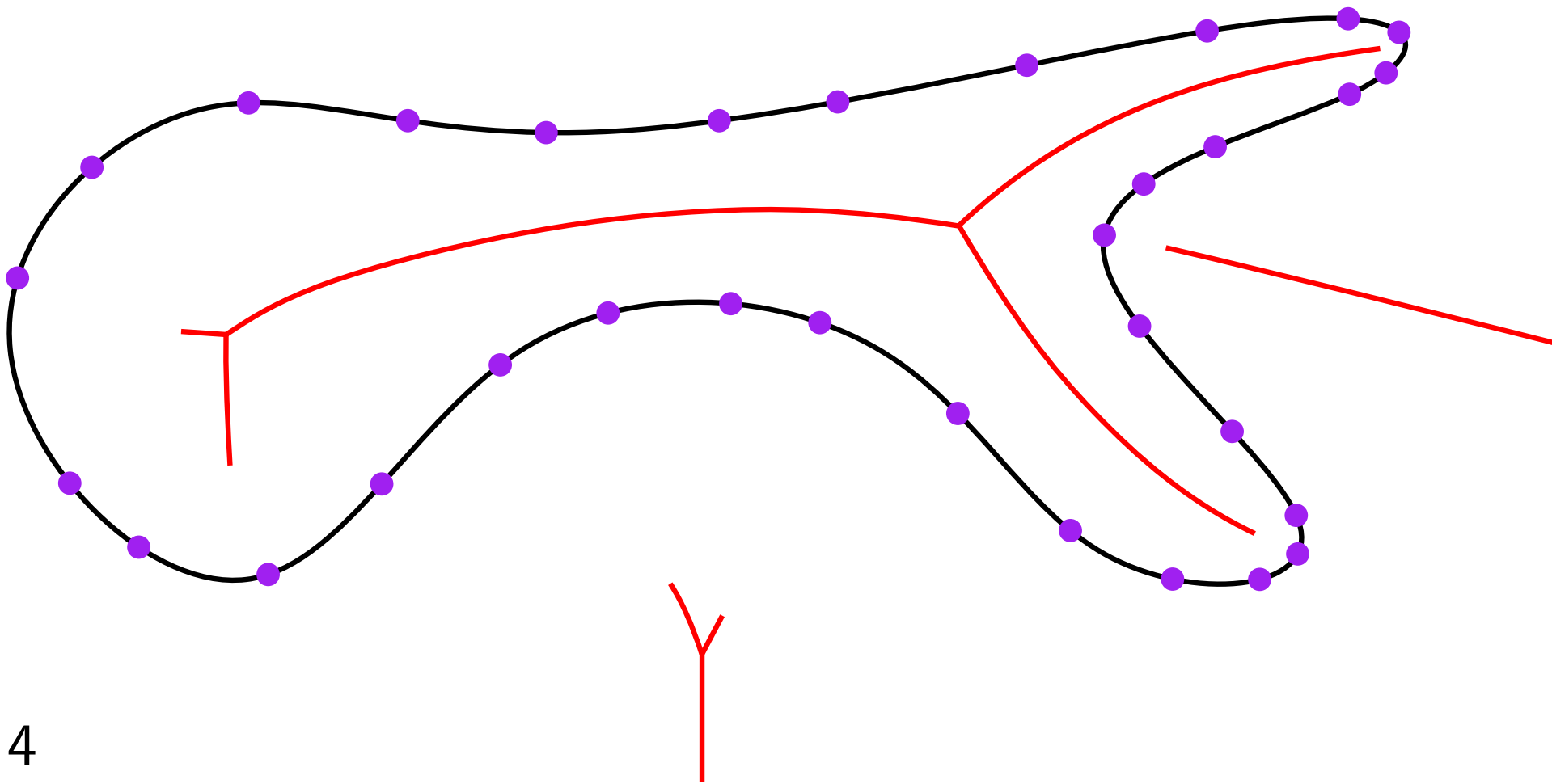
Reconstruction

Delaunay is a good start

Sample is an

ϵ-sample of a curve

Local feature size:



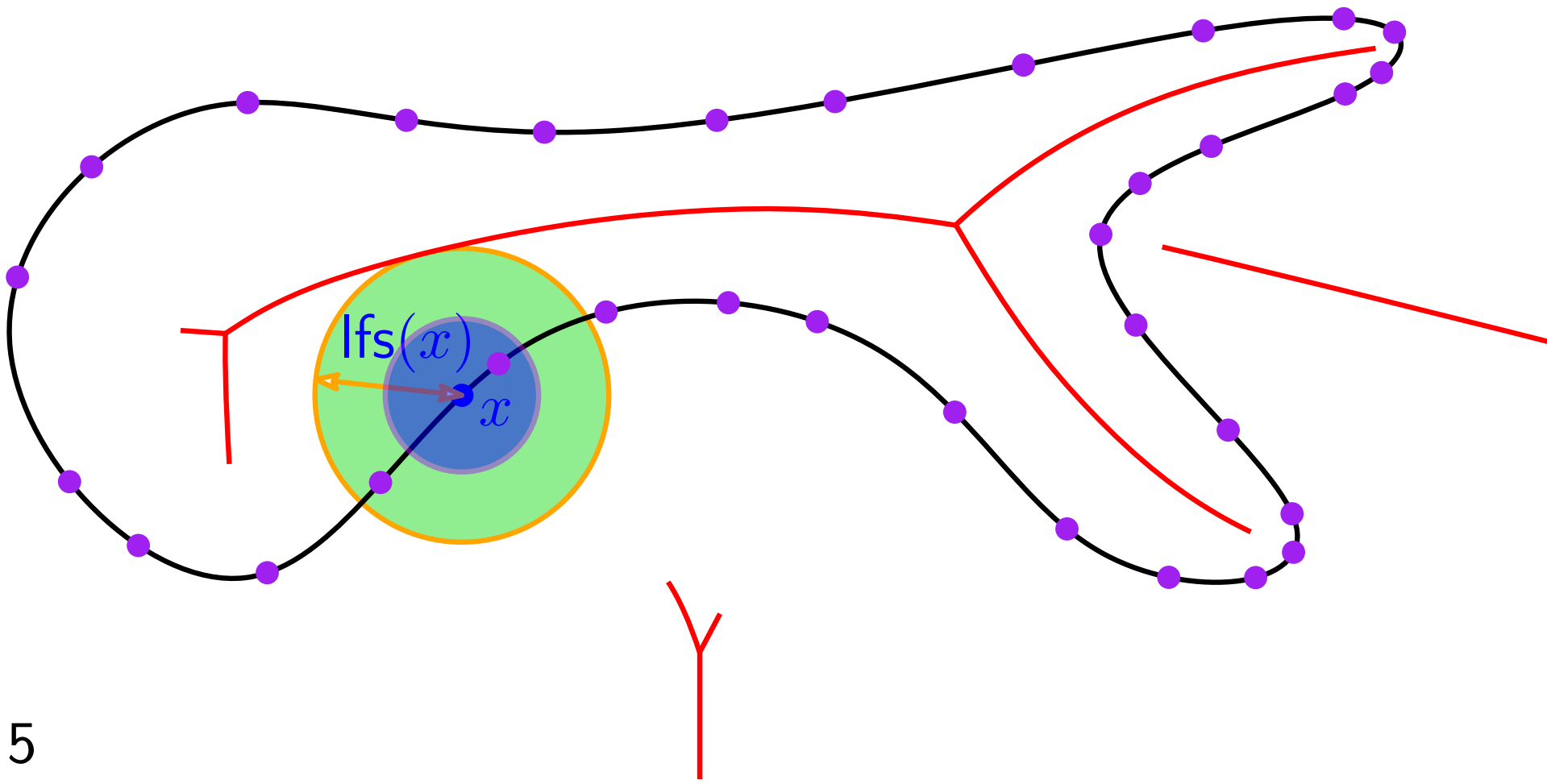
Reconstruction

Delaunay is a good start

Sample is an

ϵ-sample of a curve if $\forall x$, Disk$(x, \epsilon \cdot \text{lfs}(x)) \cap \text{Sample} \neq \emptyset$

Local feature size: lfs(x) = distance$(x$, medial axis$)$



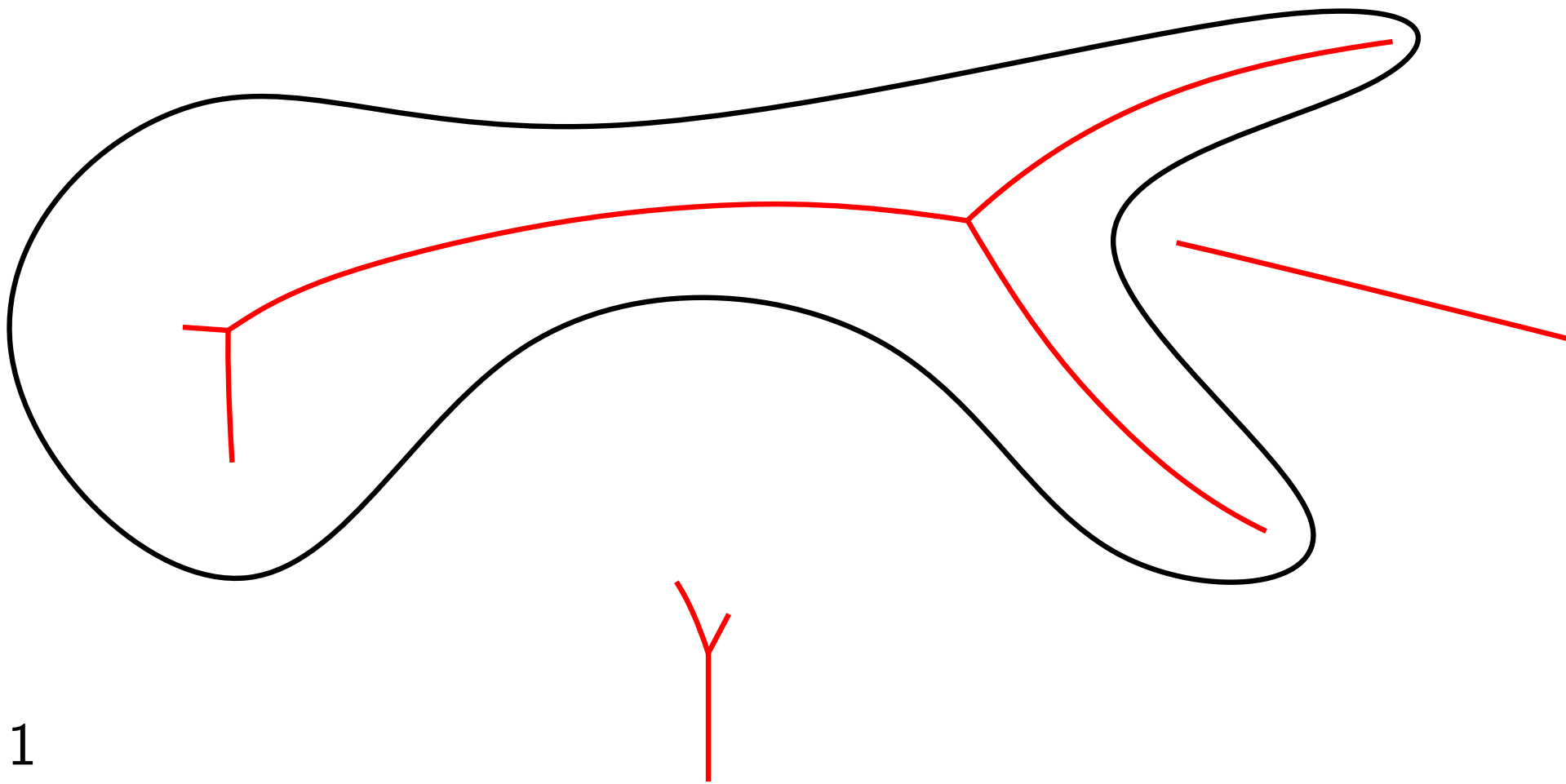
Reconstruction

Delaunay is a good start

Lemma:

$\forall$ Disk, Disk$\cap$Curve has a single connected component

or Disk$\cap$Medial axis$\neq \emptyset$



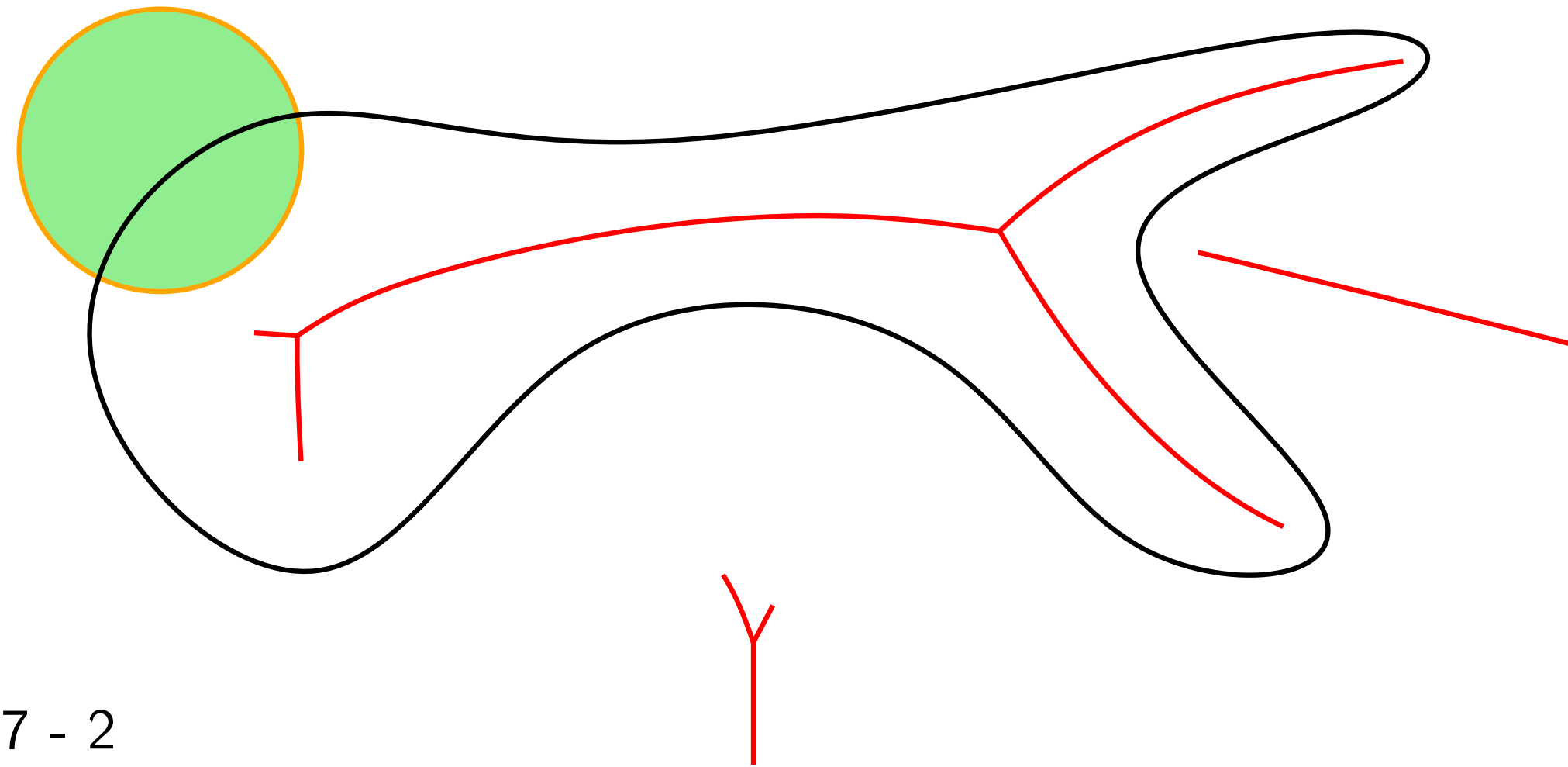
Reconstruction

Delaunay is a good start

Lemma:

$\forall$ Disk, Disk$\cap$Curve has a single connected component

or Disk$\cap$Medial axis$\neq \emptyset$



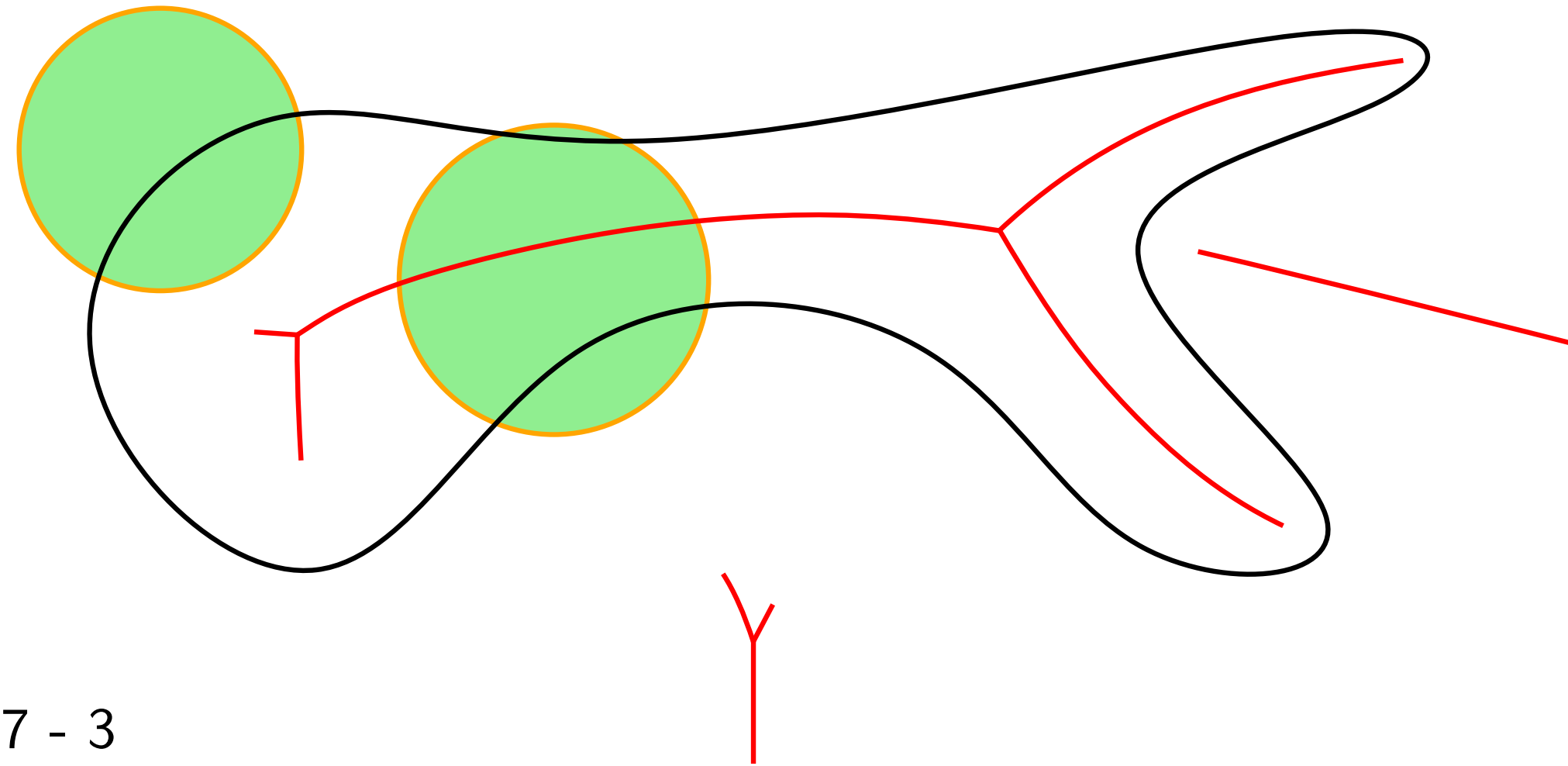
Reconstruction

Delaunay is a good start

Lemma:

$\forall$ Disk, Disk$\cap$Curve has a single connected component

or Disk$\cap$Medial axis$\neq \emptyset$



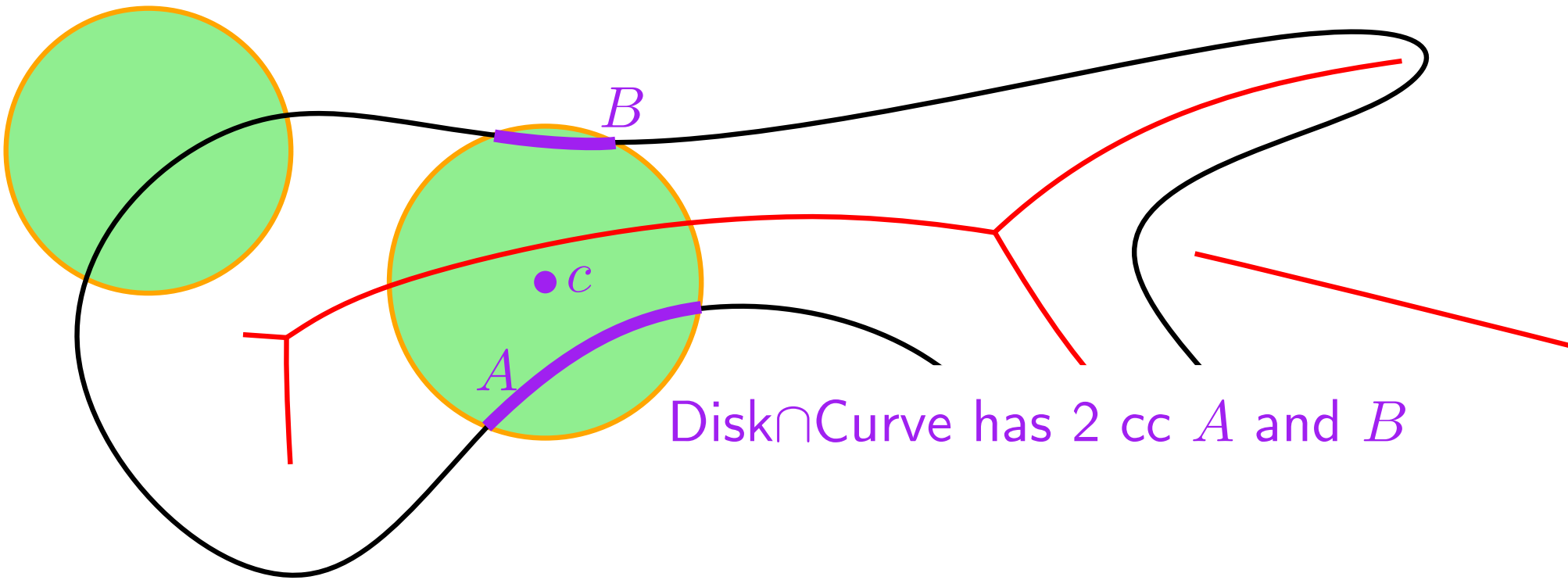
Reconstruction

Delaunay is a good start

Lemma:

$\forall$ Disk, Disk$\cap$Curve has a single connected component

or Disk$\cap$Medial axis$\neq \emptyset$



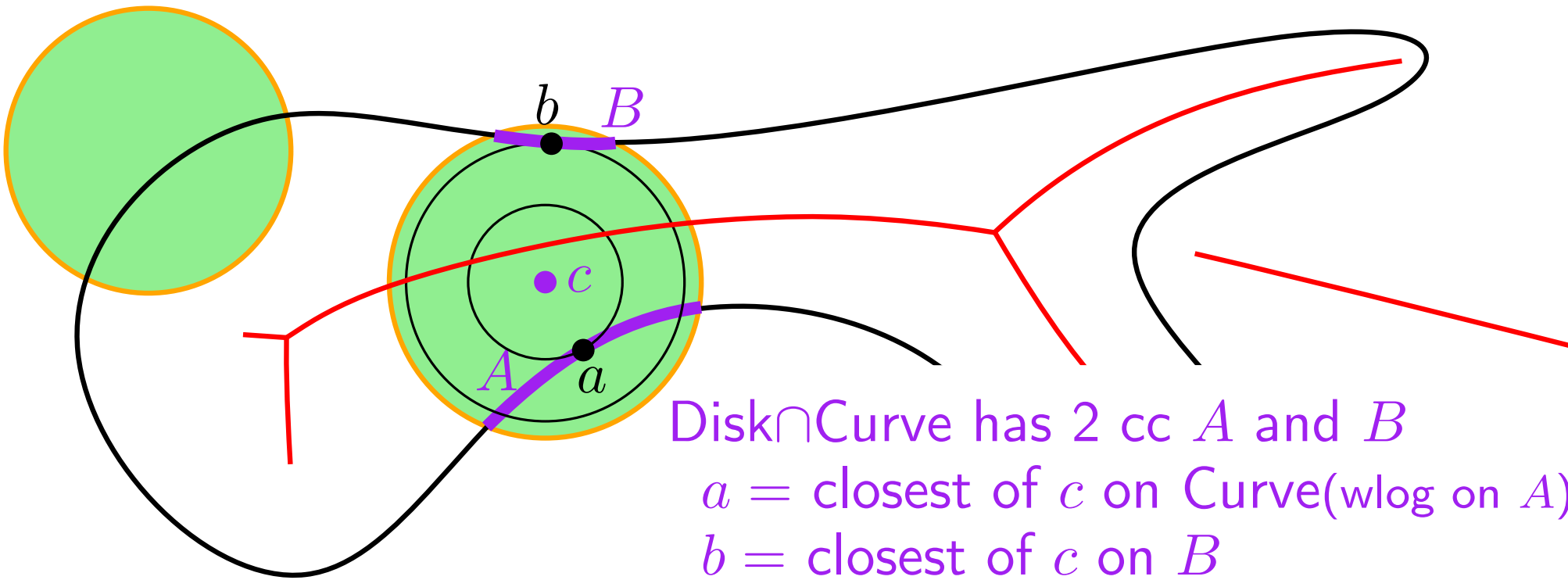
Reconstruction

Delaunay is a good start

Lemma:

$\forall$ Disk, Disk$\cap$Curve has a single connected component

or Disk$\cap$Medial axis$\neq \emptyset$



Disk$\cap$Curve has 2 cc A and B

$a =$ closest of c on Curve(wlog on A)

$b =$ closest of c on B

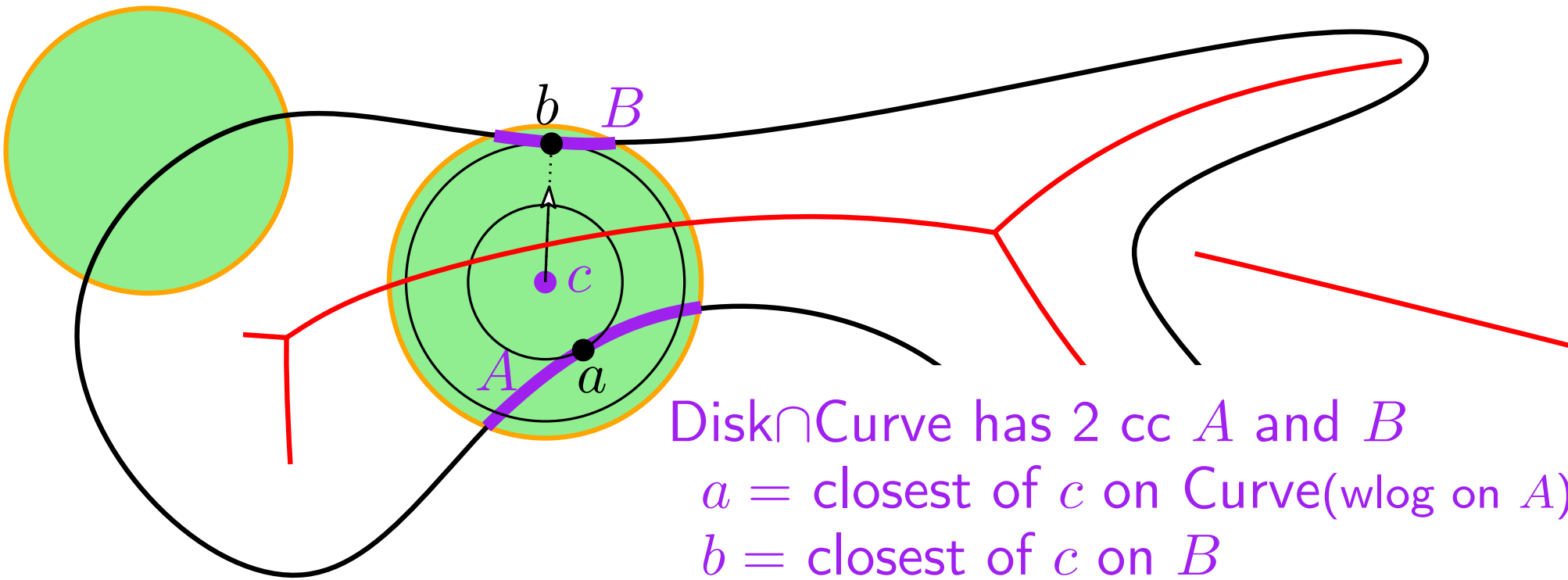
Reconstruction

Delaunay is a good start

Lemma:

$\forall$ Disk, Disk$\cap$Curve has a single connected component

or Disk$\cap$Medial axis$\neq \emptyset$



Disk$\cap$Curve has 2 cc A and B

$a =$ closest of c on Curve(wlog on A)

$b =$ closest of c on B

Moving from c to a dist to B $\nearrow$

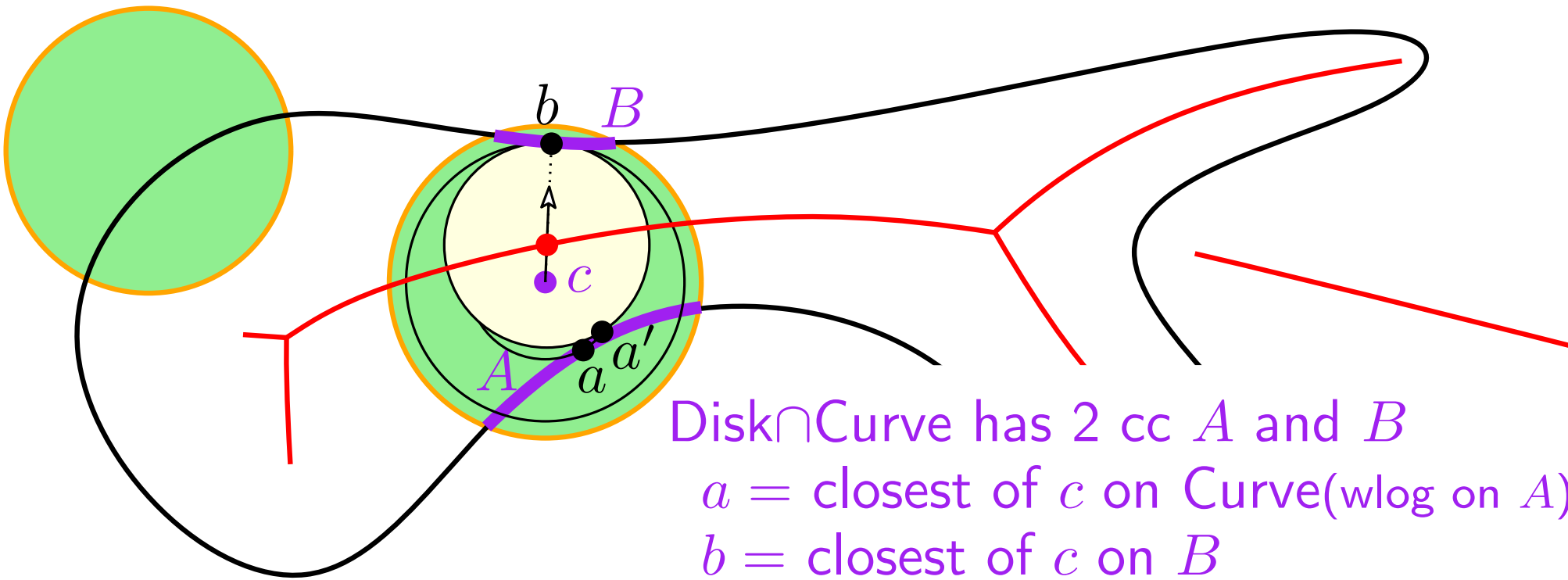
Reconstruction

Delaunay is a good start

Lemma:

$\forall$ Disk, Disk$\cap$Curve has a single connected component

or Disk$\cap$Medial axis$\neq \emptyset$



Disk$\cap$Curve has 2 cc A and B

$a =$ closest of c on Curve(wlog on A)

$b =$ closest of c on B

Moving from c to a dist to B $\nearrow$

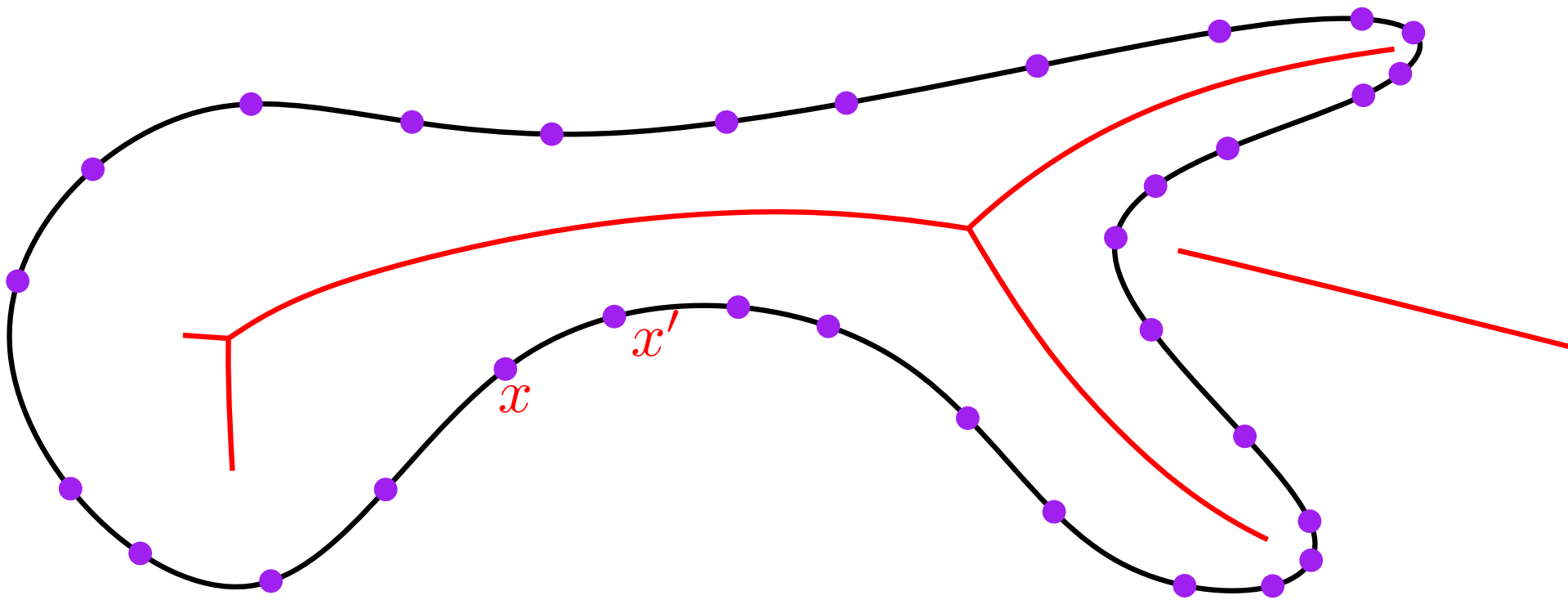
reach center of bitangent disk

Reconstruction

Delaunay is a good start

Theorem
If Sample is a ϵ-sample, $\epsilon < 1$

neighboring points along Curve are Delaunay neighbors

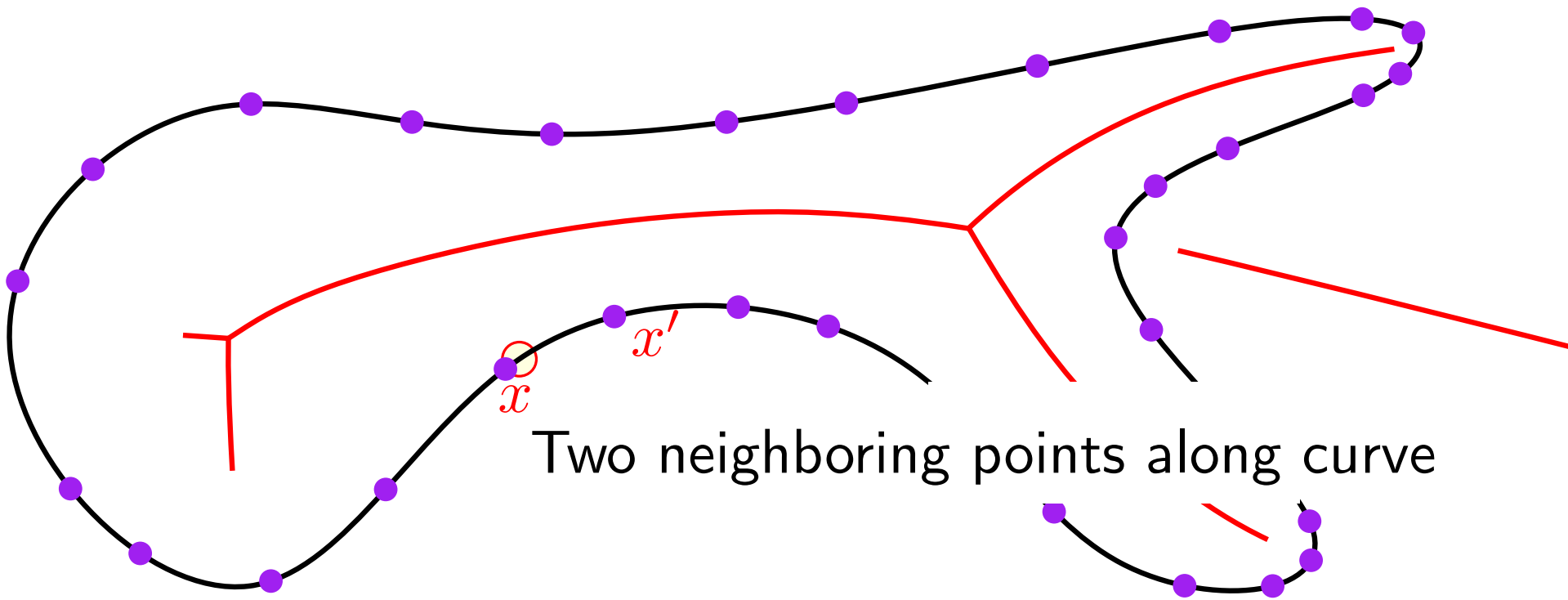


Reconstruction

Delaunay is a good start

Theorem
If Sample is a ϵ-sample, $\epsilon < 1$

neighboring points along Curve are Delaunay neighbors



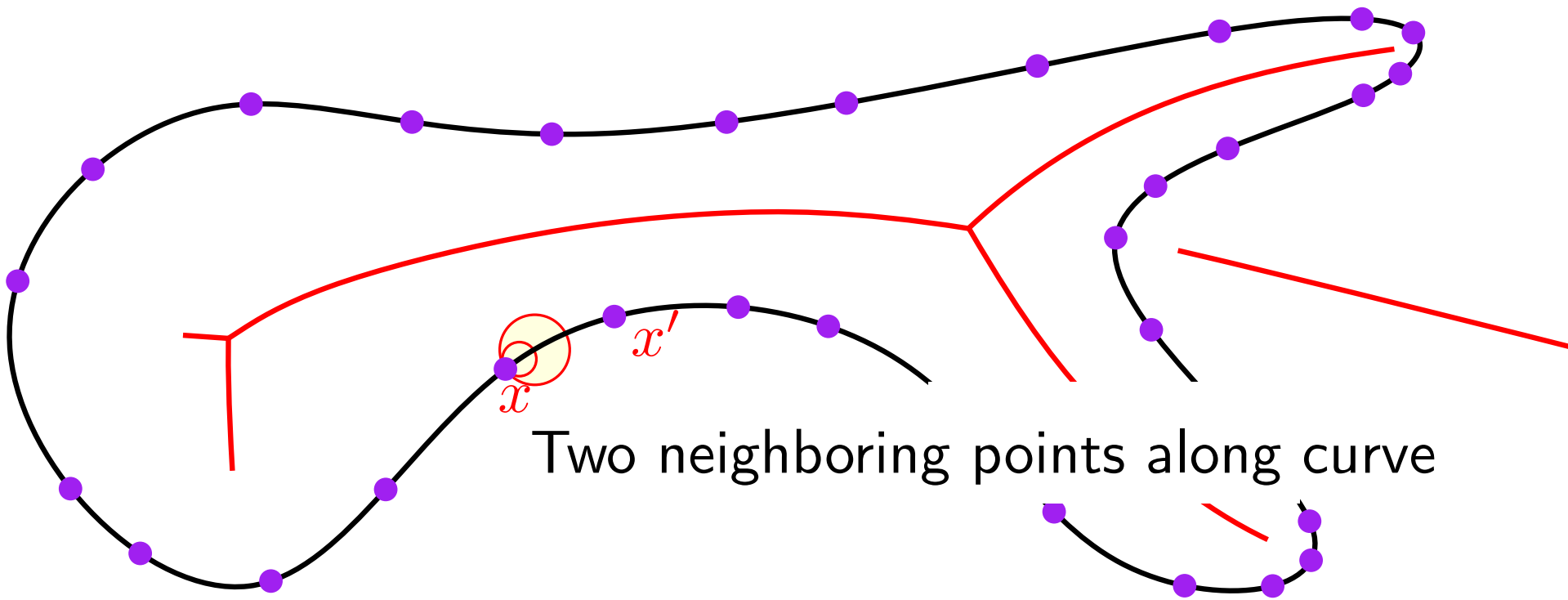
disks centered on Curve, through x

Reconstruction

Delaunay is a good start

Theorem
If Sample is a ϵ-sample, $\epsilon < 1$

neighboring points along Curve are Delaunay neighbors



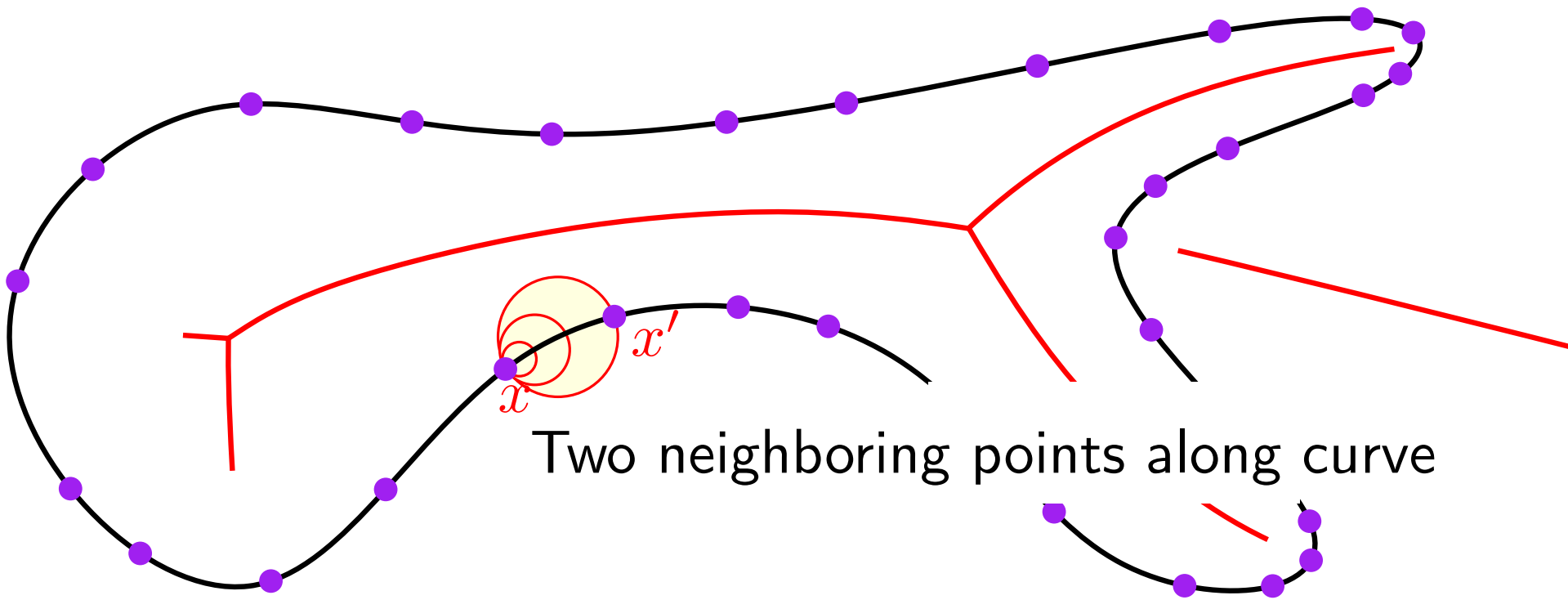
disks centered on Curve, through x

Reconstruction

Delaunay is a good start

Theorem
If Sample is a ϵ-sample, $\epsilon < 1$

neighboring points along Curve are Delaunay neighbors



Two neighboring points along curve

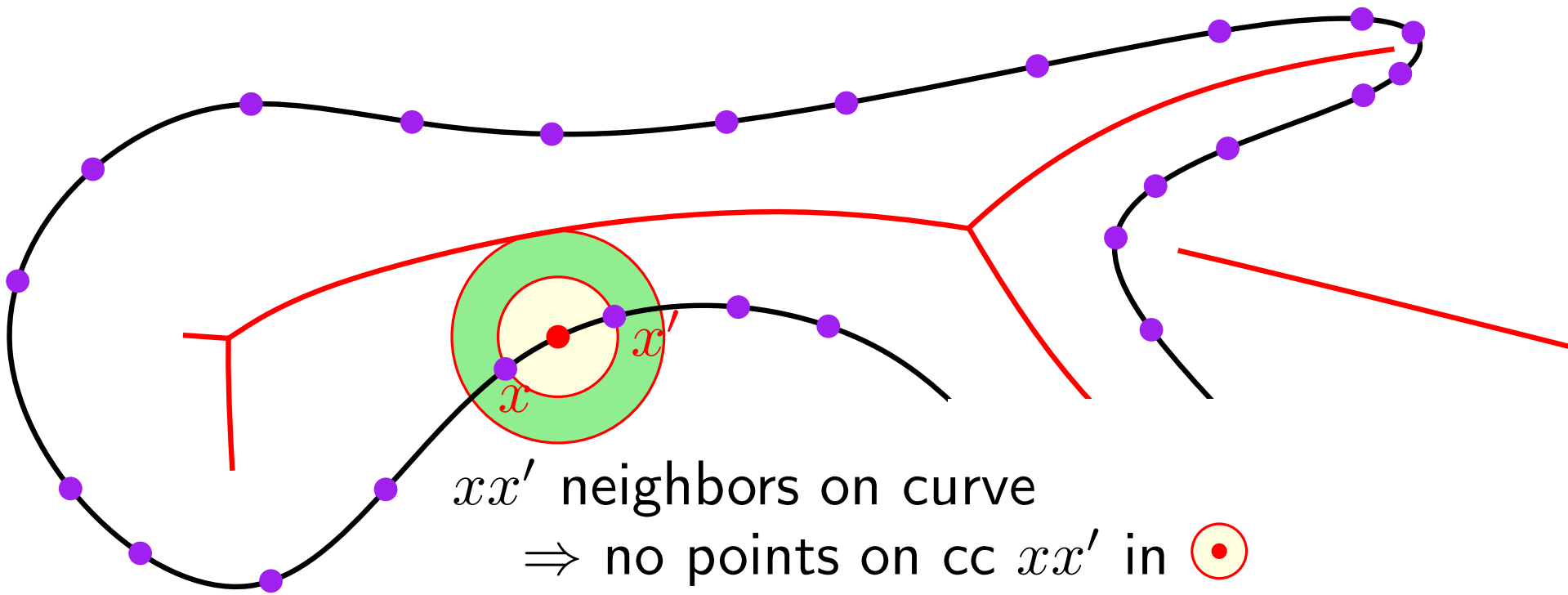
disks centered on Curve, through x

Reconstruction

Delaunay is a good start

Theorem
If Sample is a ϵ-sample, $\epsilon < 1$

neighboring points along Curve are Delaunay neighbors



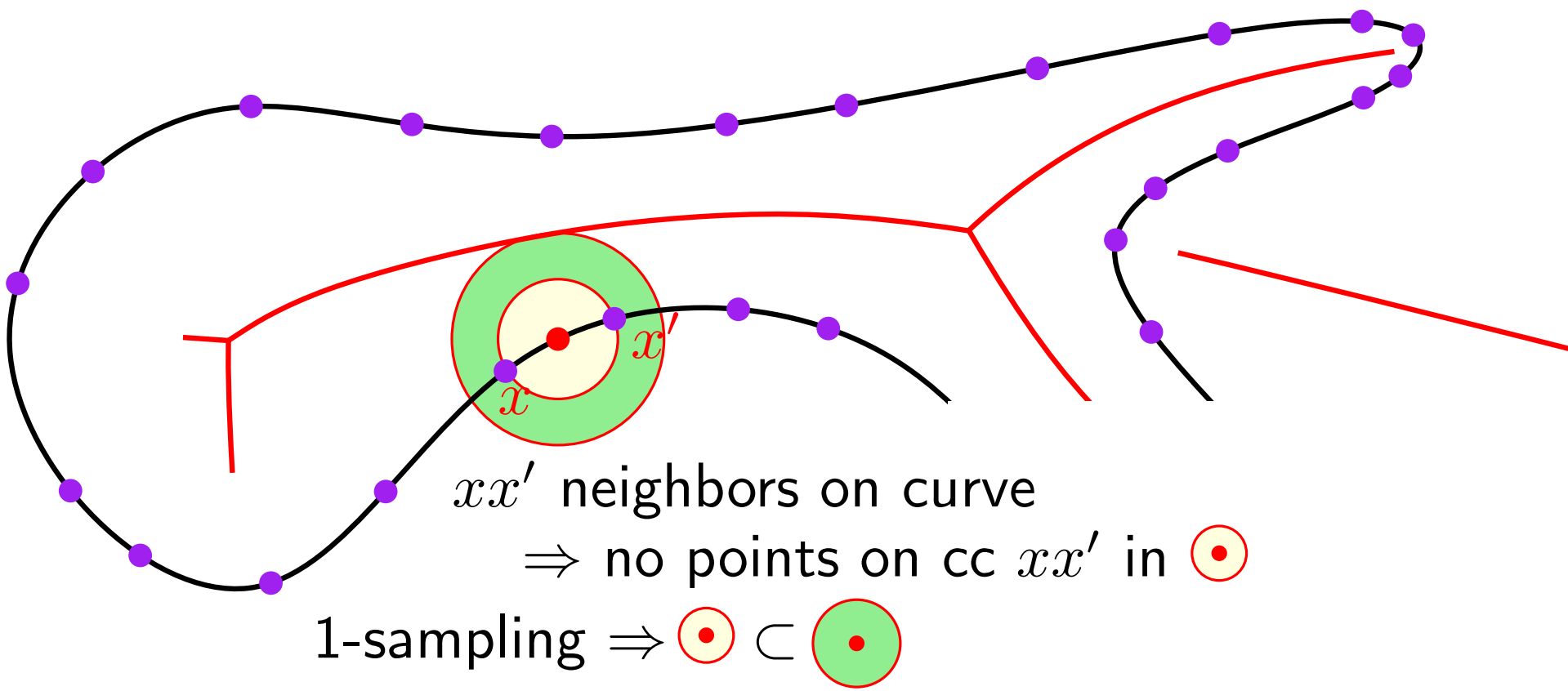
xx' neighbors on curve
$\Rightarrow$ no points on cc xx' in

Reconstruction

Delaunay is a good start

Theorem
If Sample is a ϵ-sample, $\epsilon < 1$

neighboring points along Curve are Delaunay neighbors

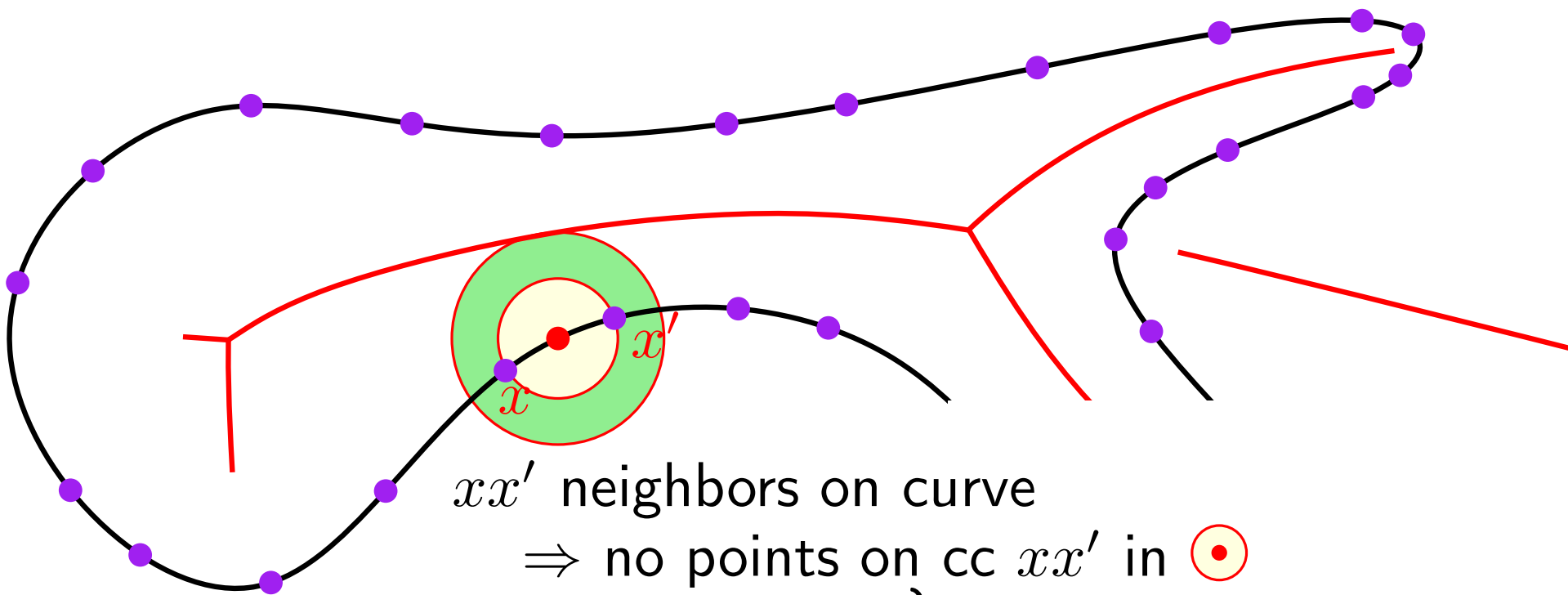


Reconstruction

Delaunay is a good start

Theorem
If Sample is a ϵ-sample, $\epsilon < 1$

neighboring points along Curve are Delaunay neighbors



xx' neighbors on curve

$\Rightarrow$ no points on cc xx' in

1-sampling $\Rightarrow$ $\subset$ $\Rightarrow$ no other cc $\cap$

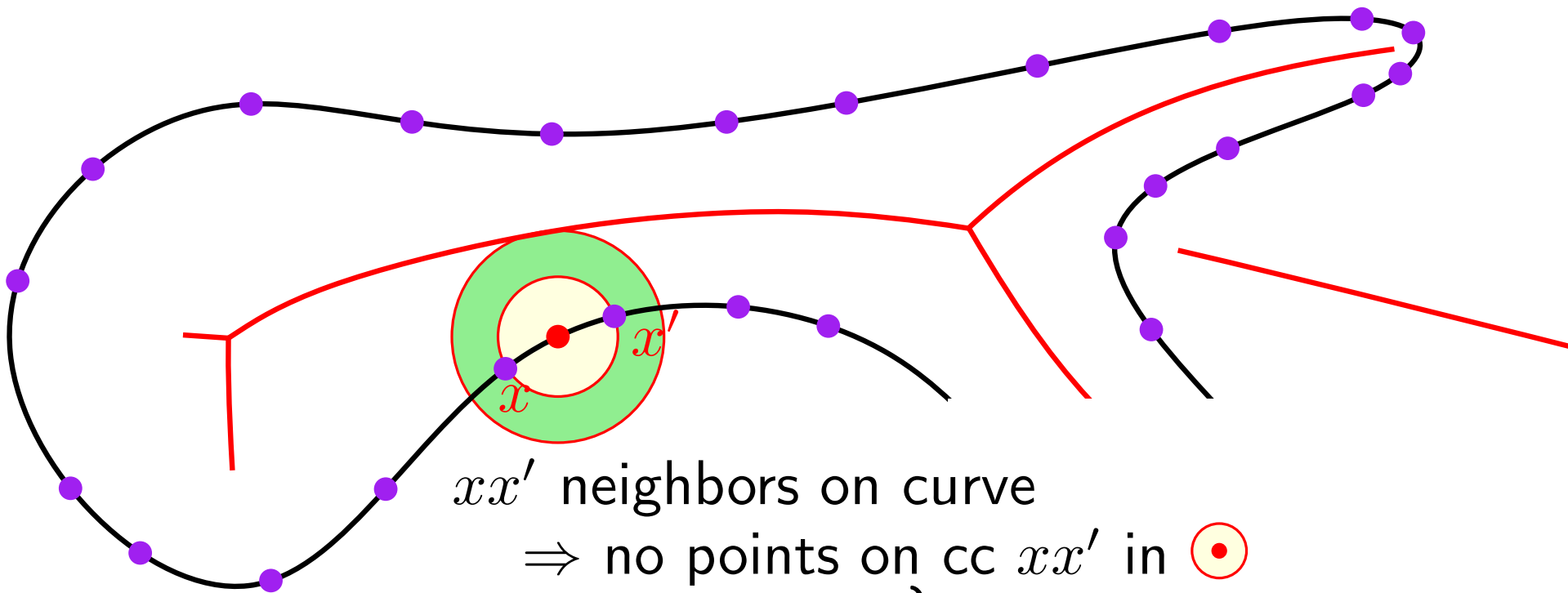
Lemma

Reconstruction

Delaunay is a good start

Theorem
If Sample is a ϵ-sample, $\epsilon < 1$

neighboring points along Curve are Delaunay neighbors



xx' neighbors on curve

$\Rightarrow$ no points on cc xx' in ⊙

1-sampling $\Rightarrow$ ⊙ $\subset$ ⊙

Lemma

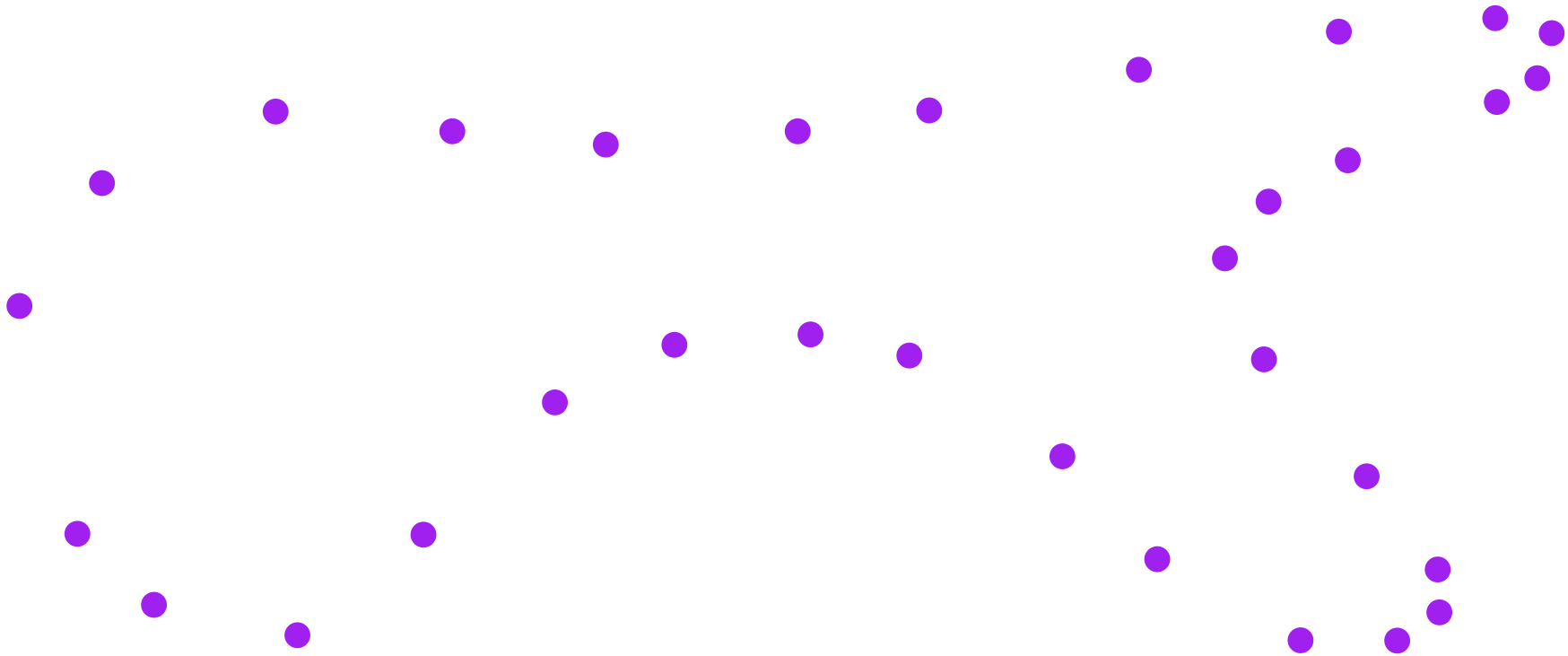
$\Rightarrow$ no other cc $\cap$ ⊙

$\Rightarrow$ ⊙ empty

Reconstruction

Delaunay is a good start

Given a sampling

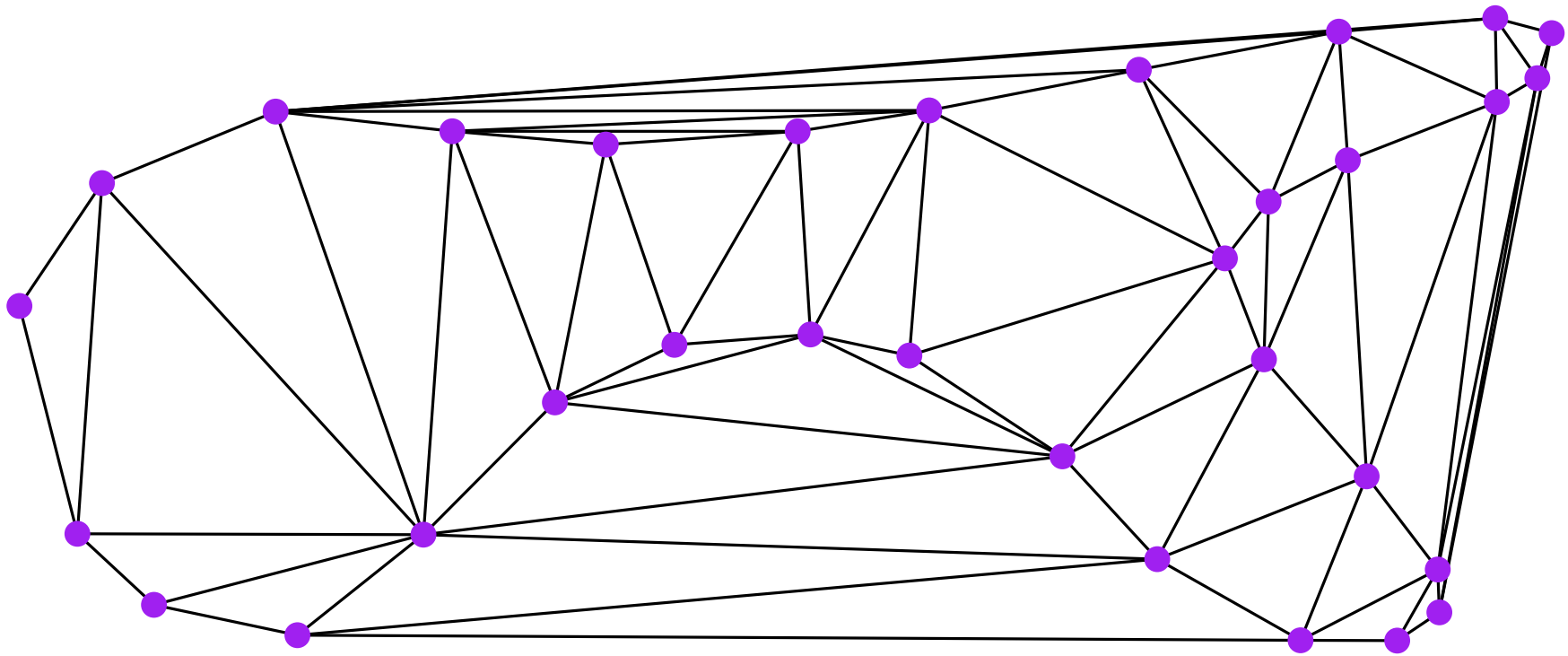


Reconstruction

Delaunay is a good start

Given a sampling

Compute Delaunay



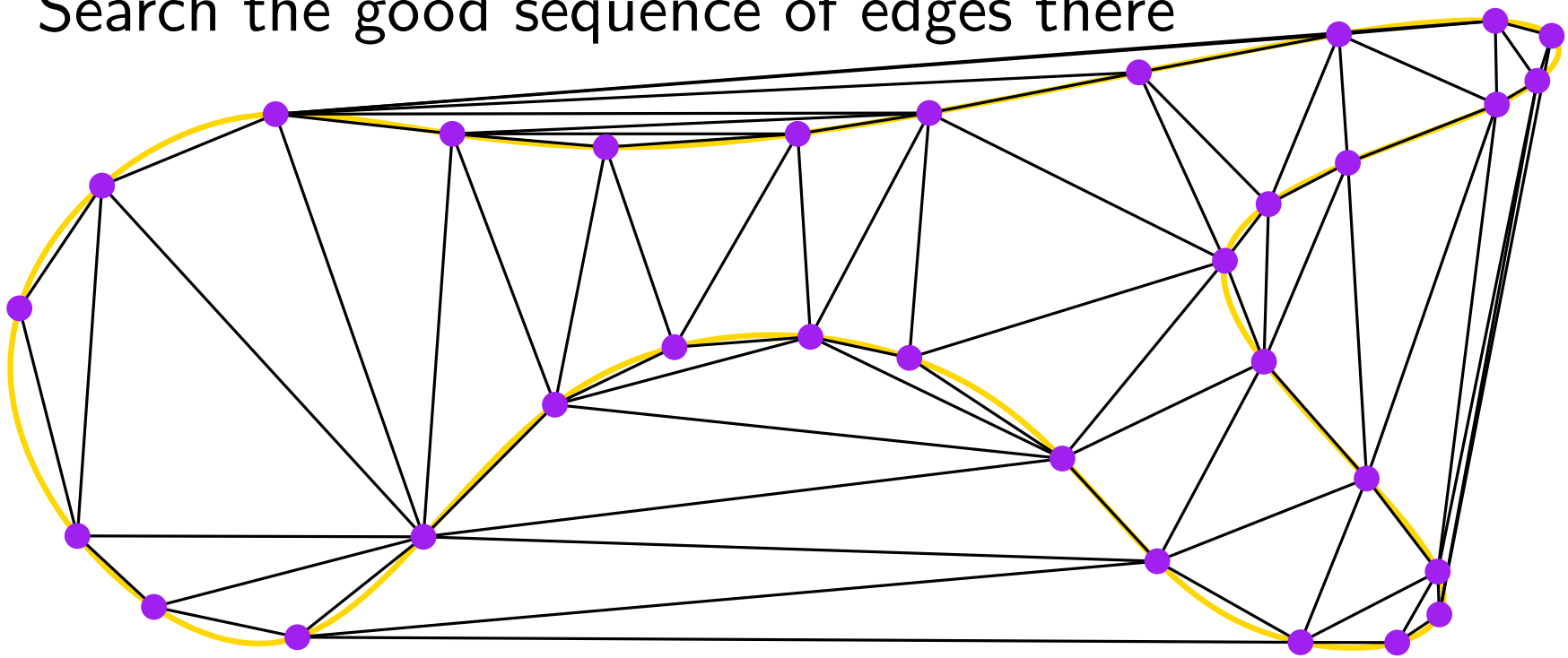
Reconstruction

Delaunay is a good start

Given a sampling

Compute Delaunay

Search the good sequence of edges there



Reconstruction

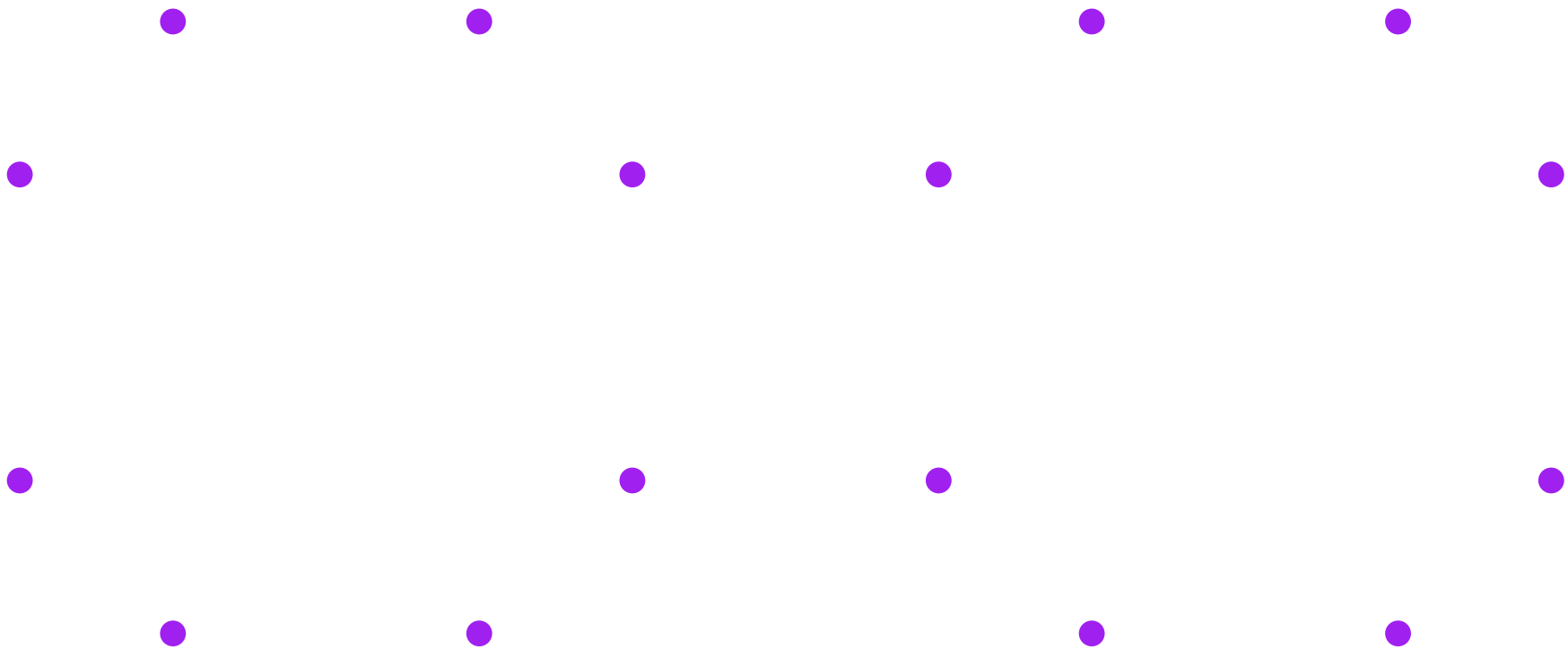
Delaunay is a good start

1-sample is not enough

Reconstruction

Delaunay is a good start

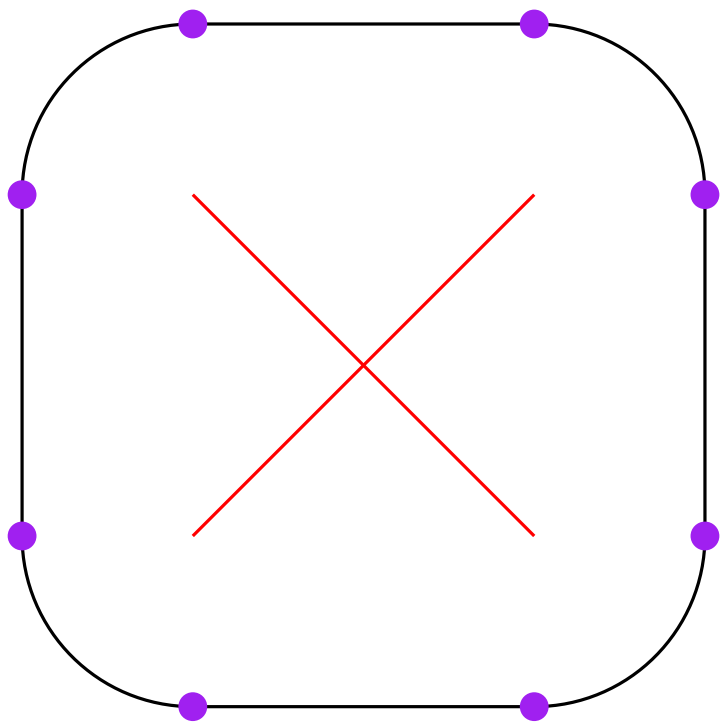
1-sample is not enough

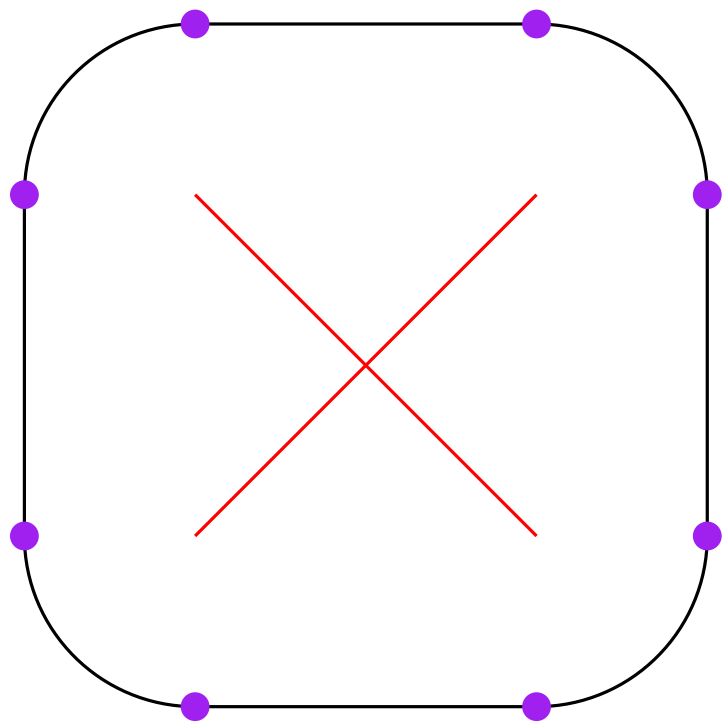


Reconstruction

Delaunay is a good start

1-sample is not enough

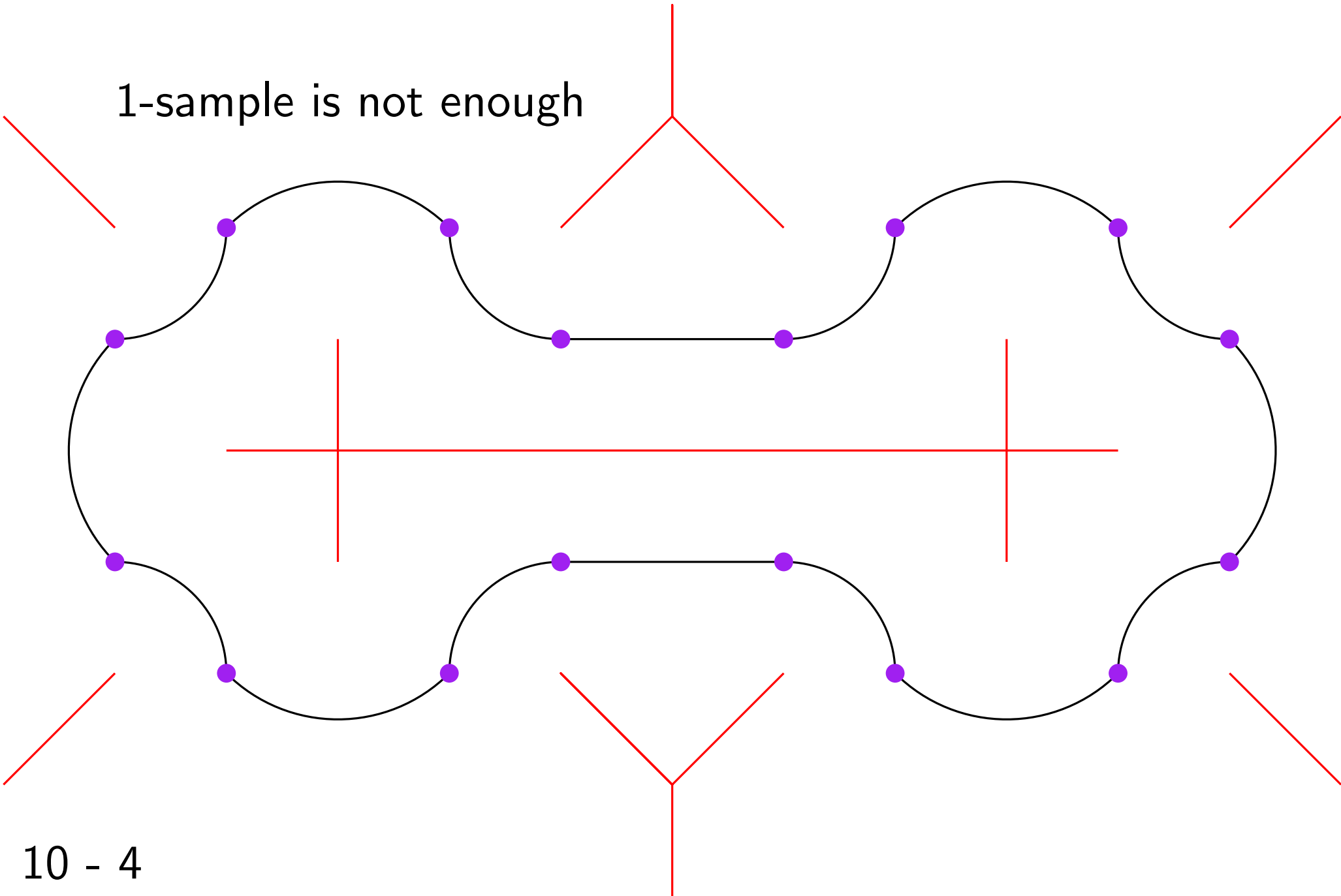


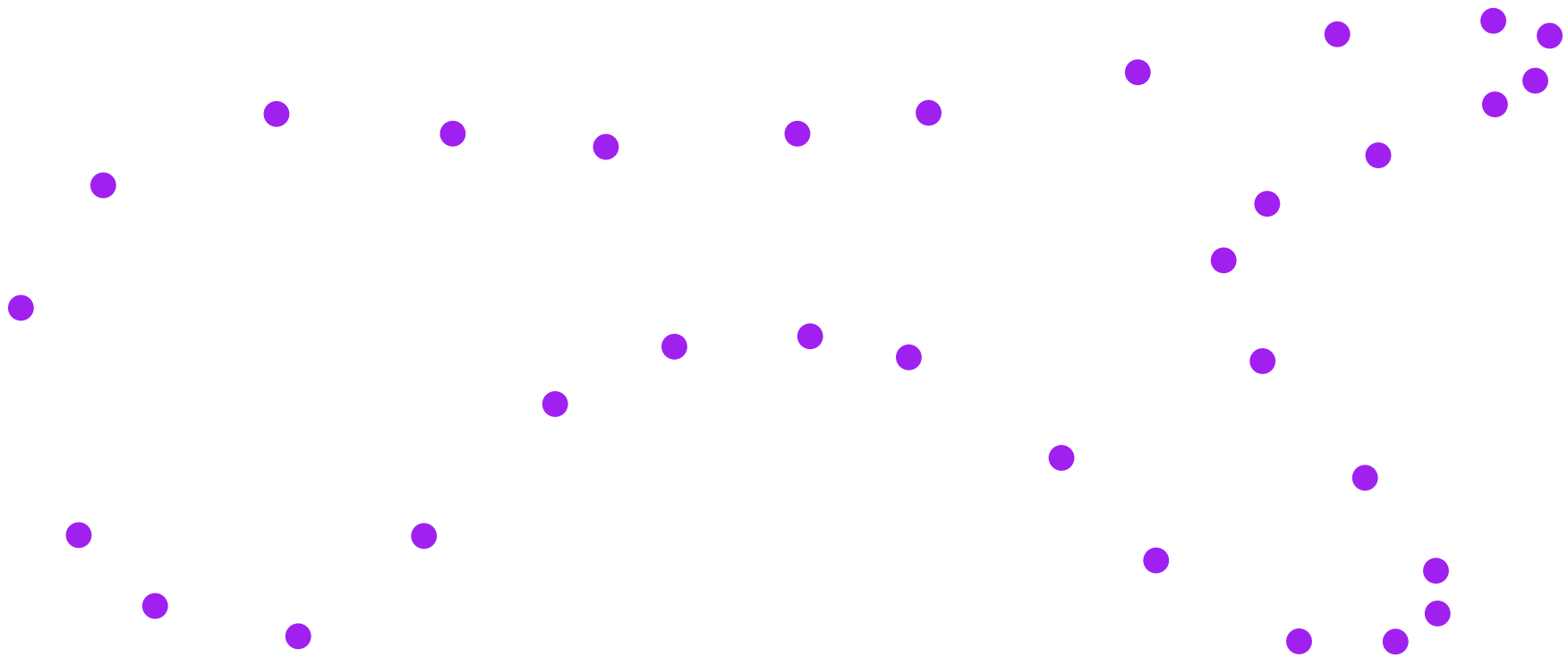


Reconstruction

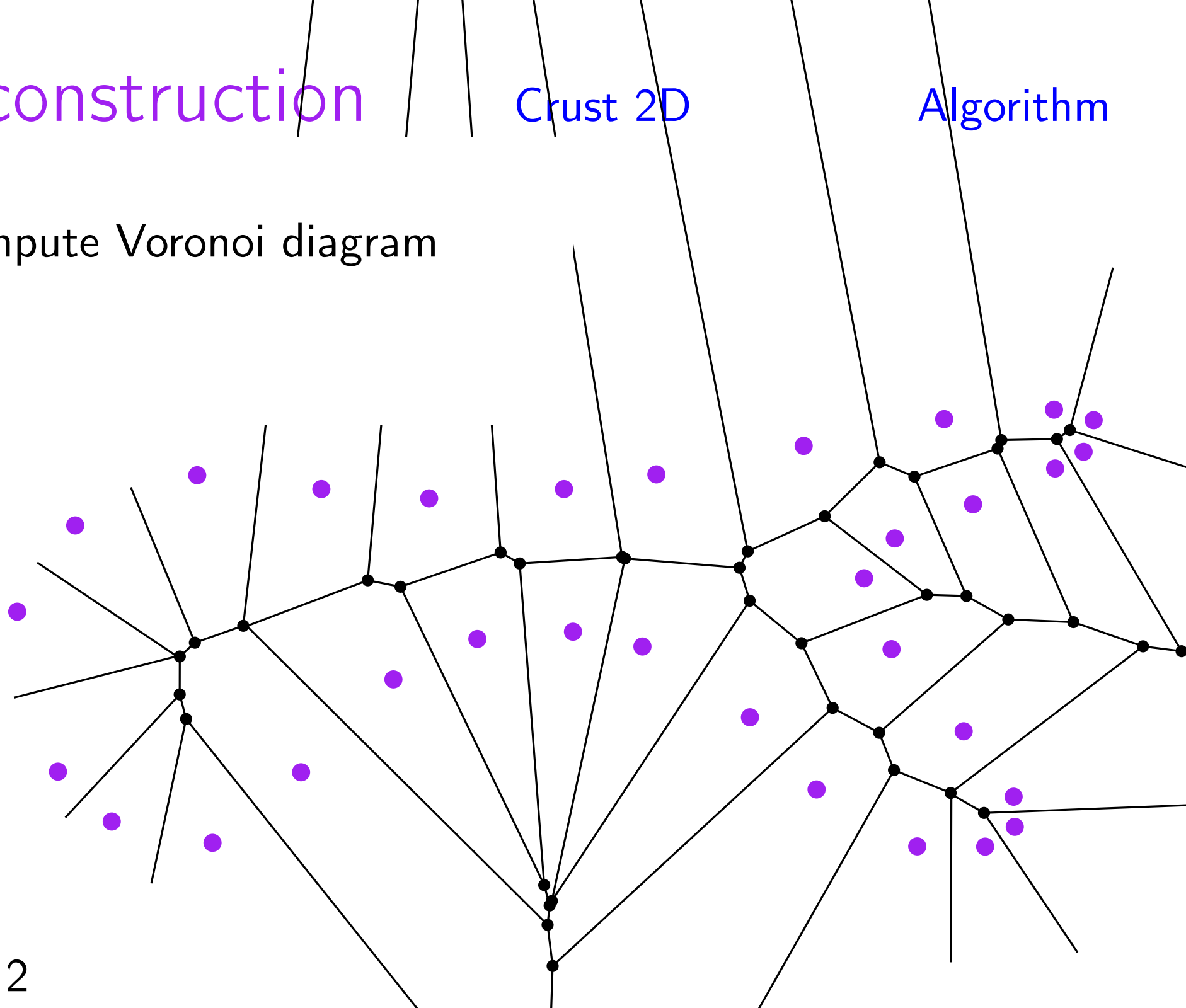
Delaunay is a good start

1-sample is not enough

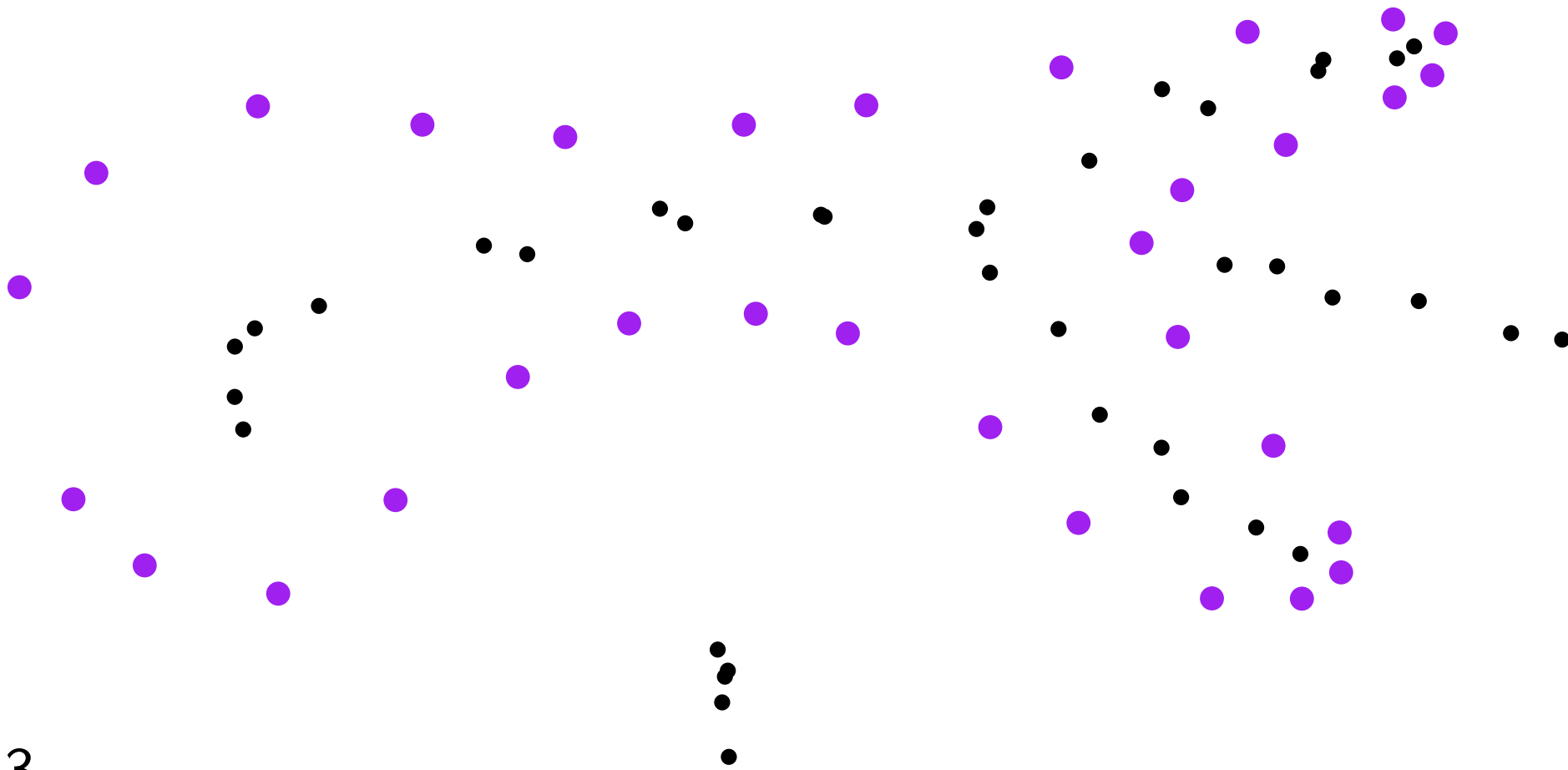




Compute Voronoi diagram

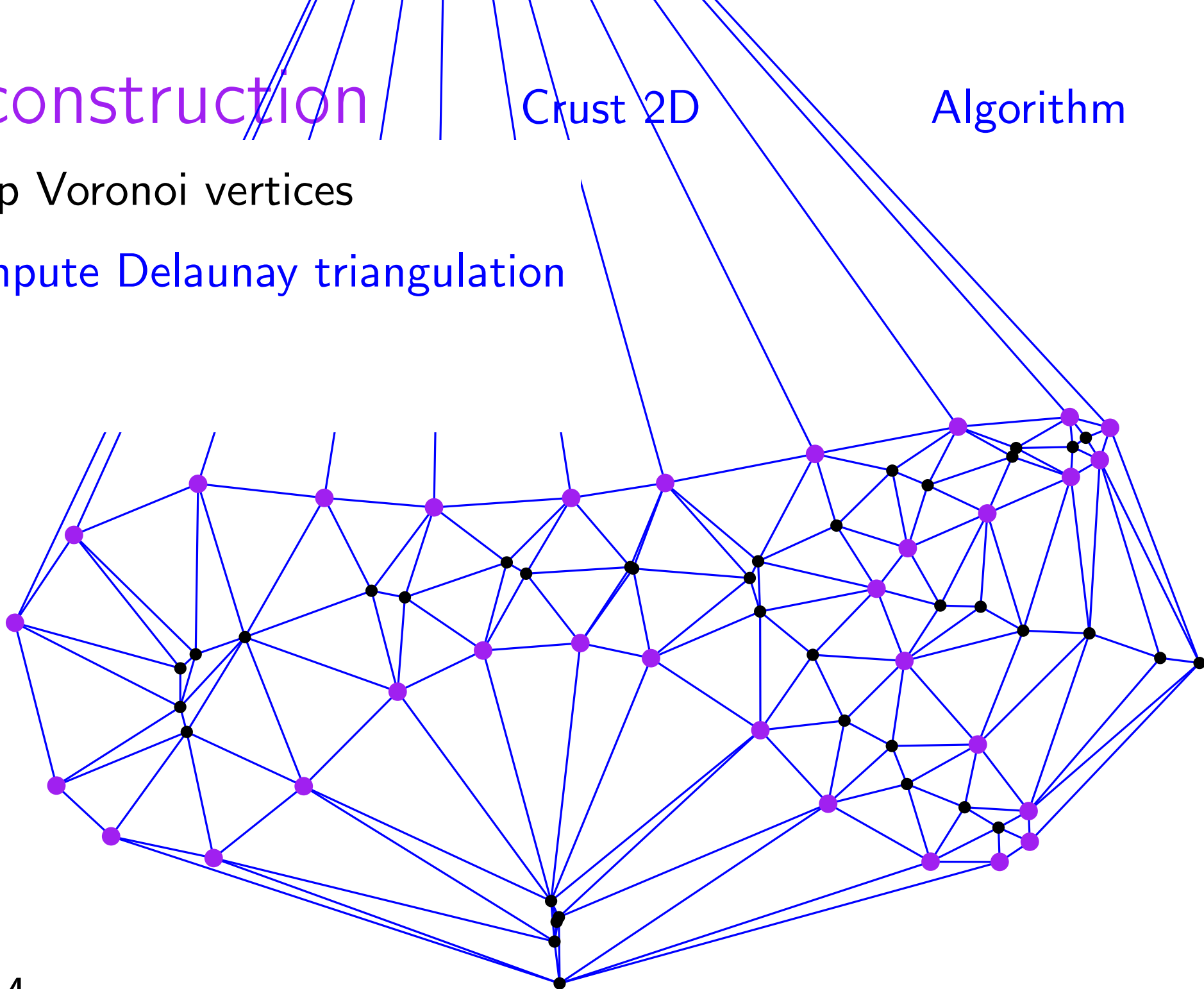


Keep Voronoi vertices



Keep Voronoi vertices

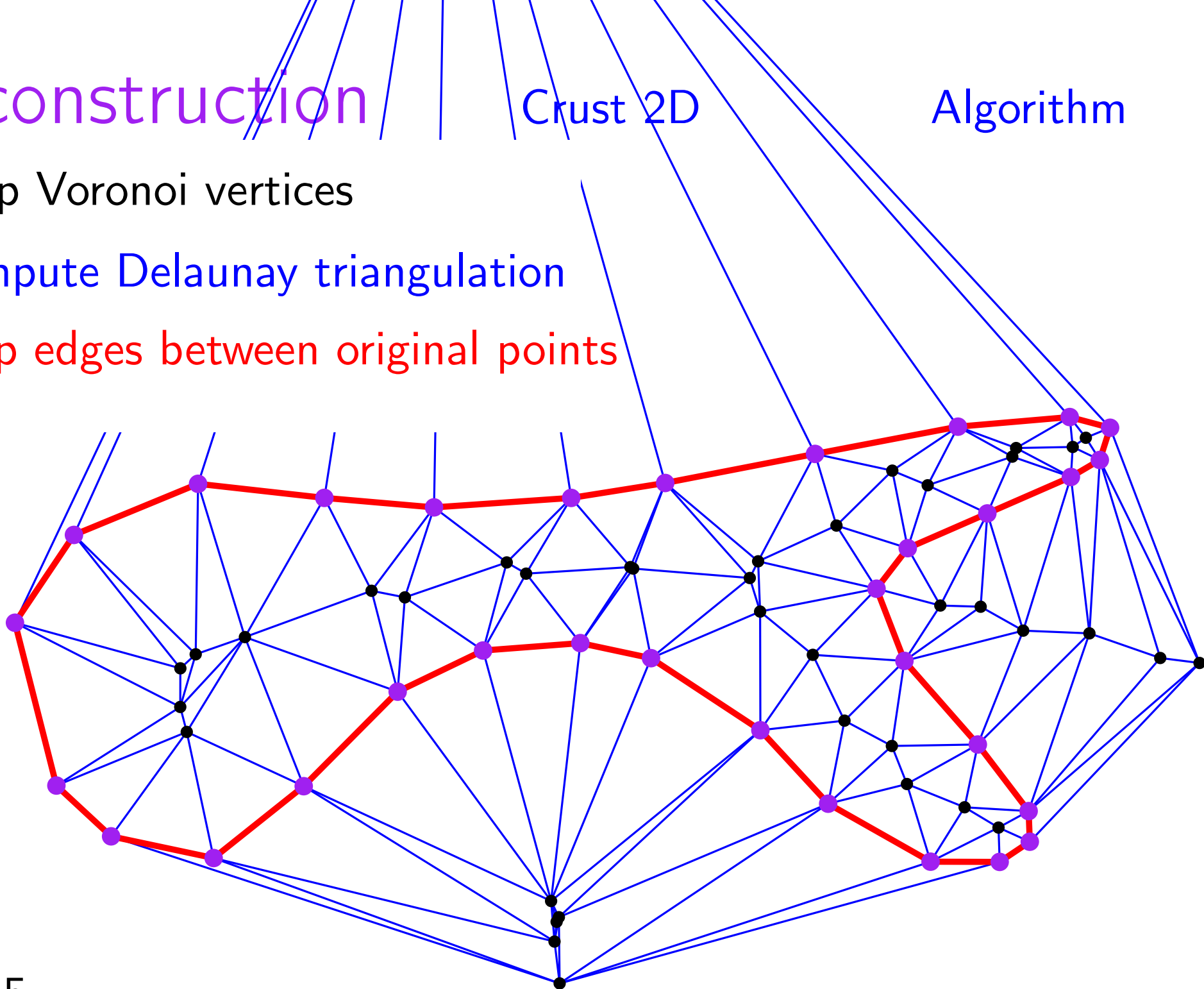
Compute Delaunay triangulation



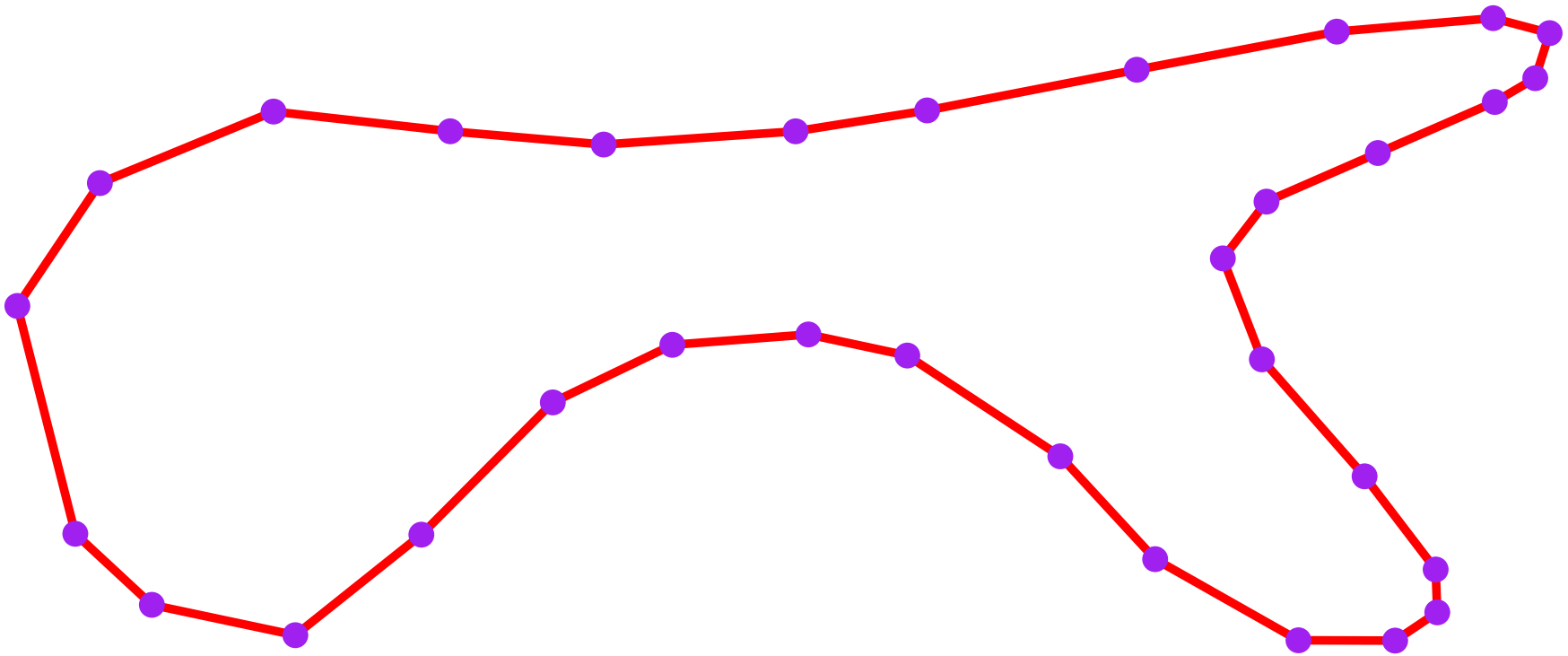
Keep Voronoi vertices

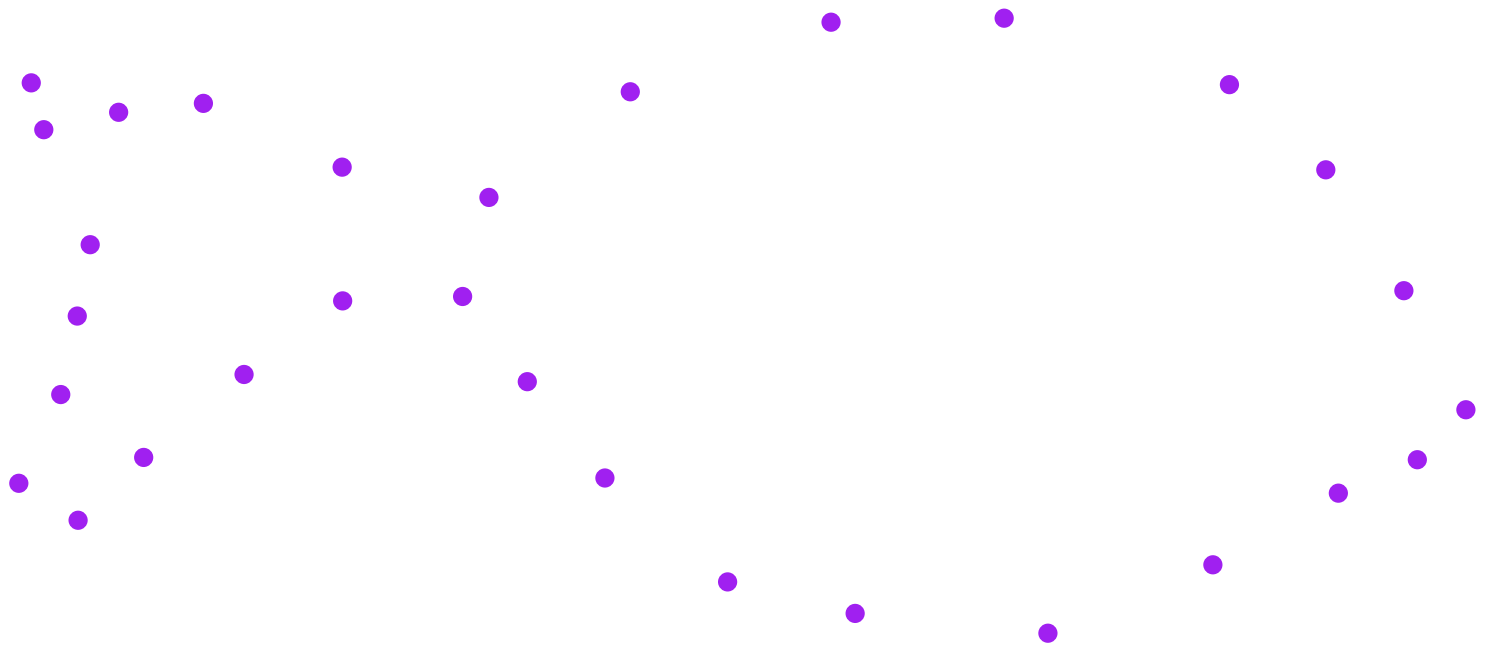
Compute Delaunay triangulation

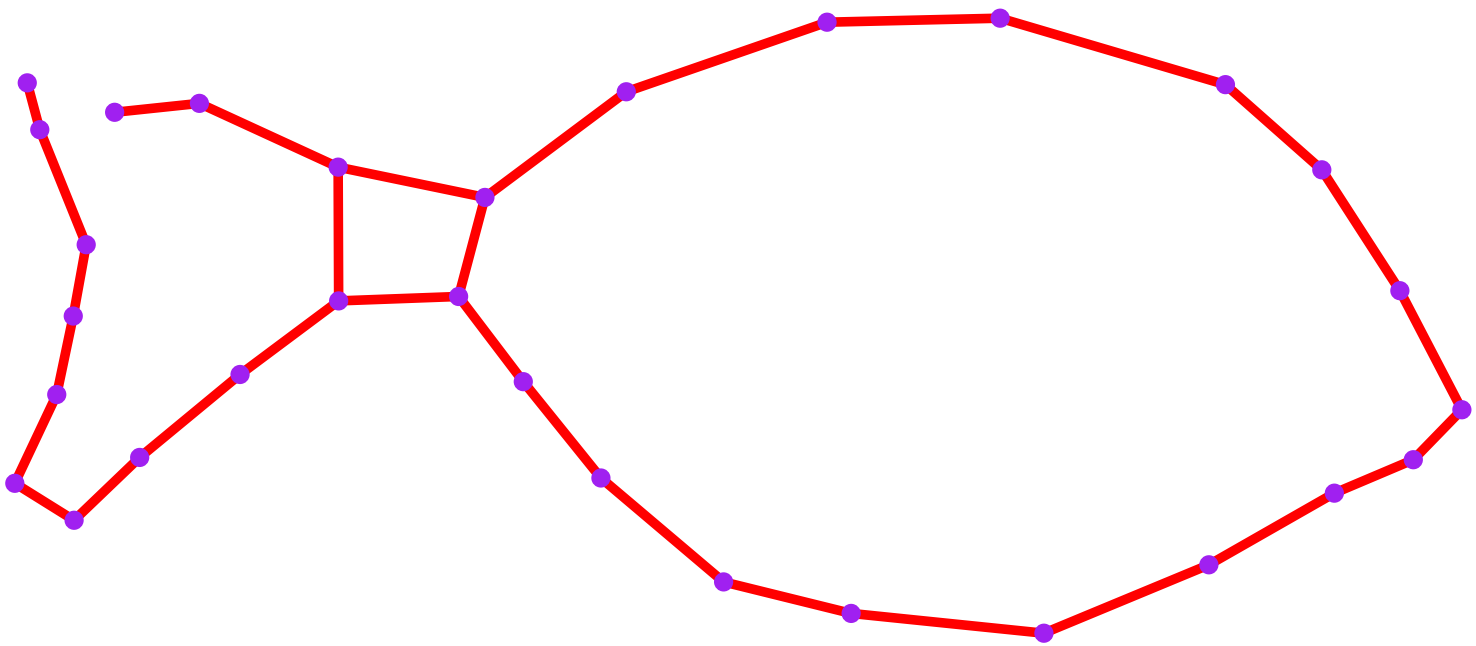
Keep edges between original points

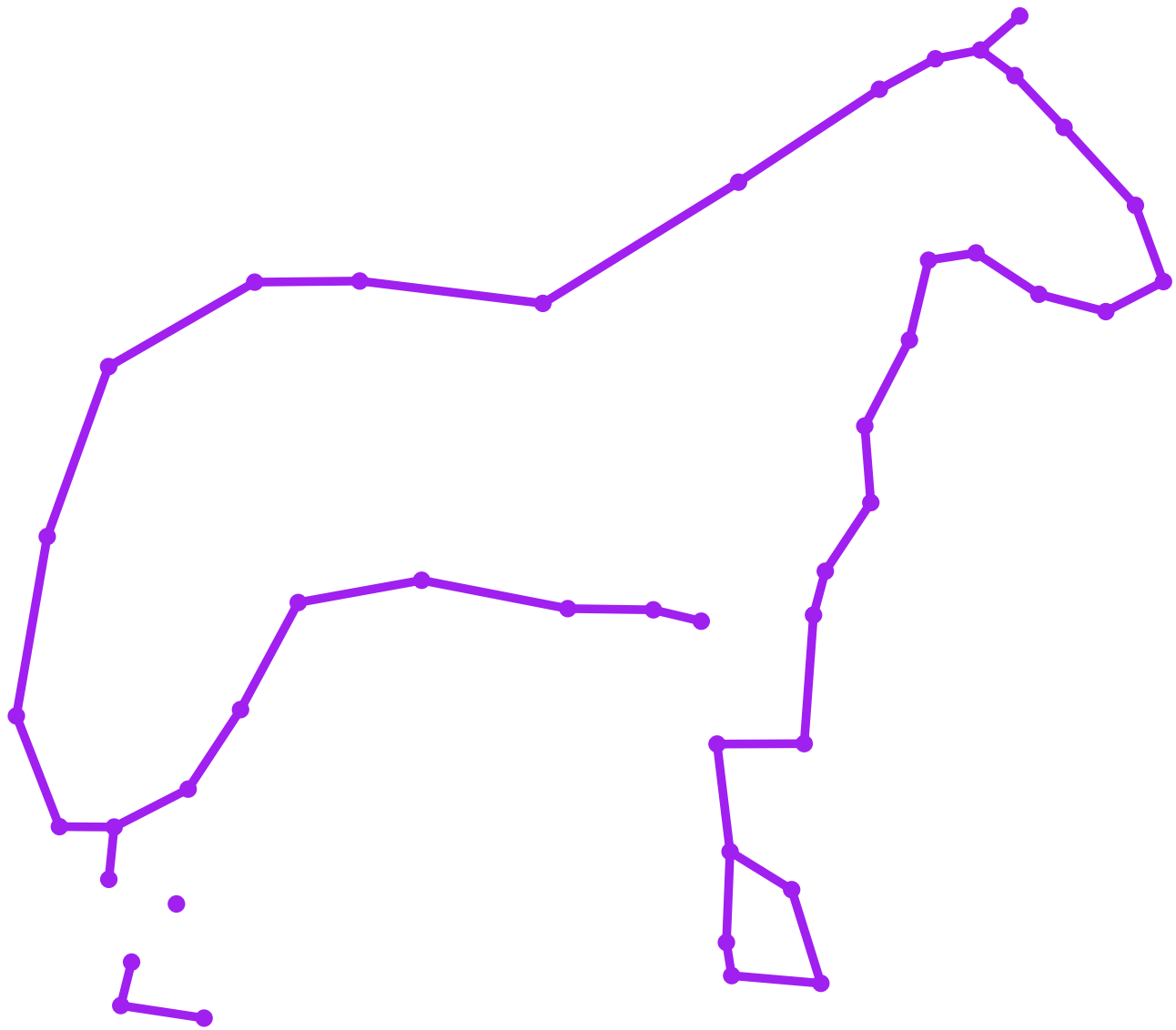


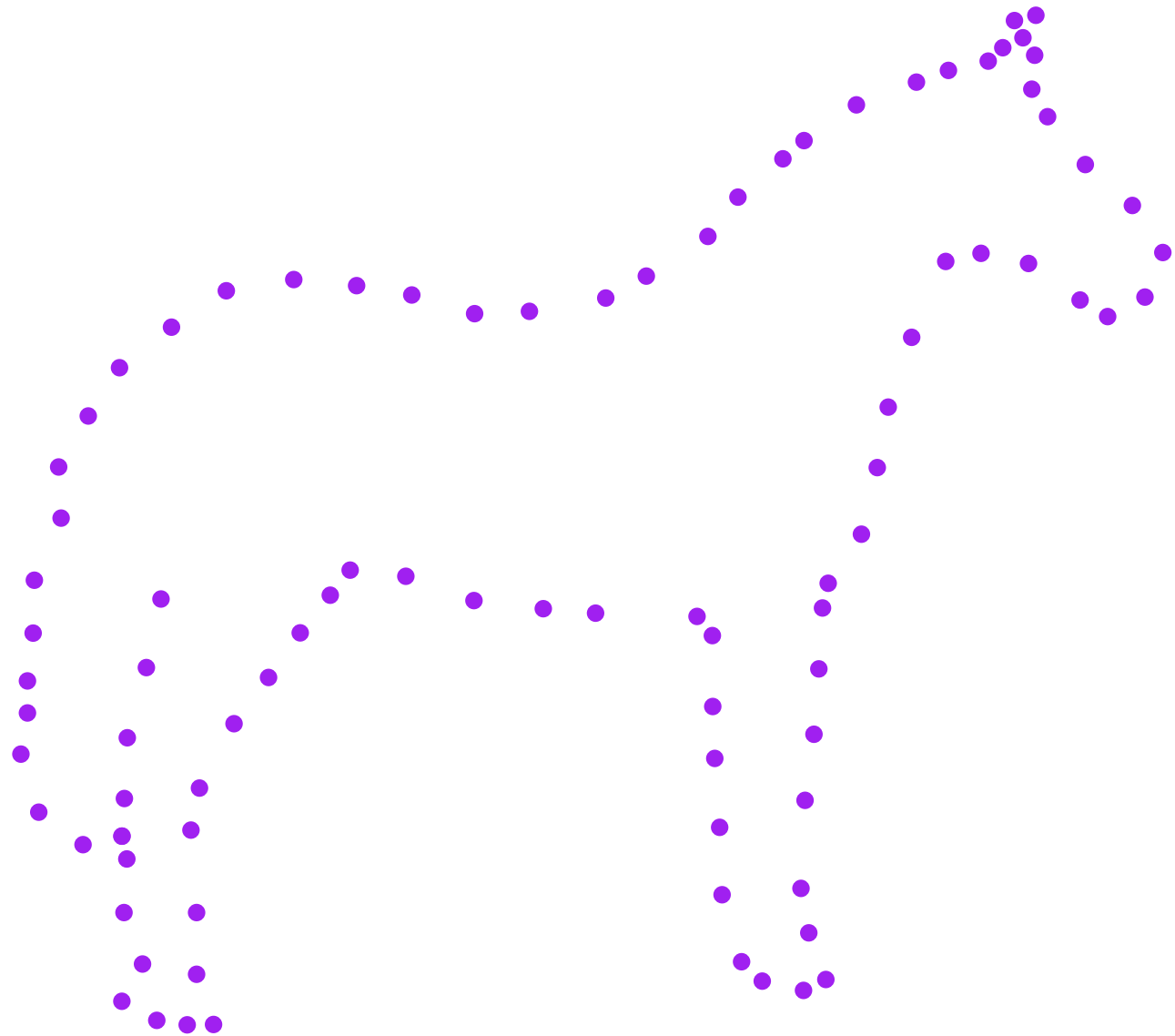
Keep edges between original points

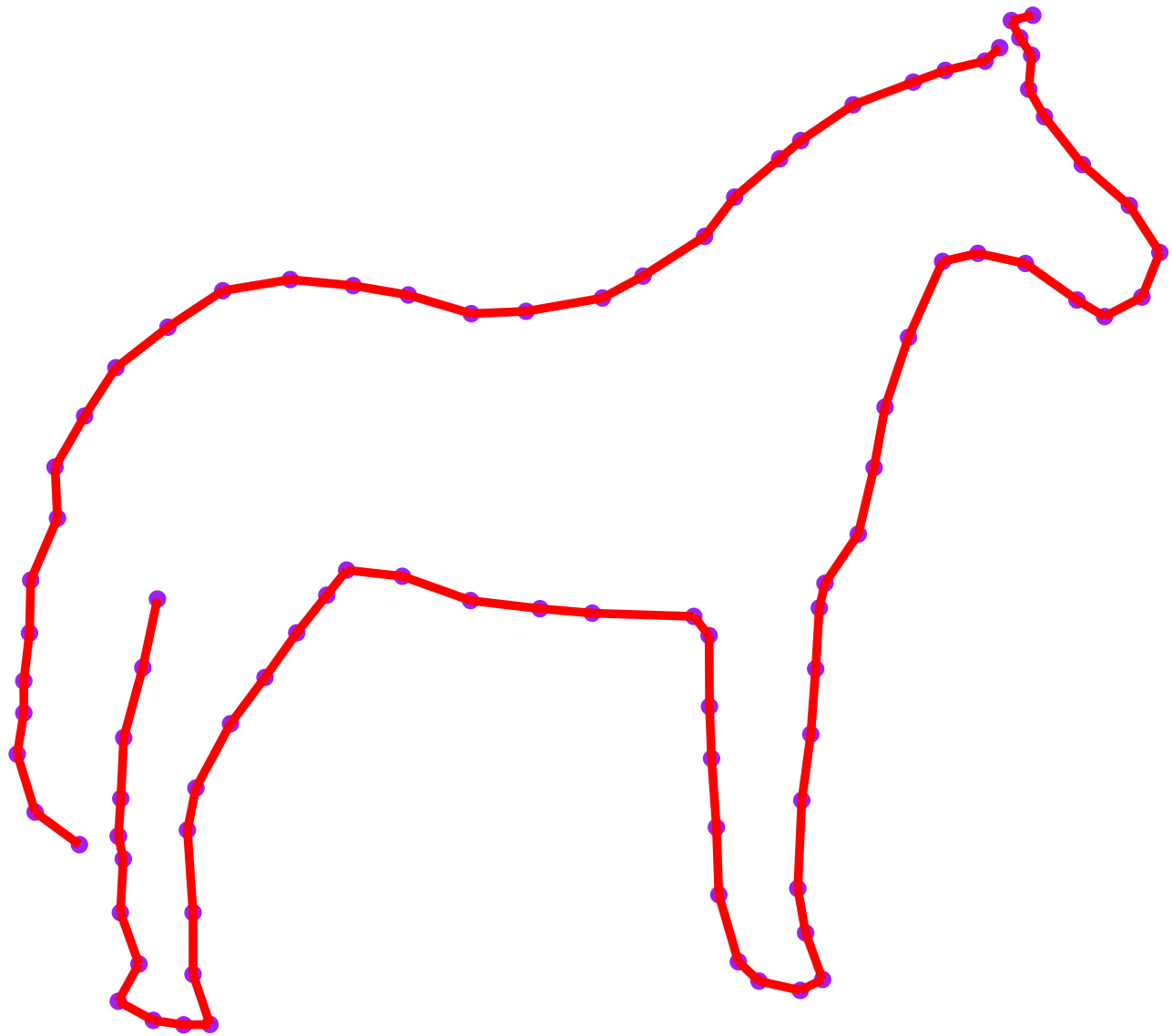












Reconstruction

Crust 2D

0.4 sample $\Rightarrow$ wanted result $\subset$ crust

Theorem: $0.4\ \text{sample} \Rightarrow \text{wanted result} \subset \text{crust}$

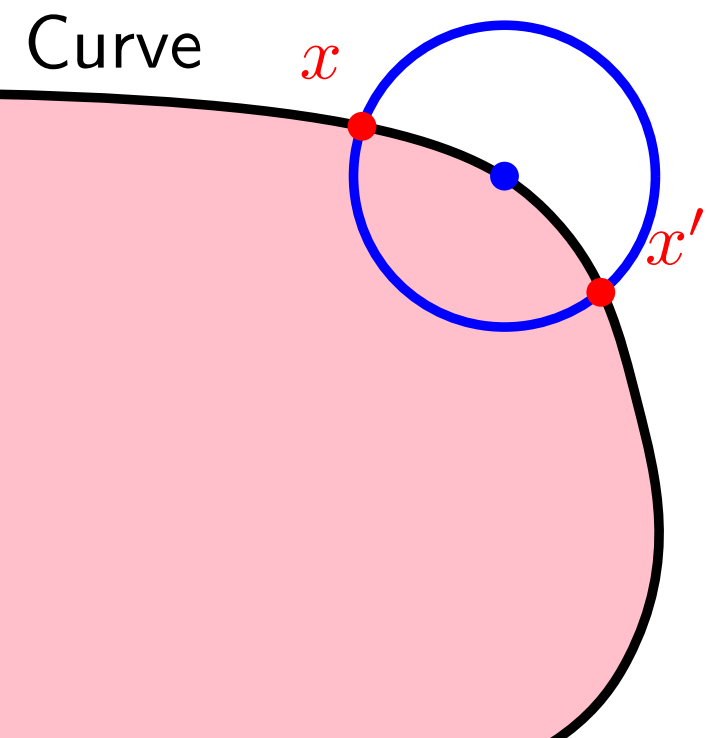
Reconstruction

Crust 2D

Theorem: 0.4 sample ⇒ wanted result ⊂ crust

x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve



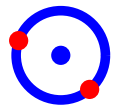
Reconstruction

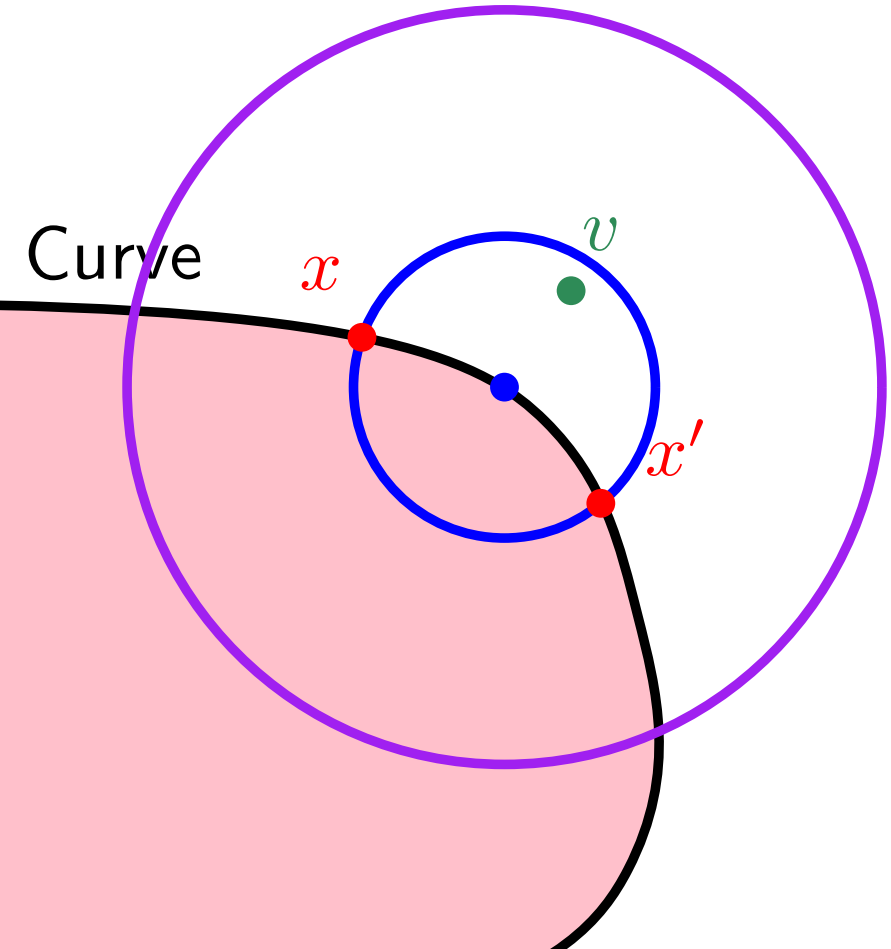
Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust

x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve

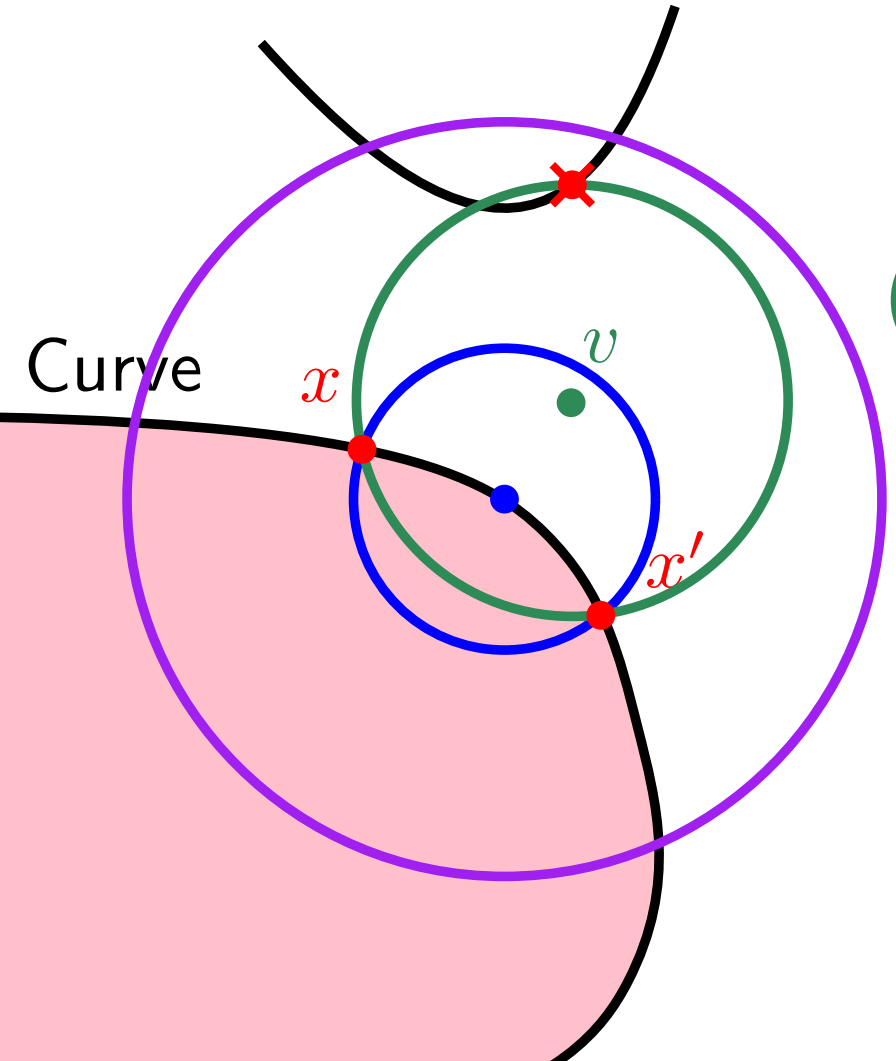
By contradiction assume $v \in$ 



Reconstruction

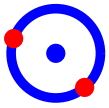
Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve

By contradiction assume $v \in$ 

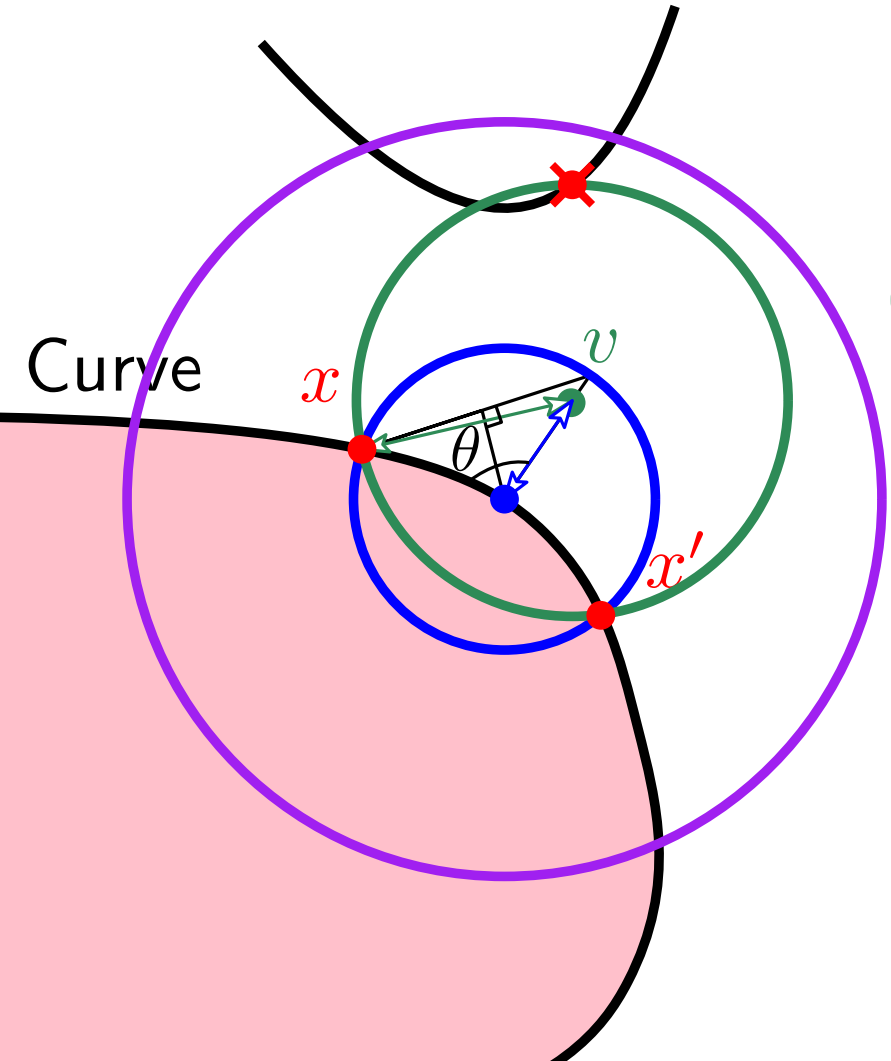
 intersects another cc of curve

(by Lemma)

Reconstruction

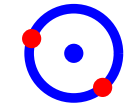
Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve

By contradiction assume $v \in$ 

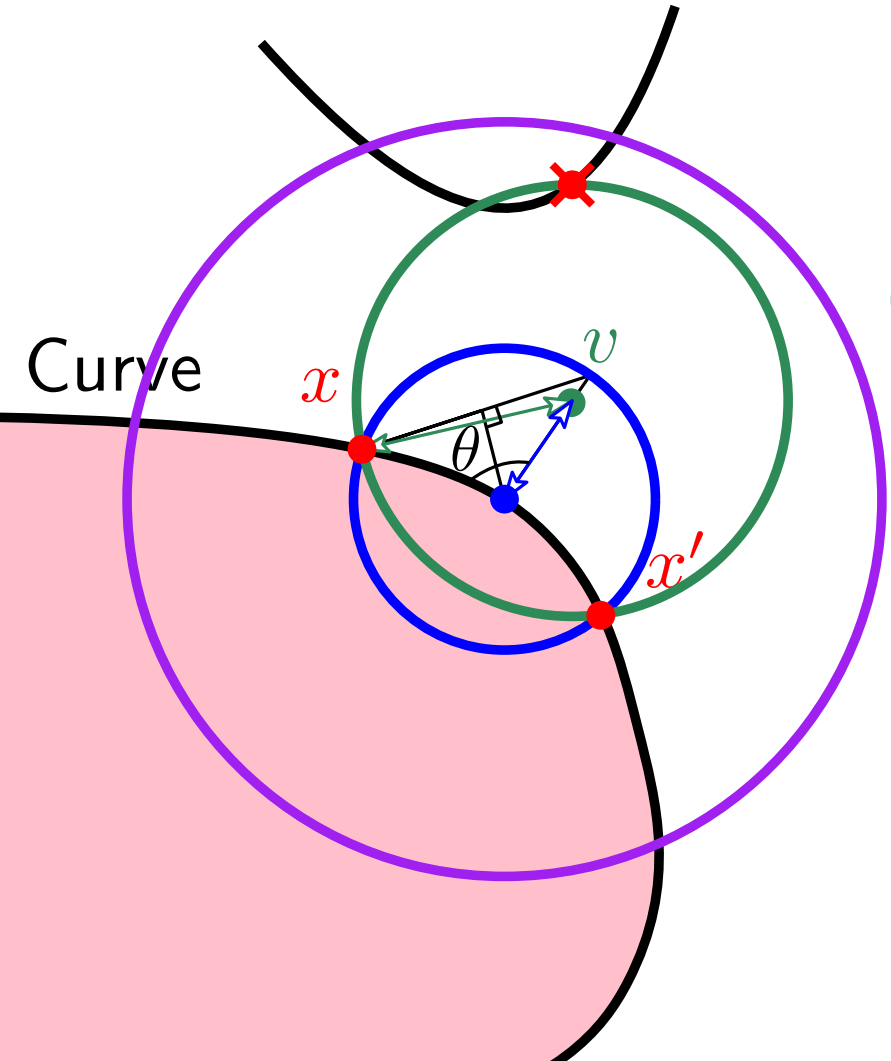
 intersects another cc of curve (by Lemma)

$R \leq 2r \sin \frac{\theta}{2}$

Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

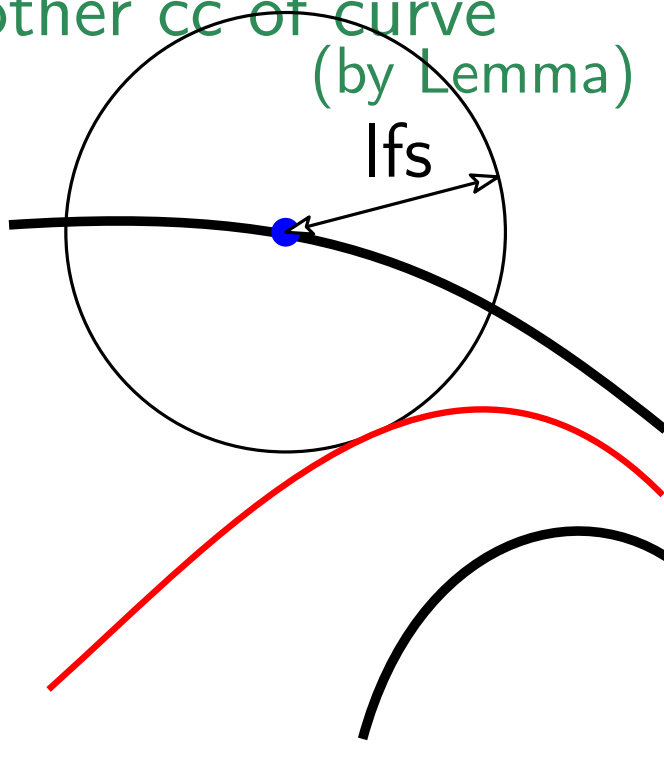
Circle thru x and x' centered on Curve

By contradiction assume $v \in$ ⊙

⊙ intersects another cc of curve (by Lemma)

$R \leq 2r \sin \frac{\theta}{2}$

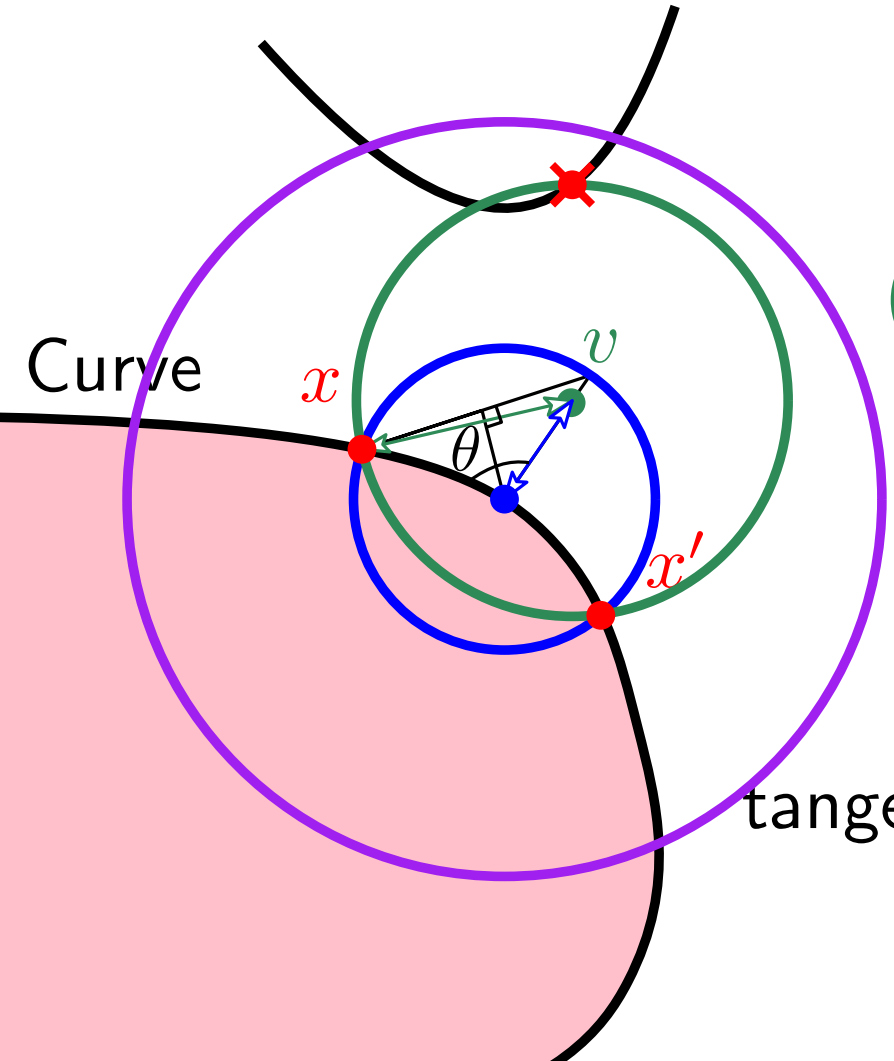
$\theta \leq$



Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve

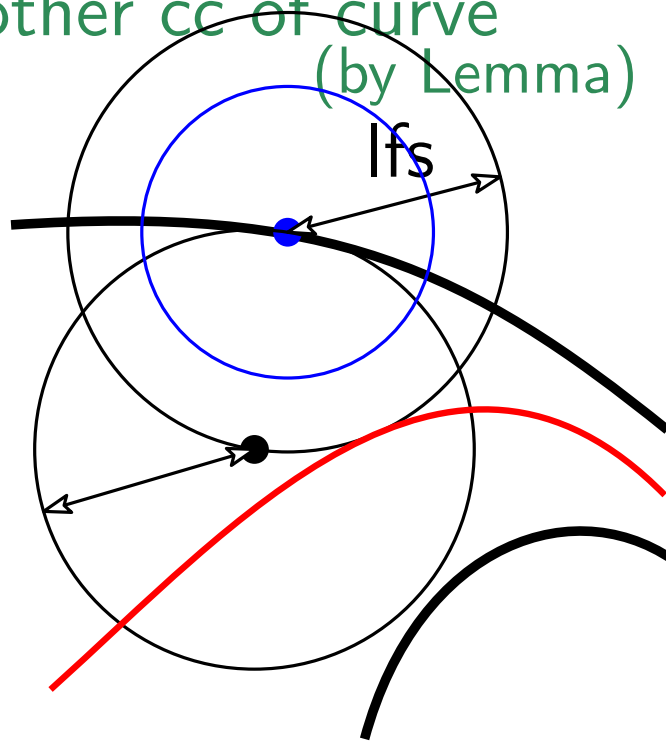
By contradiction assume $v \in$ ⊙

⊙ intersects another cc of curve (by Lemma)

$R \leq 2r \sin \frac{\theta}{2}$

$\theta \leq$

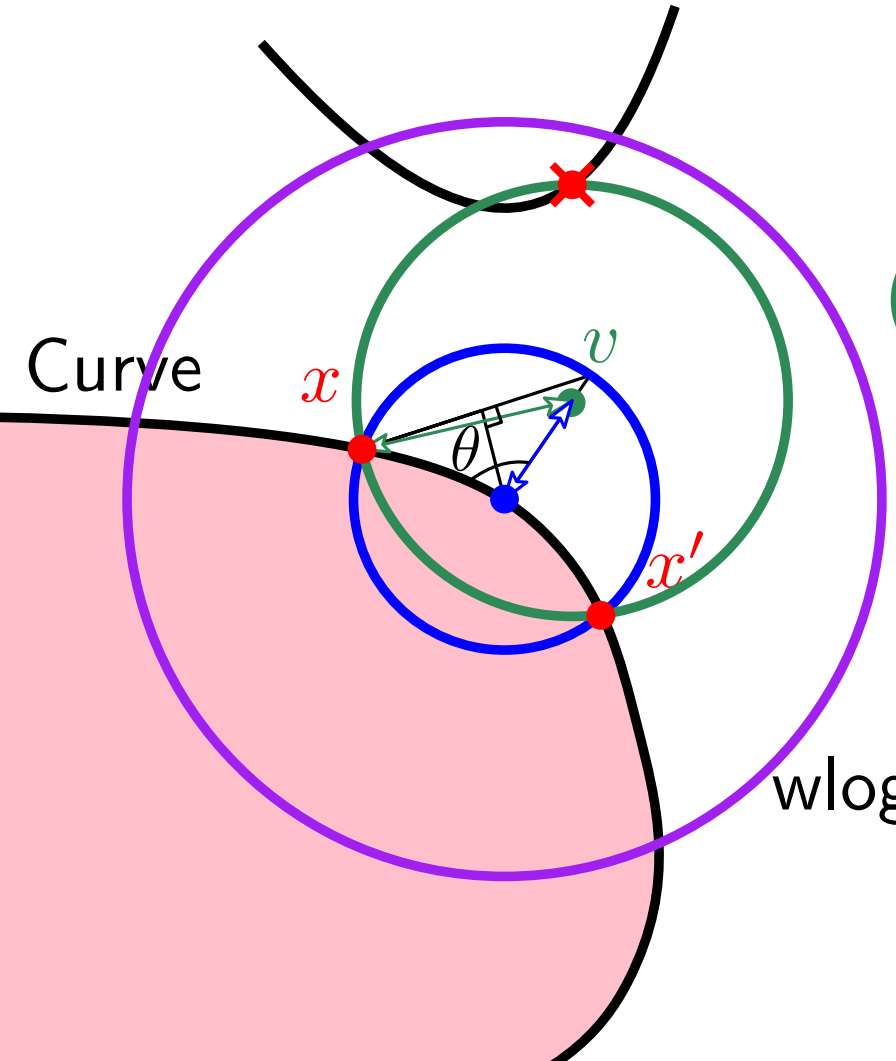
tangent disk is empty



Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve

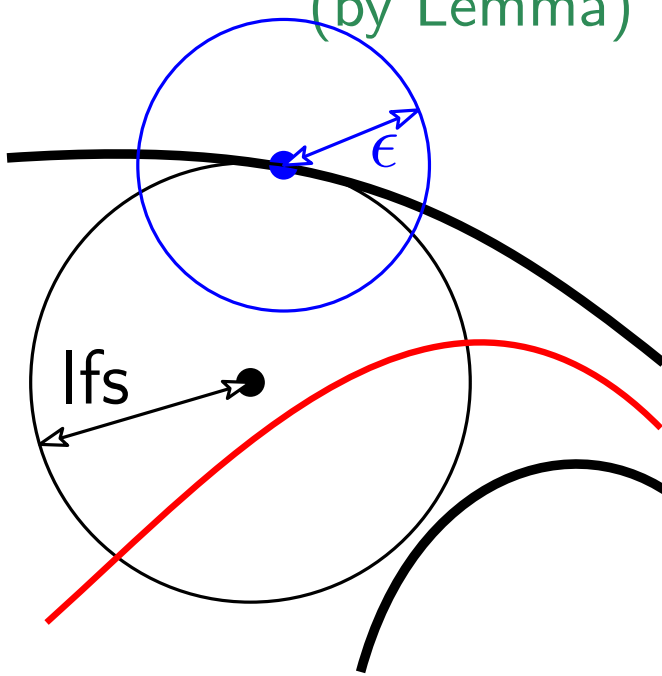
By contradiction assume $v \in$ ⊙

⊙ intersects another cc of curve (by Lemma)

$R \leq 2r \sin \frac{\theta}{2}$

$\theta \leq$

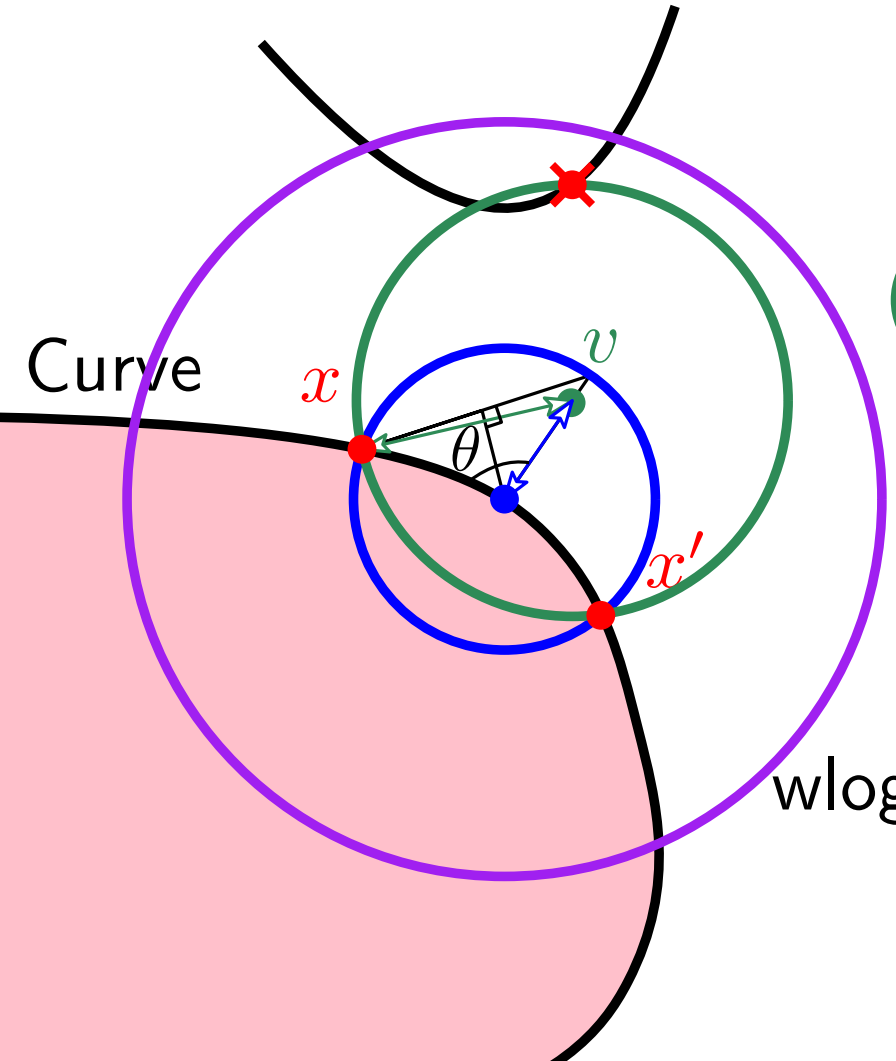
wlog lfs=1 and $r \leq \epsilon$



Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve

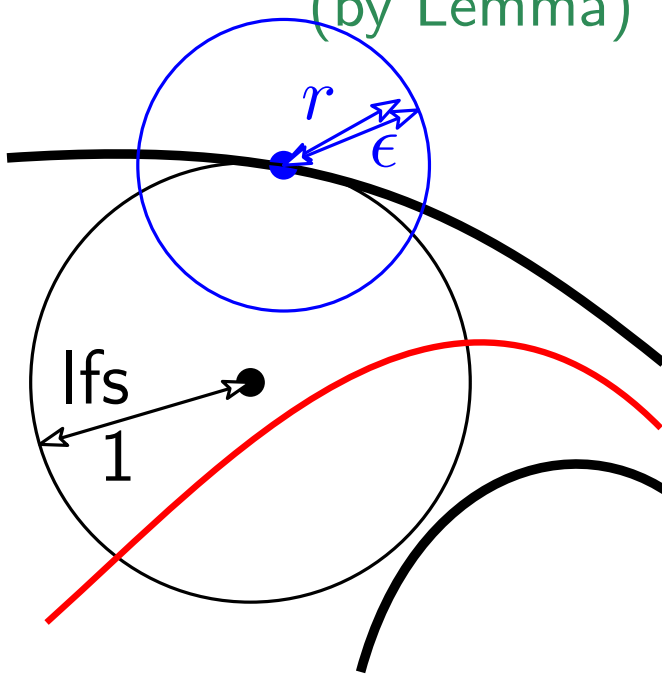
By contradiction assume $v \in$ ⊙

⊙ intersects another cc of curve (by Lemma)

$R \leq 2r \sin \frac{\theta}{2}$

$\theta \leq$

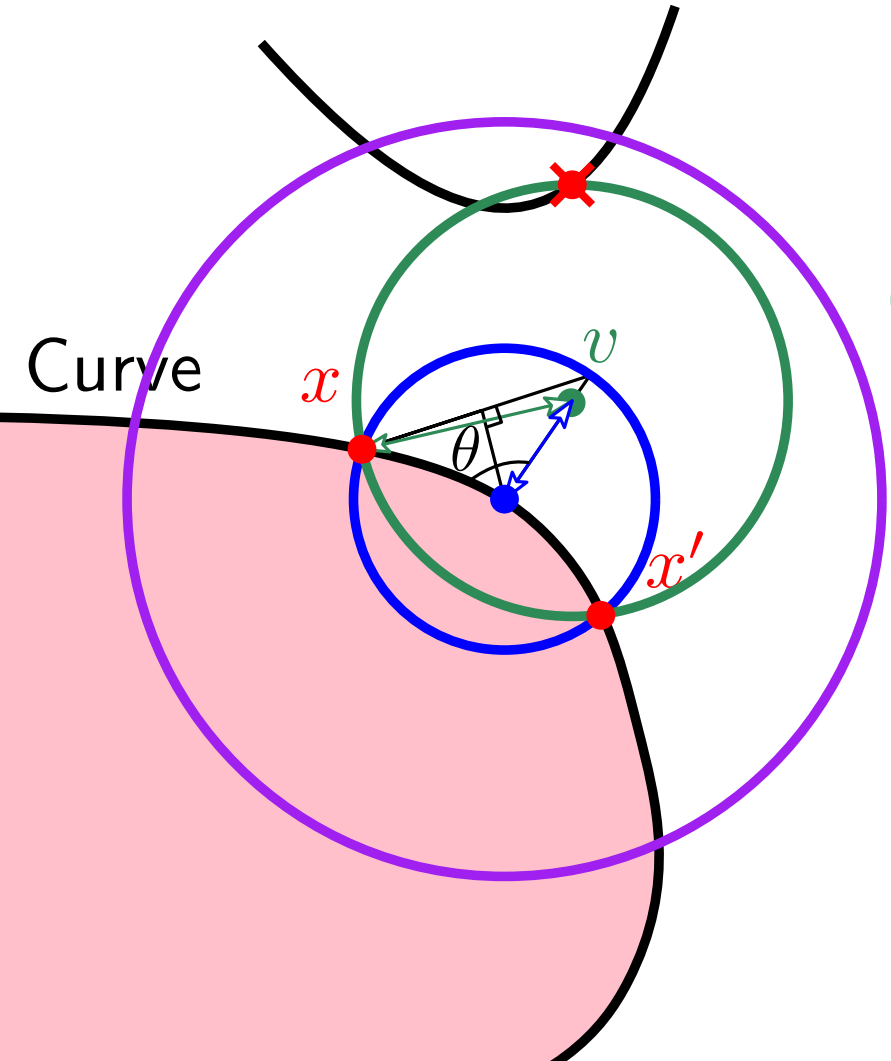
wlog lfs=1 and $r \leq \epsilon$



Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

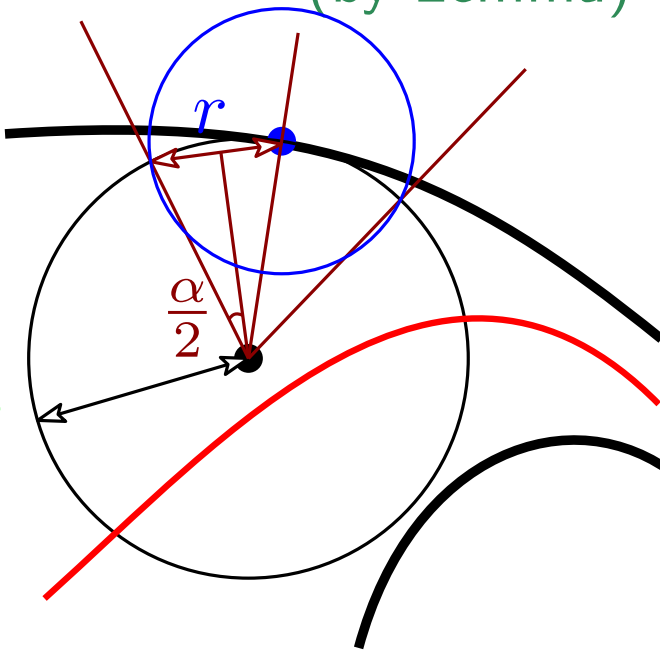
Circle thru x and x' centered on Curve

By contradiction assume $v \in$ ⊙

⊙ intersects another cc of curve (by Lemma)

$R \leq 2r \sin \frac{\theta}{2}$

$\theta \leq$

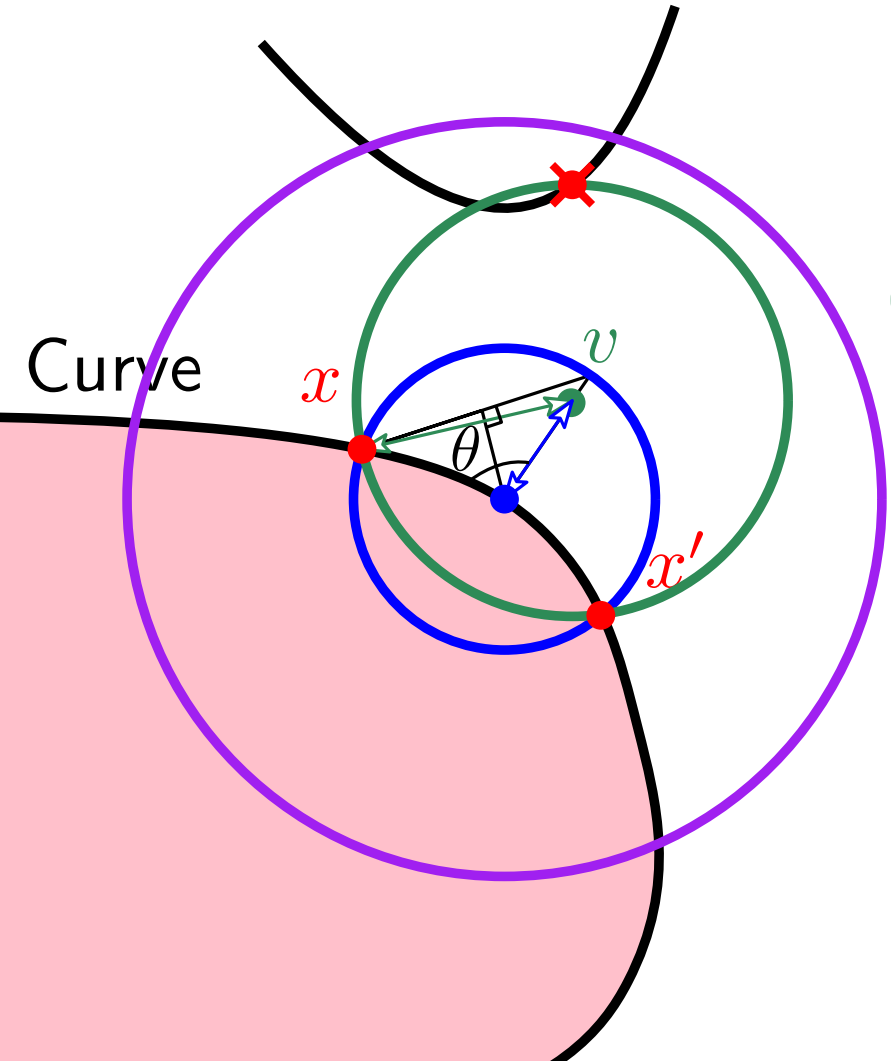


$r = 2 \sin \frac{\alpha}{2}$

Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

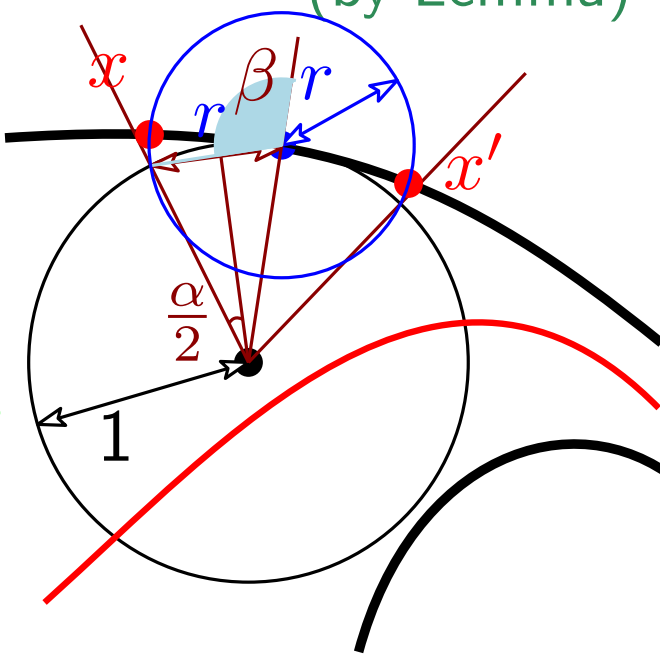
Circle thru x and x' centered on Curve

By contradiction assume $v \in$ ⊙

⊙ intersects another cc of curve (by Lemma)

$R \leq 2r \sin \frac{\theta}{2}$

$\theta \leq \beta = \pi - \frac{\pi - \alpha}{2}$

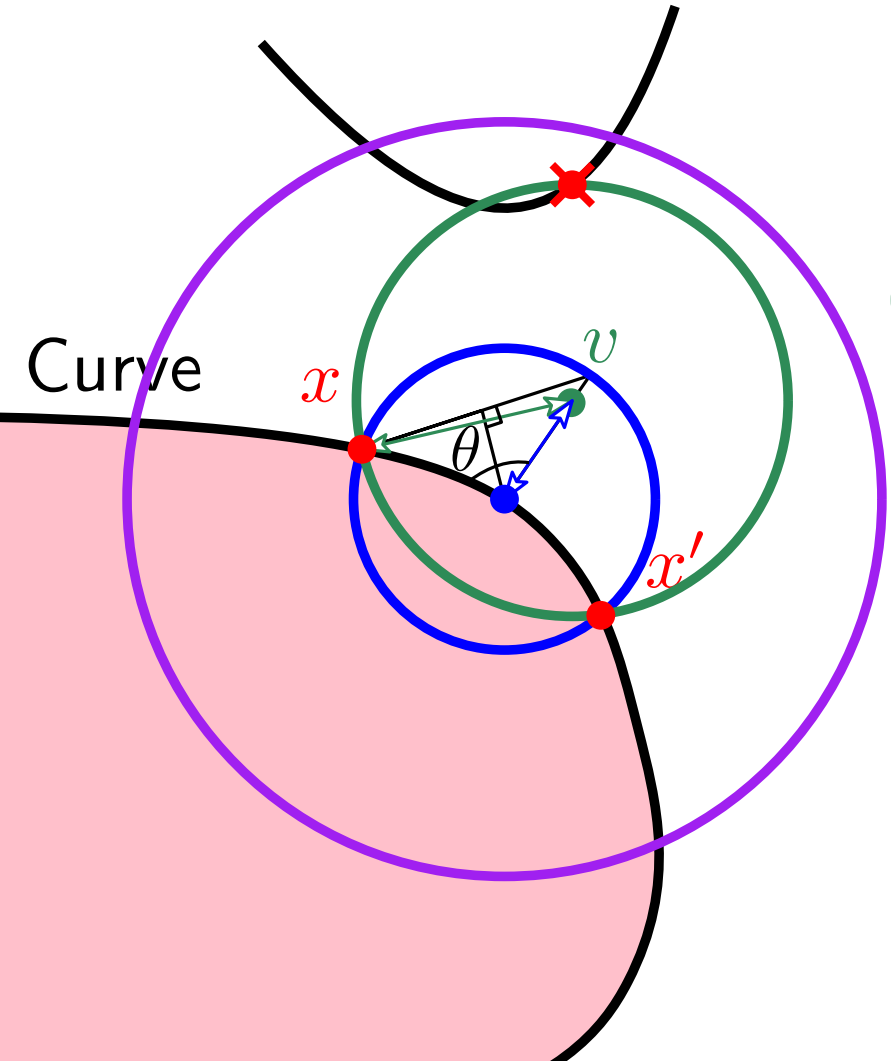


$r = 2 \sin \frac{\alpha}{2}$

Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve

By contradiction assume $v \in$ ⊙

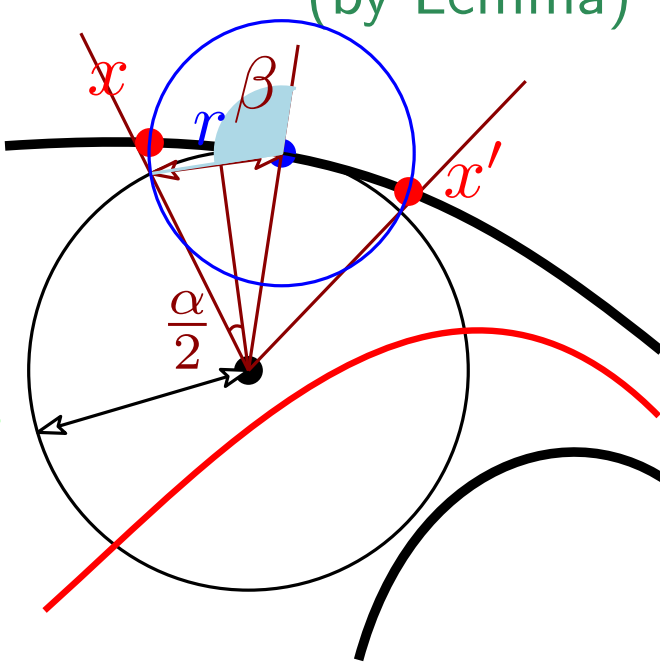
⊙ intersects another cc of curve (by Lemma)

$$R \le 2r \sin\frac{\theta}{2}$$

$$\theta \le \beta = \pi - \frac{\pi-\alpha}{2}$$

$$\le \frac{\pi}{2} + \arcsin\frac{r}{2}$$

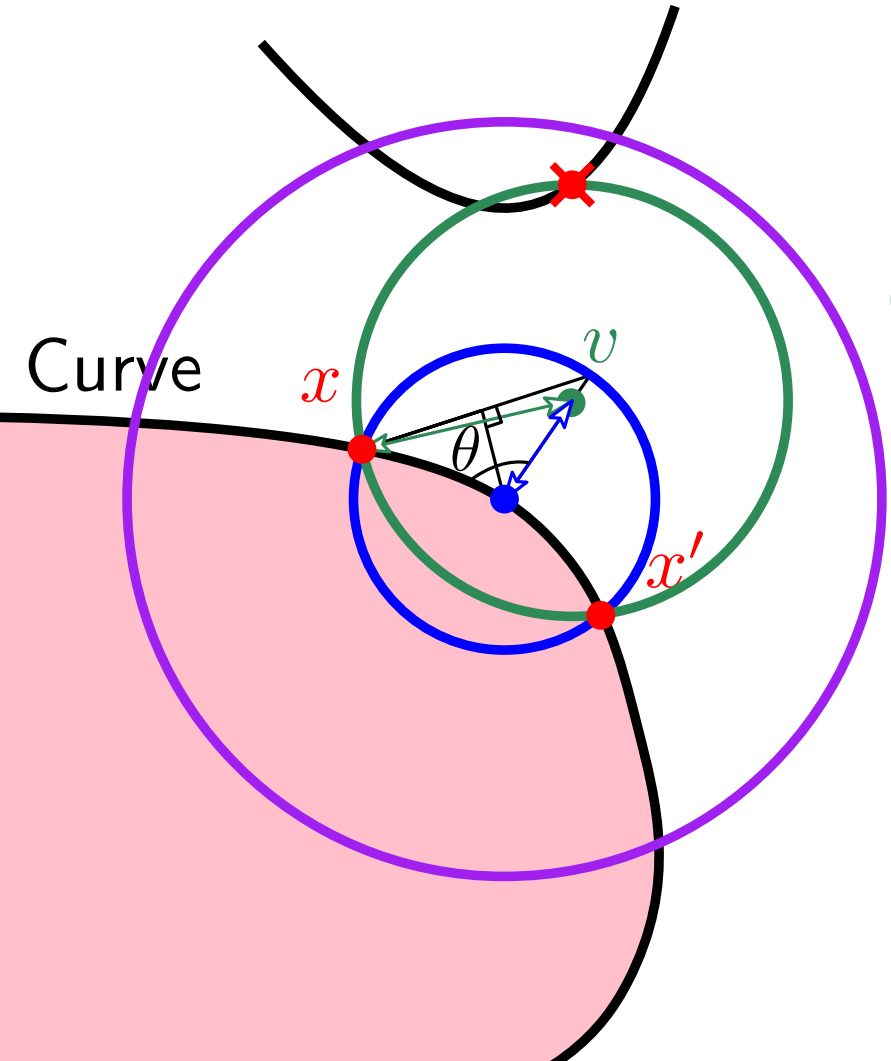
$$r = 2\sin\frac{\alpha}{2}$$



Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve

By contradiction assume $v \in$ ⊙

⊙ intersects another cc of curve (by Lemma)

$R \leq 2r \sin \frac{\theta}{2}$

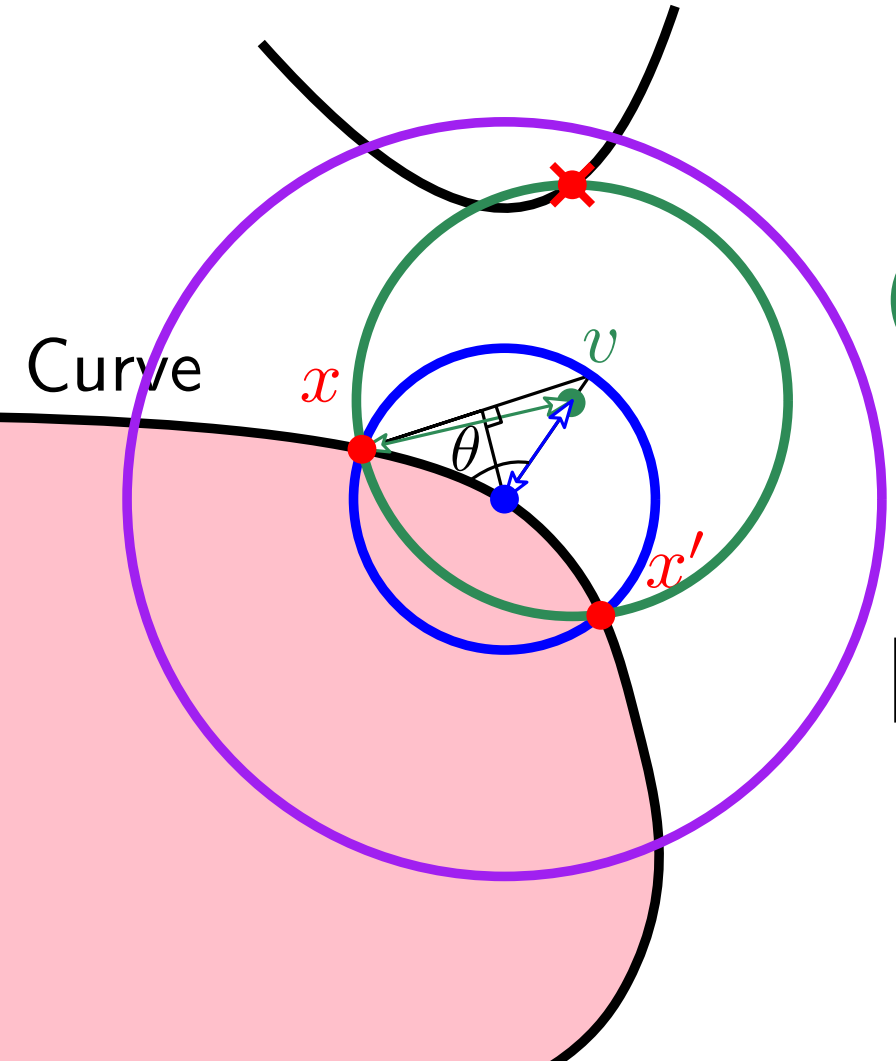
$\theta \leq \frac{\pi}{2} + \arcsin \frac{r}{2}$

$\| \bullet\!\times \| \leq \| \bullet\ \bullet \| + \| \bullet\!\times \|$

Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve

By contradiction assume $v \in$ ⊙

⊙ intersects another cc of curve (by Lemma)

$R \leq 2r \sin \frac{\theta}{2}$

$\theta \leq \frac{\pi}{2} + \arcsin \frac{r}{2}$

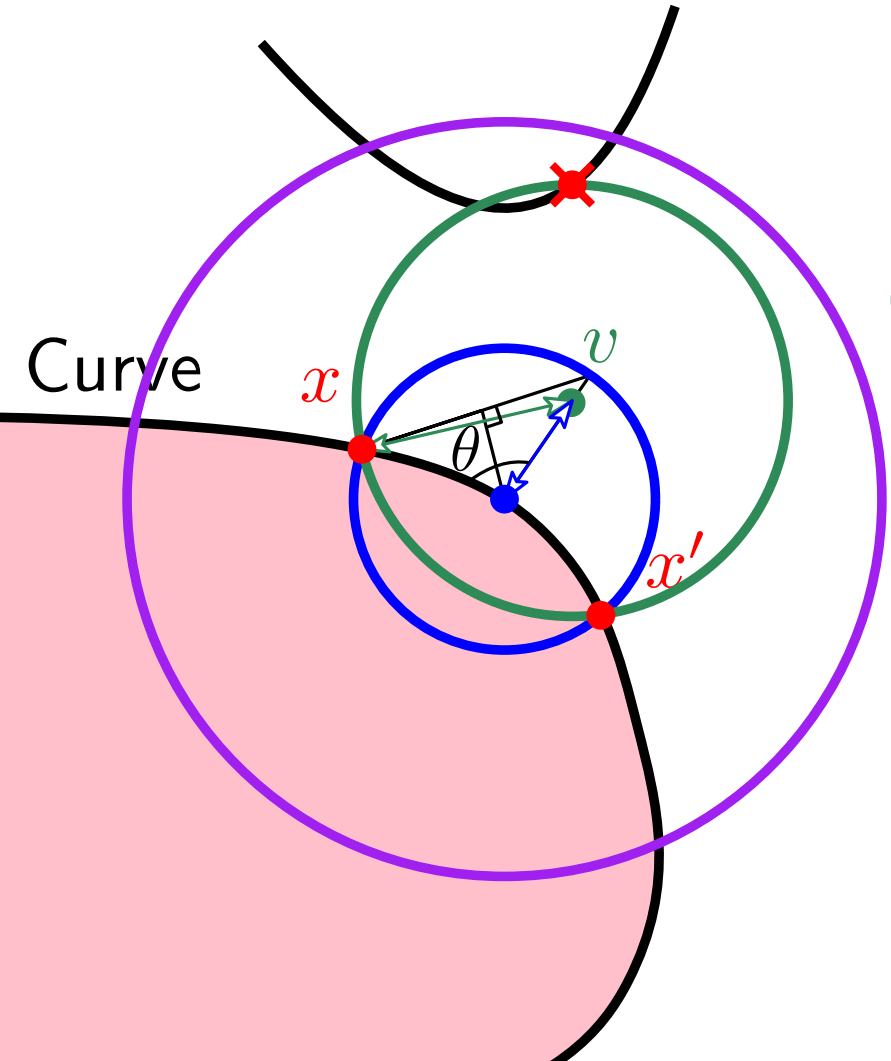
$\|\bullet\,\times\| \leq \|\bullet\,\bullet\| + \|\bullet\,\times\|$

$\leq r + 2r \sin\left(\frac{\pi}{4} + \frac{1}{2}\arcsin \frac{r}{2}\right)$

Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two neighboring points on Curve

Circle thru x and x' centered on Curve

By contradiction assume $v \in$ ⊙

⊙ intersects another cc of curve (by Lemma)

$R \leq 2r \sin \frac{\theta}{2}$

$\theta \leq \frac{\pi}{2} + \arcsin \frac{r}{2}$

$\| \bullet\!\times \| \leq \| \bullet\ \bullet \| + \| \bullet\!\times \|$

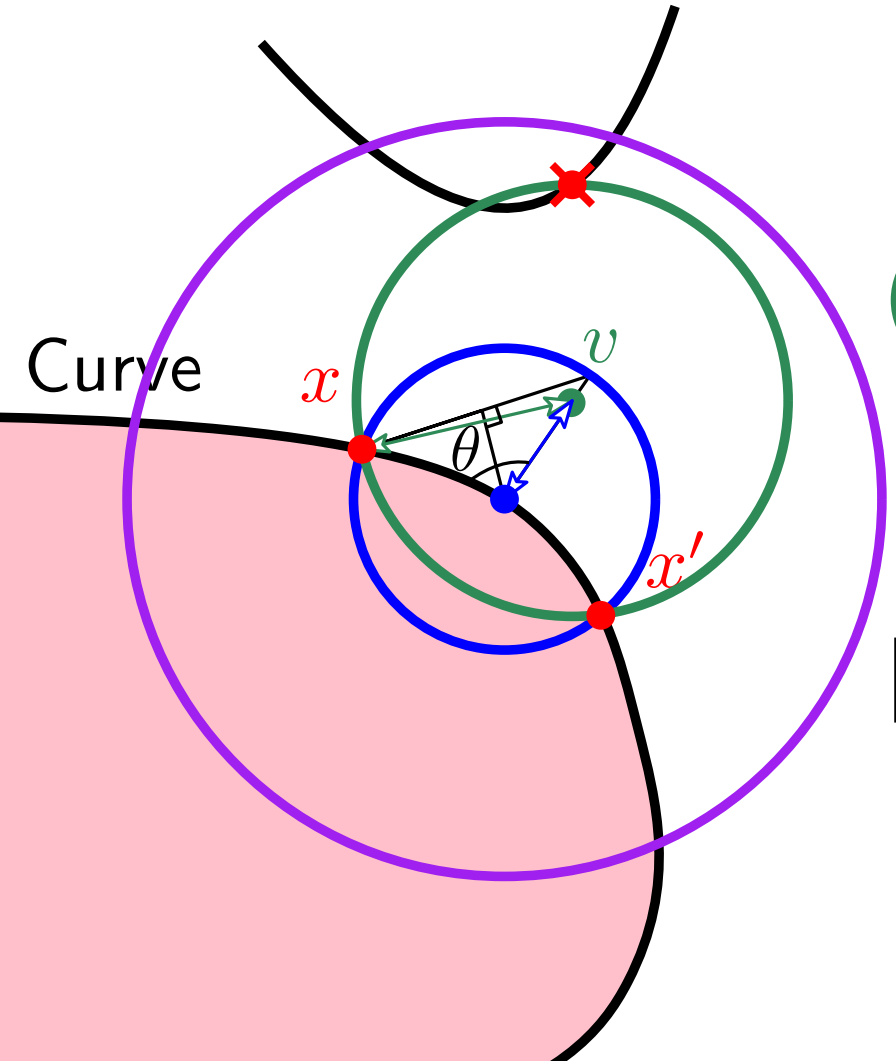
$\leq r + 2r \sin \left(\frac{\pi}{4} + \frac{1}{2} \arcsin \frac{r}{2} \right)$

if $\| \bullet\!\times \| \leq$ lfs$= 1$ contradiction is reached

Reconstruction

Crust 2D 0.4 sample ⇒ wanted result ⊂ crust

Theorem: 0.4 sample ⇒ wanted result ⊂ crust



x, x' two nei

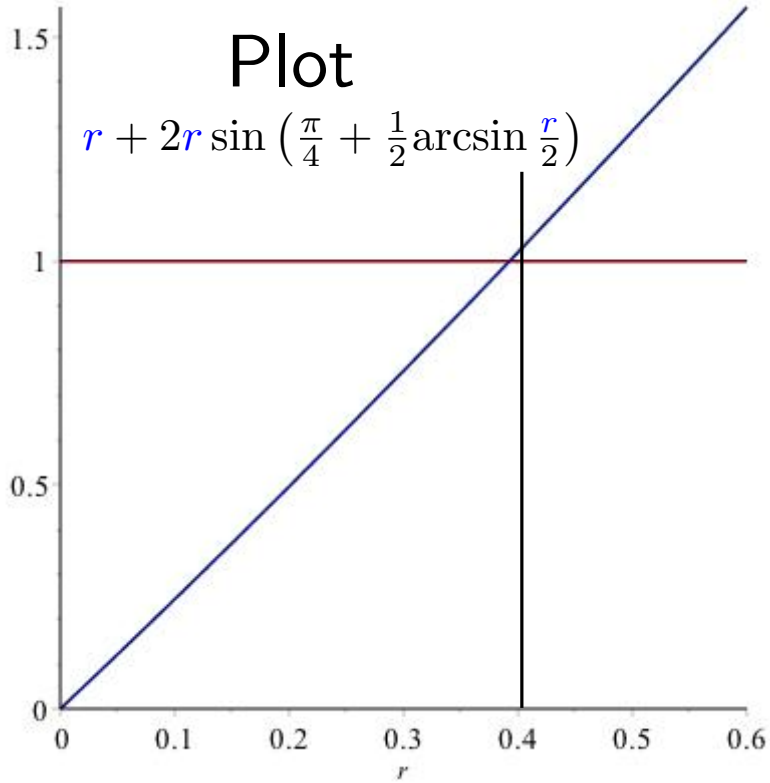
Circle thru x

By contradict

intersect

$R \leq 2r \sin \frac{\theta}{2}$

$\theta \leq \frac{\pi}{2} +$ arcs



$\|\bullet\times\| \leq \|\bullet\ \bullet\| + \|\bullet\times\|$

$\leq r + 2r \sin\left(\frac{\pi}{4} + \frac{1}{2}\arcsin\frac{r}{2}\right)$

if $\|\bullet\times\| \leq$ lfs$= 1$ contradiction is reached

Reconstruction

Theorem: 0.4 sample ⇒ wanted result ⊂ crust

Reconstruction

Crust 2D

0.25 sample $\Rightarrow$ crust $\subset$ wanted result

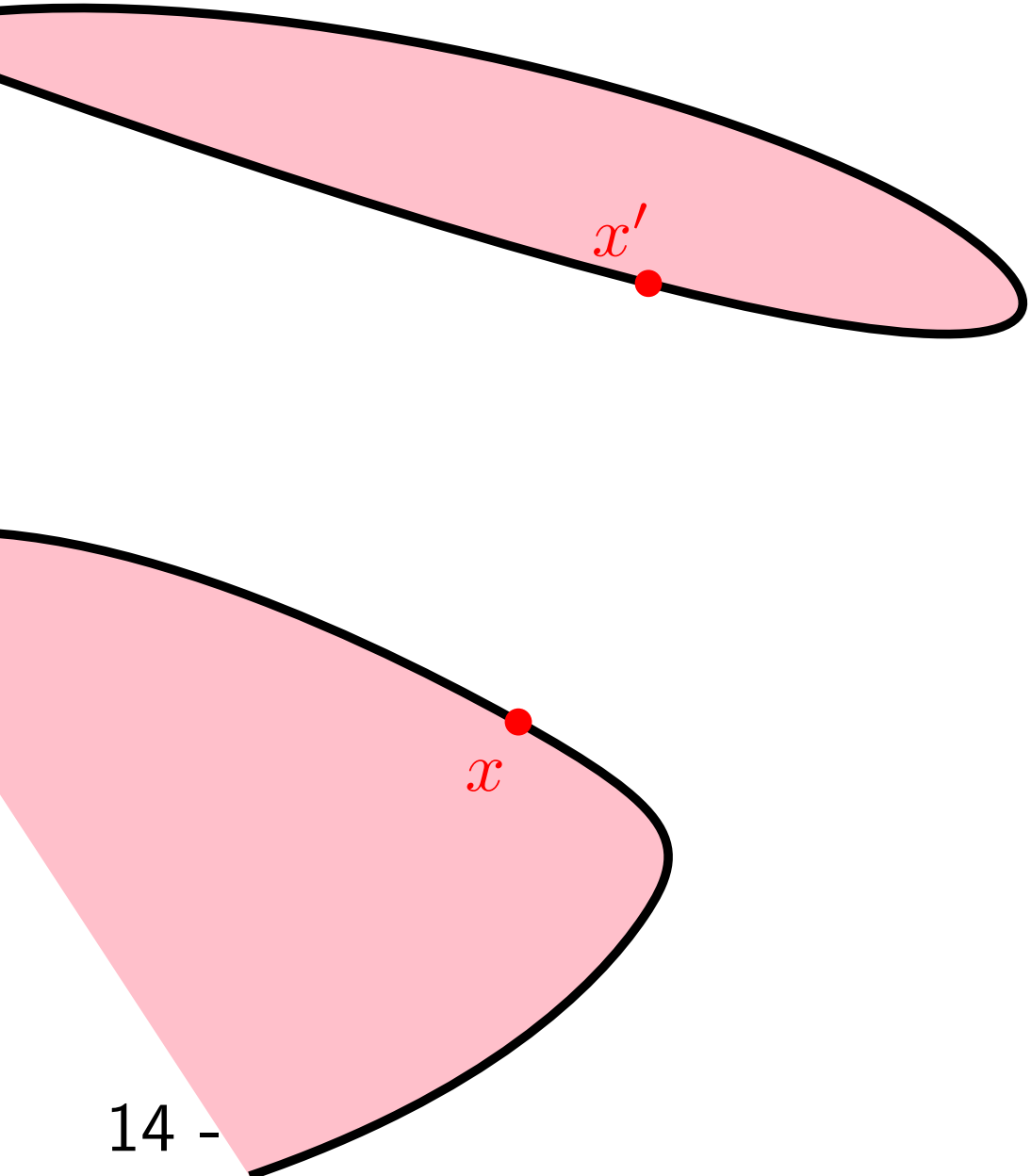
Theorem: $0.25\ \text{sample} \Rightarrow \text{crust} \subset \text{wanted result}$

Reconstruction

Crust 2D

0.25 sample $\Rightarrow$ crust $\subset$ wanted result

Theorem: 0.25 sample $\Rightarrow$ crust $\subset$ wanted result

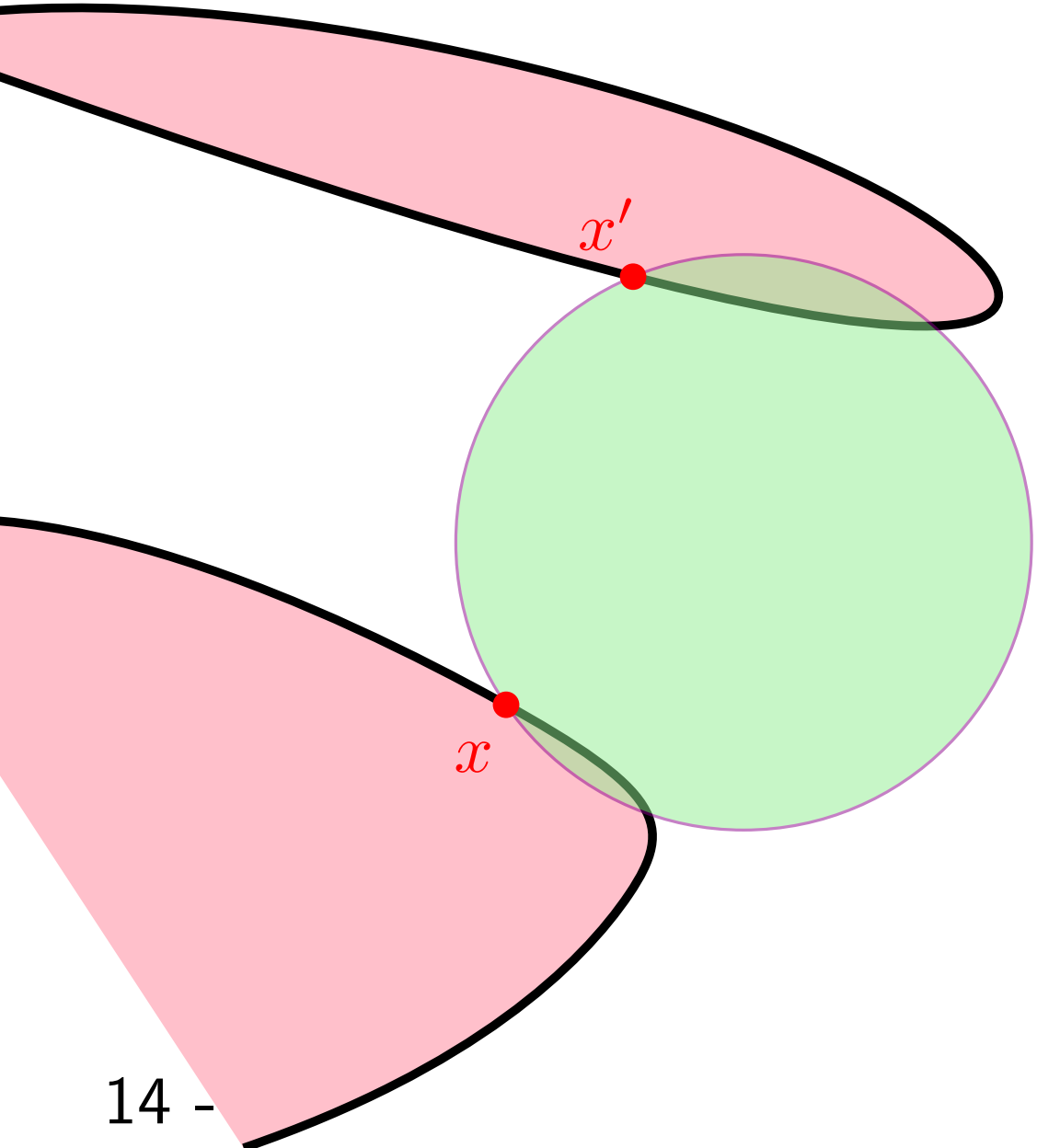


Reconstruction

Crust 2D

0.25 sample $\Rightarrow$ crust $\subset$ wanted result

Theorem: 0.25 sample $\Rightarrow$ crust $\subset$ wanted result

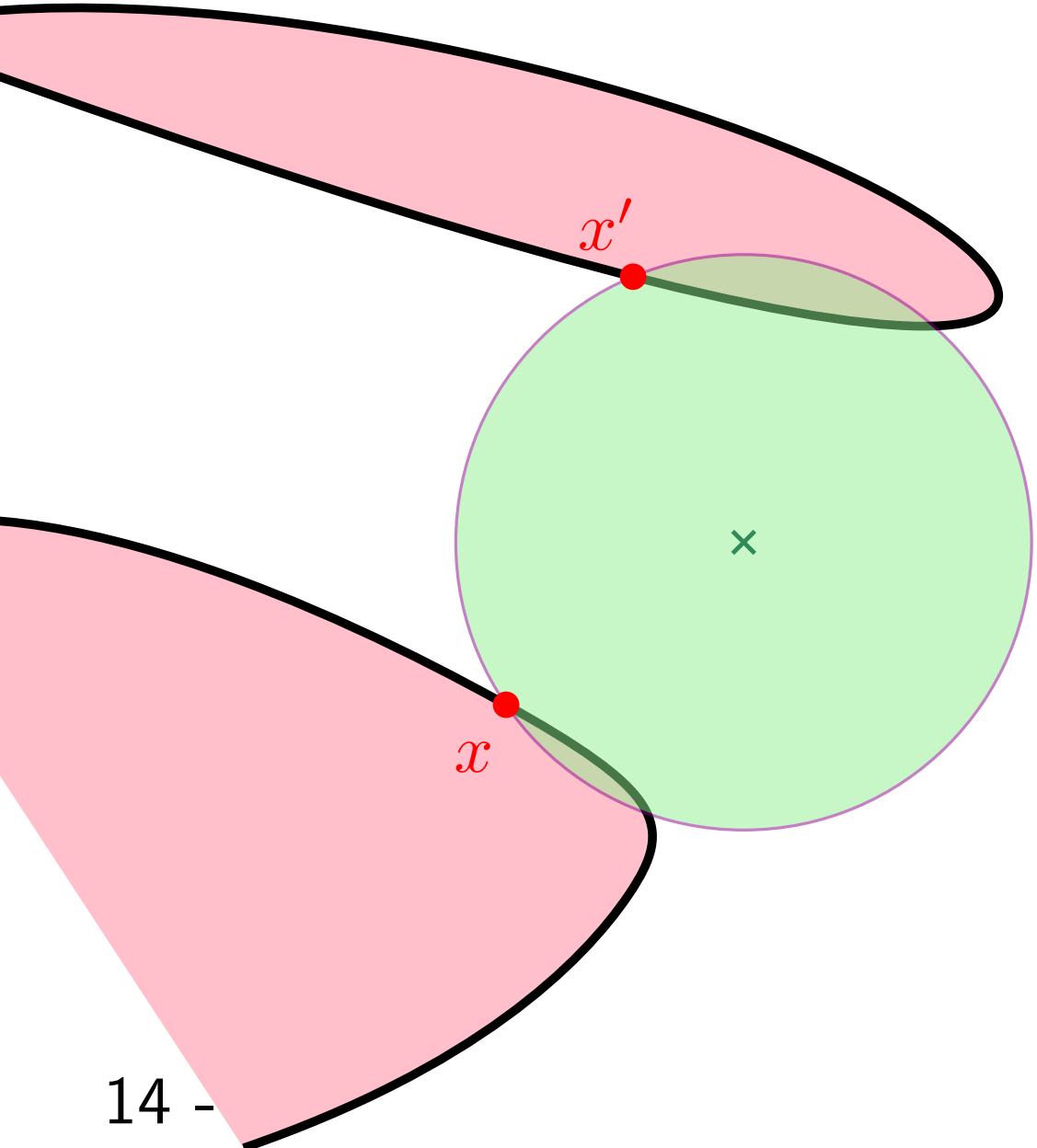


Assume empty circle

Reconstruction

Crust 2D 0.25 sample $\Rightarrow$ crust $\subset$ wanted result

Theorem: 0.25 sample $\Rightarrow$ crust $\subset$ wanted result



Assume empty circle

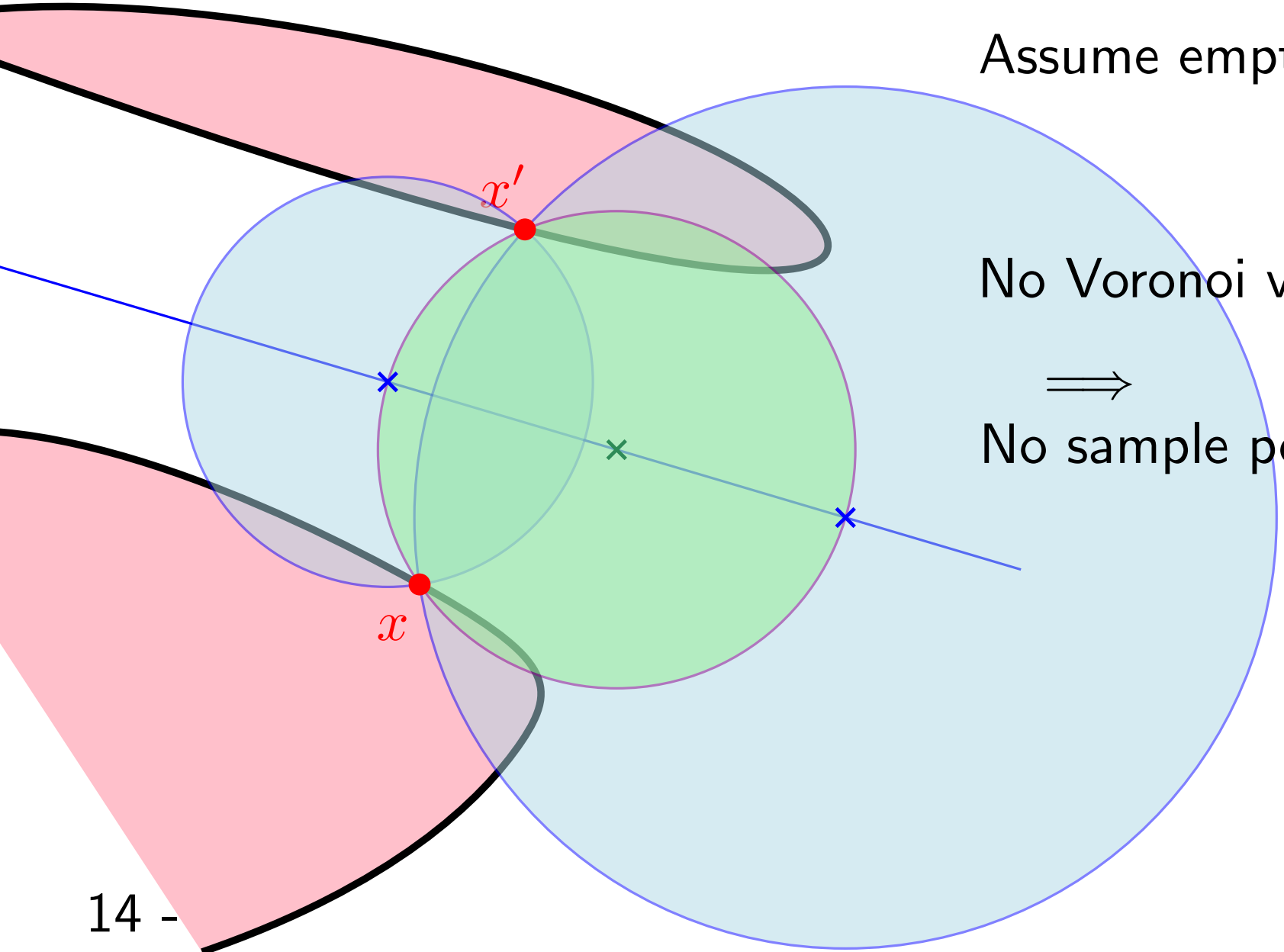
No Voronoi vertices there

$\Longrightarrow$

Reconstruction

Crust 2D 0.25 sample ⇒ crust ⊂ wanted result

Theorem: 0.25 sample ⇒ crust ⊂ wanted result



Assume empty circle

No Voronoi vertices there

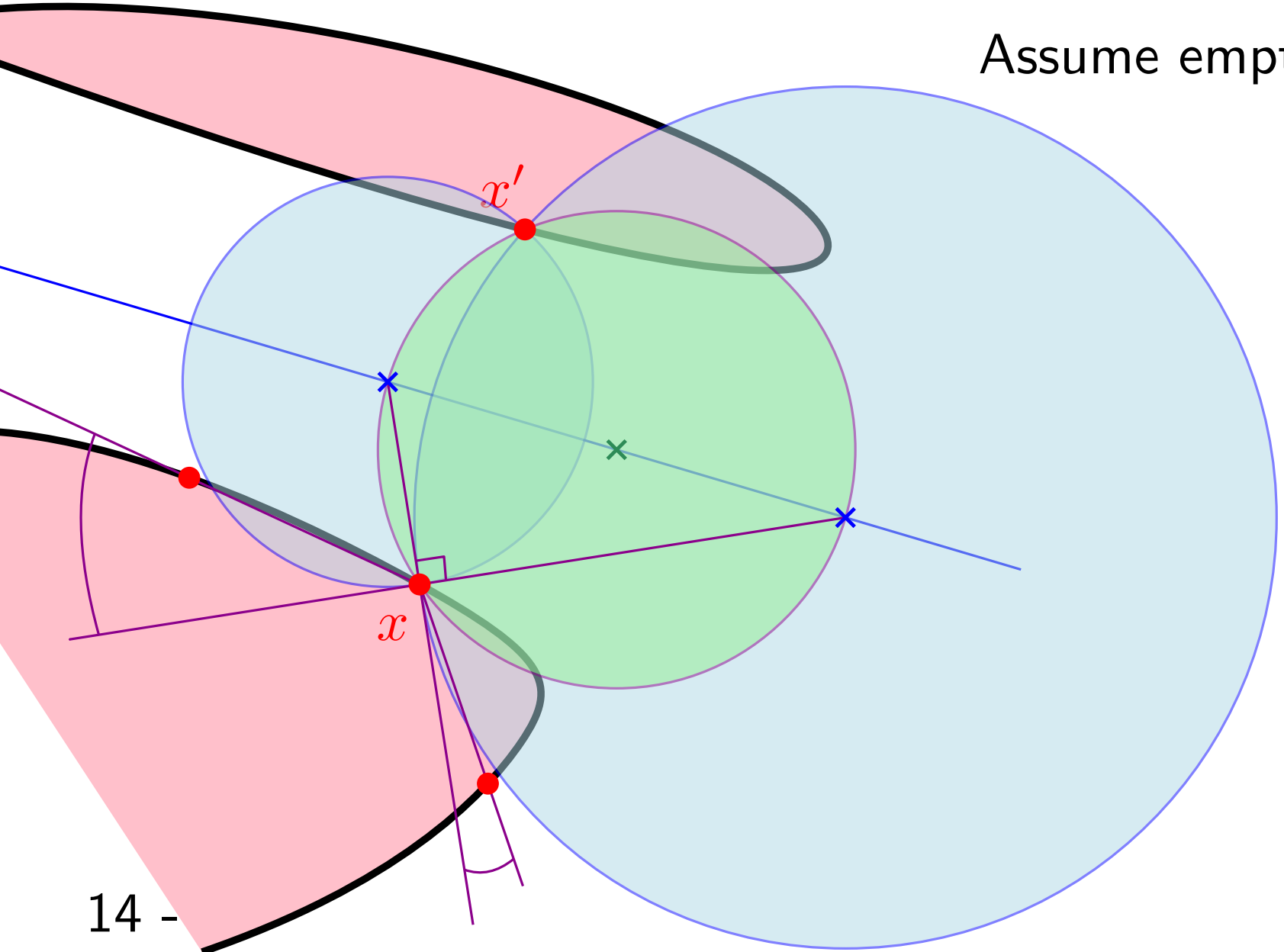
$\Longrightarrow$

No sample points there

Reconstruction

Crust 2D 0.25 sample ⇒ crust ⊂ wanted result

Theorem: 0.25 sample ⇒ crust ⊂ wanted result



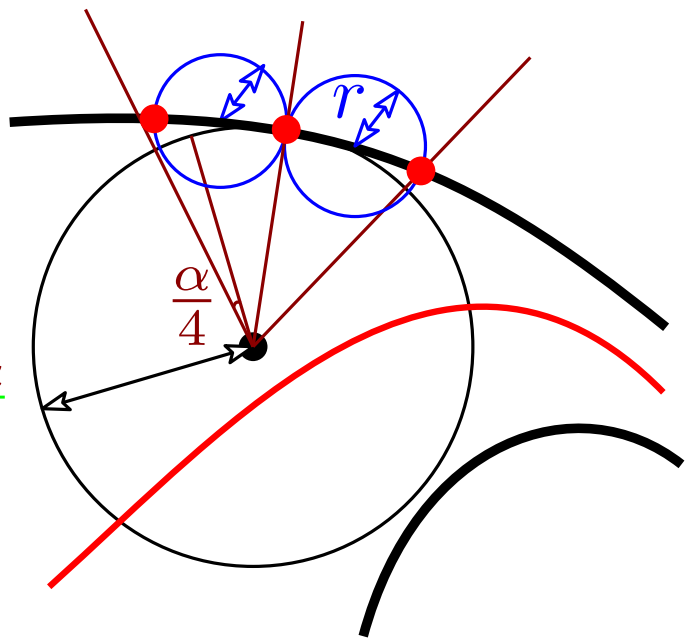
Reconstruction

Crust 2D

0.25 sample $\Rightarrow$ crust $\subset$ wanted result

Theorem: 0.25 sample $\Rightarrow$ crust $\subset$ wanted result

$$\beta = \pi - \frac{\pi - \alpha}{2}$$
$$\leq \frac{\pi}{2} + 2\arcsin\frac{r}{2}$$
$$r \simeq 2\sin\frac{\alpha}{4}$$



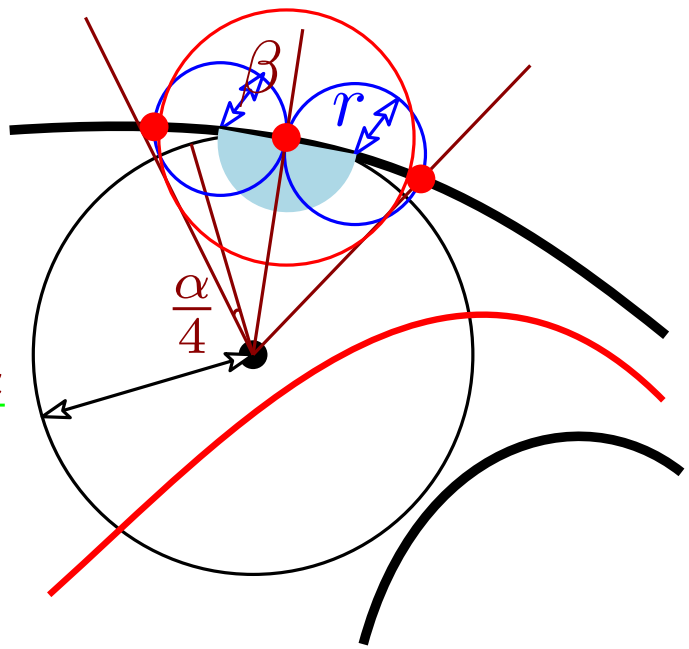
Reconstruction

Crust 2D

0.25 sample $\Rightarrow$ crust $\subset$ wanted result

Theorem: 0.25 sample $\Rightarrow$ crust $\subset$ wanted result

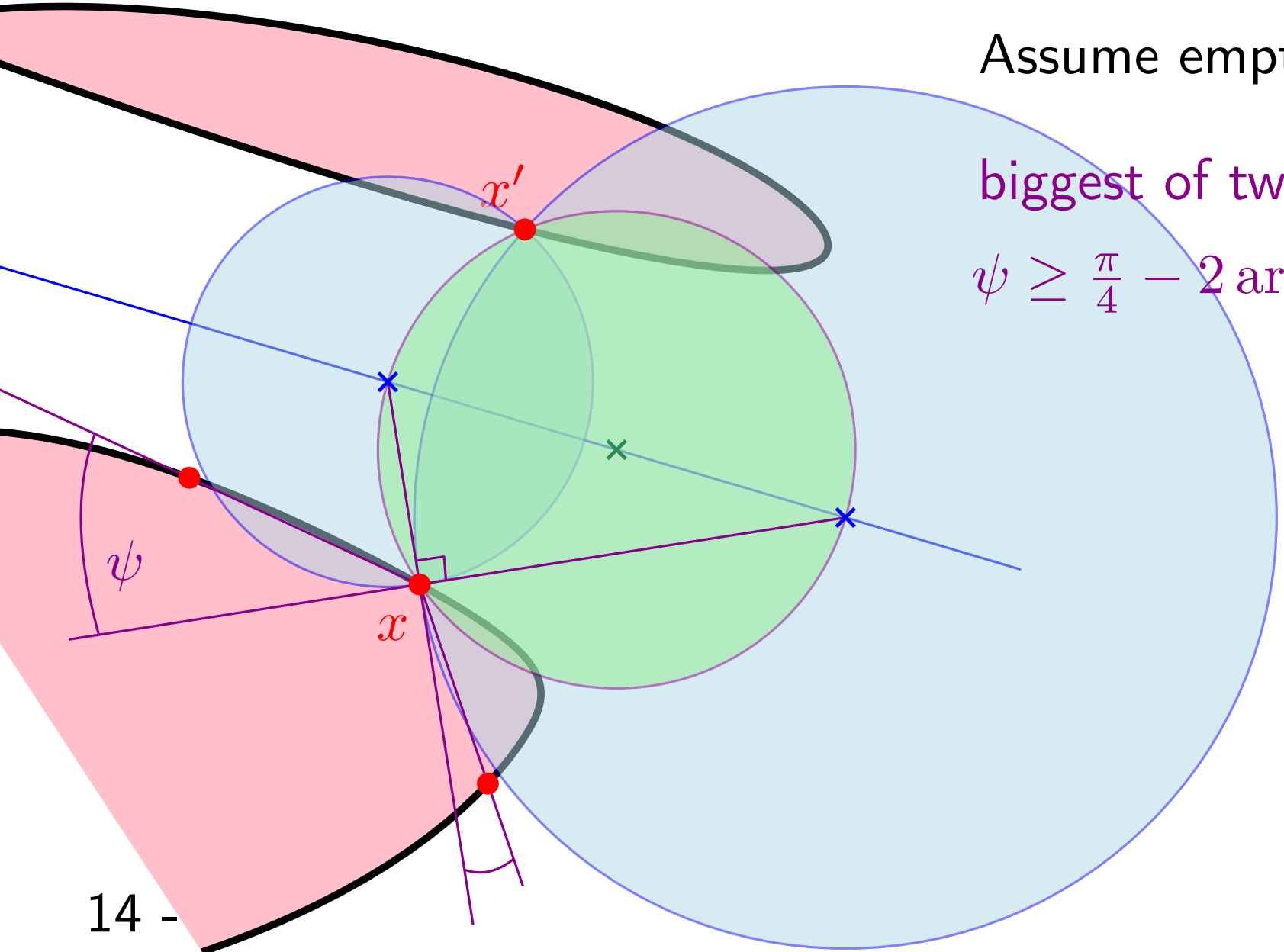
$$\beta = \pi - \frac{\pi - \alpha}{2}$$
$$\leq \frac{\pi}{2} + 2\arcsin\frac{r}{2}$$
$$r \simeq 2\sin\frac{\alpha}{4}$$



Reconstruction

Crust 2D 0.25 sample ⇒ crust ⊂ wanted result

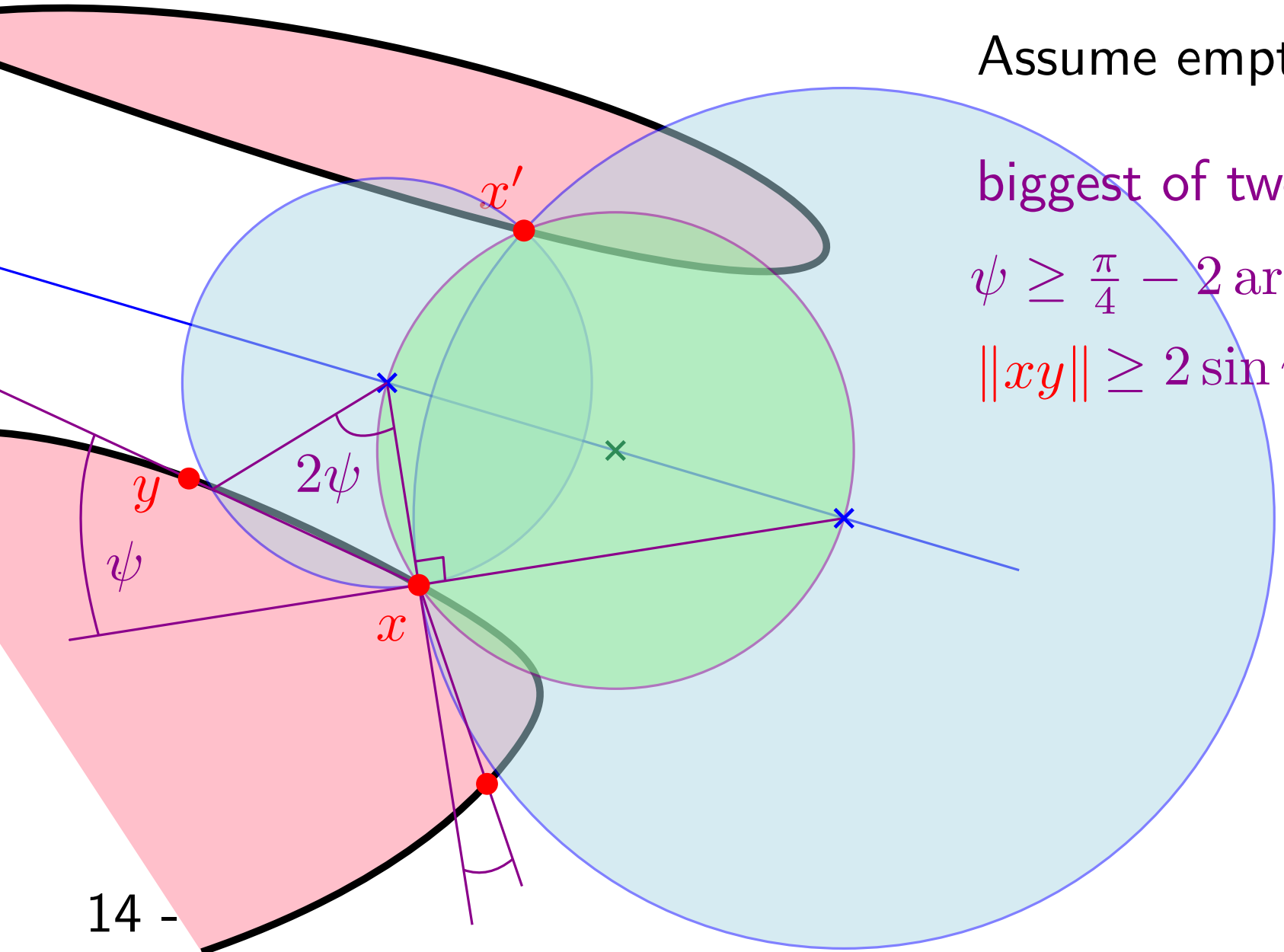
Theorem: 0.25 sample ⇒ crust ⊂ wanted result



Reconstruction

Crust 2D 0.25 sample ⇒ crust ⊂ wanted result

Theorem: 0.25 sample ⇒ crust ⊂ wanted result



Assume empty circle

biggest of two angles

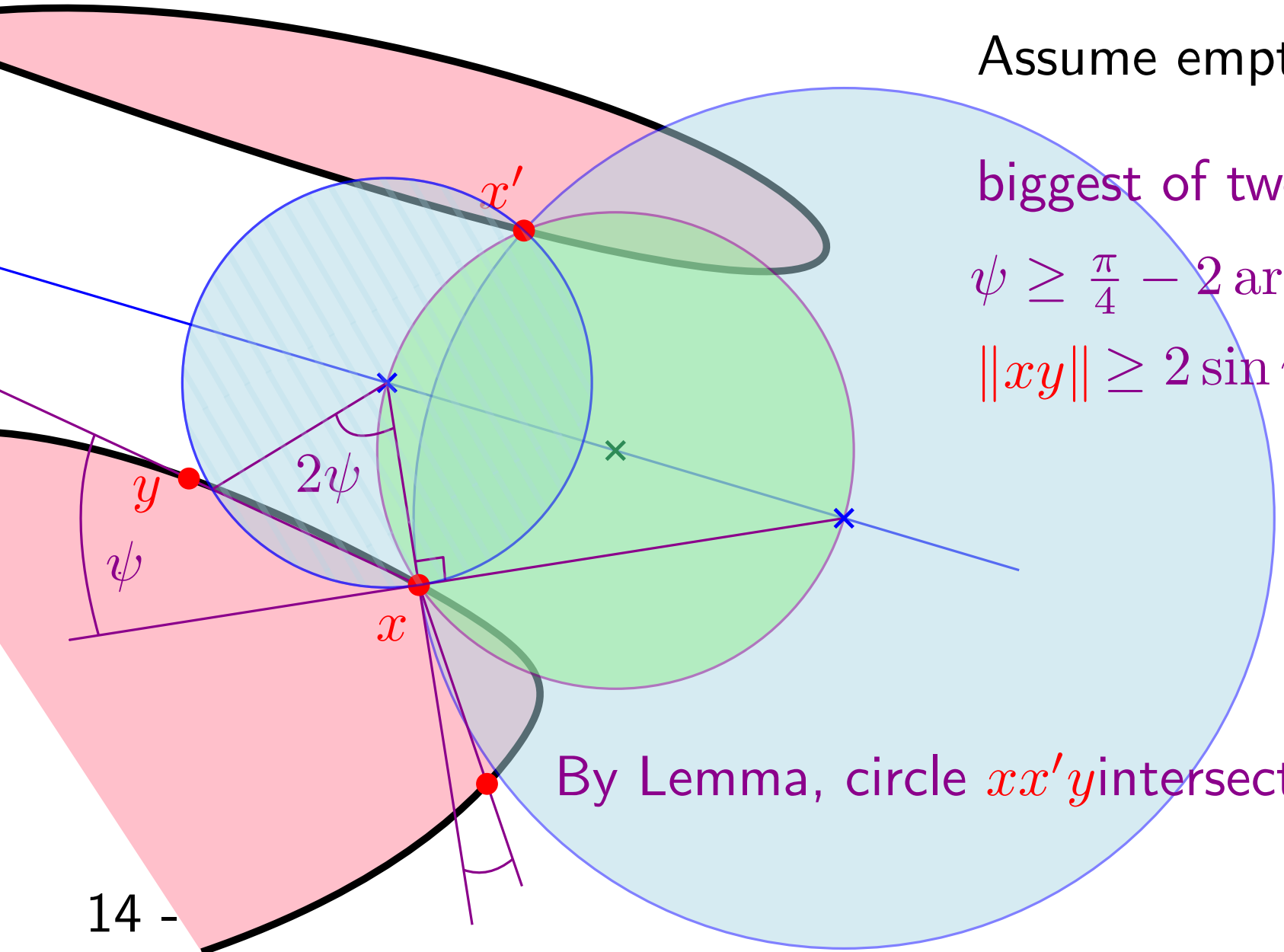
$\psi \geq \frac{\pi}{4} - 2 \arcsin \frac{r}{2}$

$\|xy\| \geq 2 \sin \psi$

Reconstruction

Crust 2D 0.25 sample ⇒ crust ⊂ wanted result

Theorem: 0.25 sample ⇒ crust ⊂ wanted result

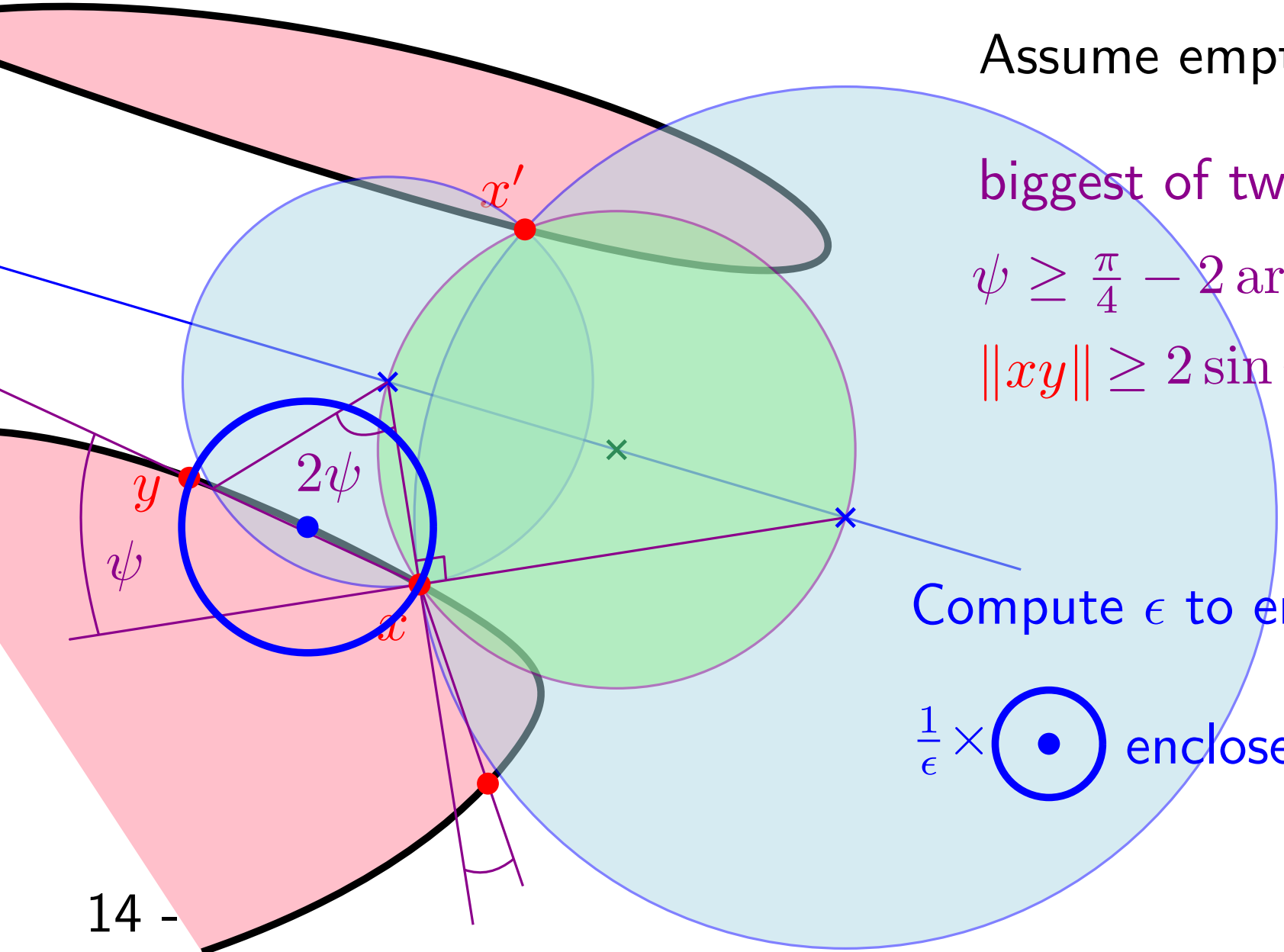


Reconstruction

Crust 2D

0.25 sample ⇒ crust ⊂ wanted result

Theorem: **0.25 sample ⇒ crust ⊂ wanted result**



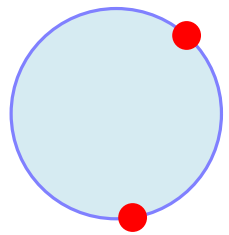
Assume empty circle

biggest of two angles

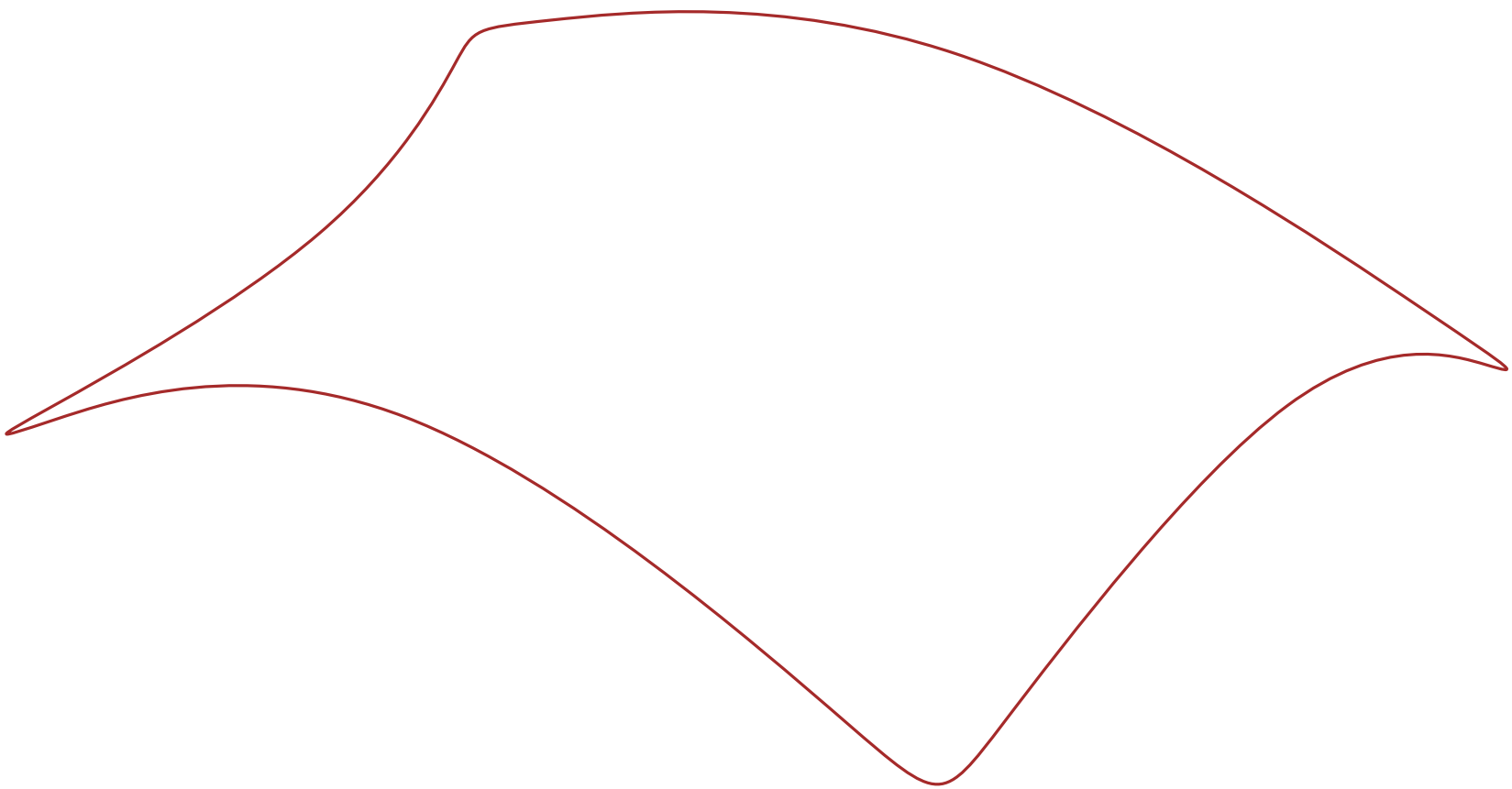
$\psi \geq \frac{\pi}{4} - 2 \arcsin \frac{r}{2}$

$\|xy\| \geq 2 \sin \psi$

Compute ϵ to ensure that

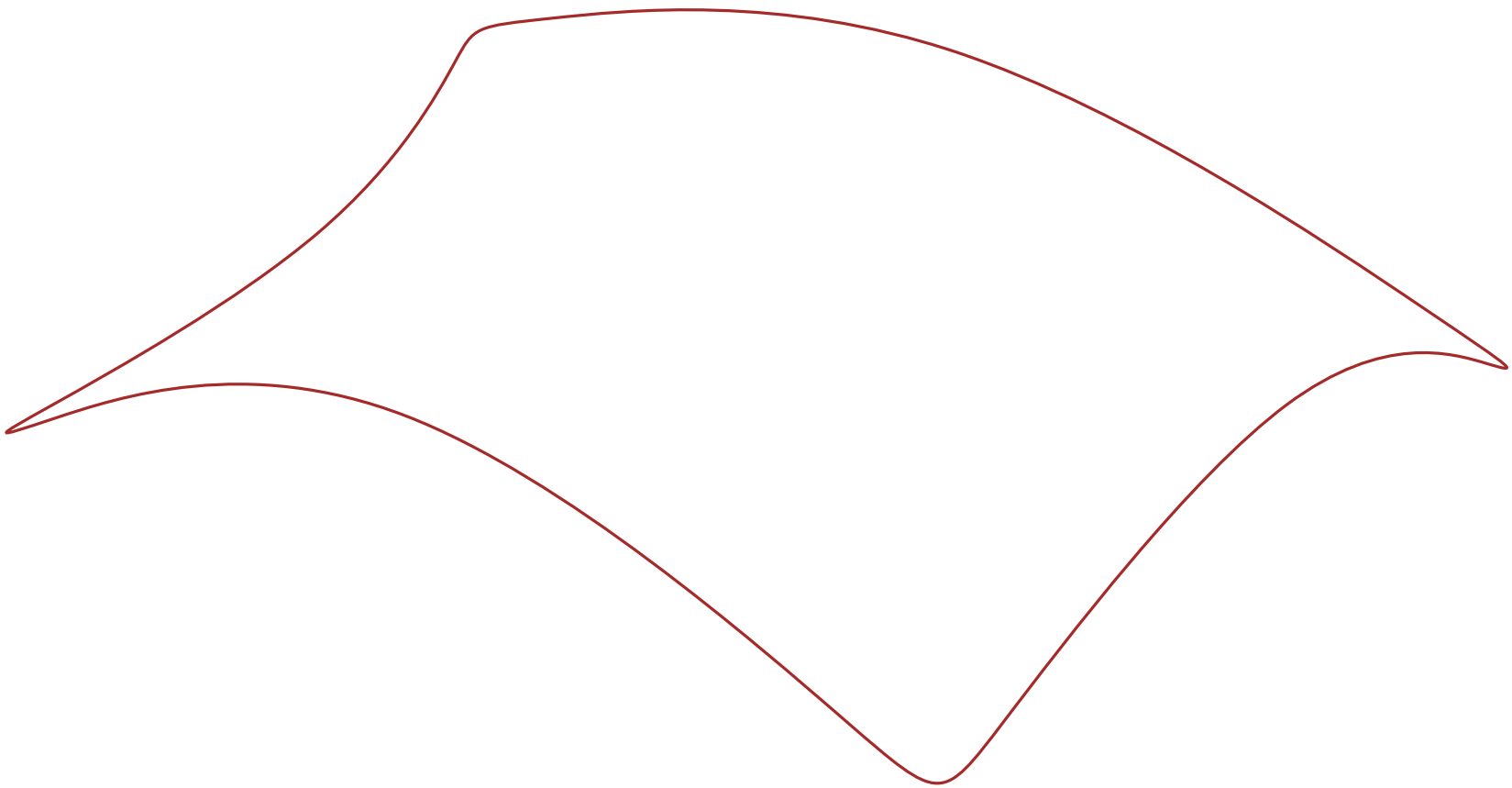
$\frac{1}{\epsilon} \times$ encloses 

Reconstruction 3D



Reconstruction 3D

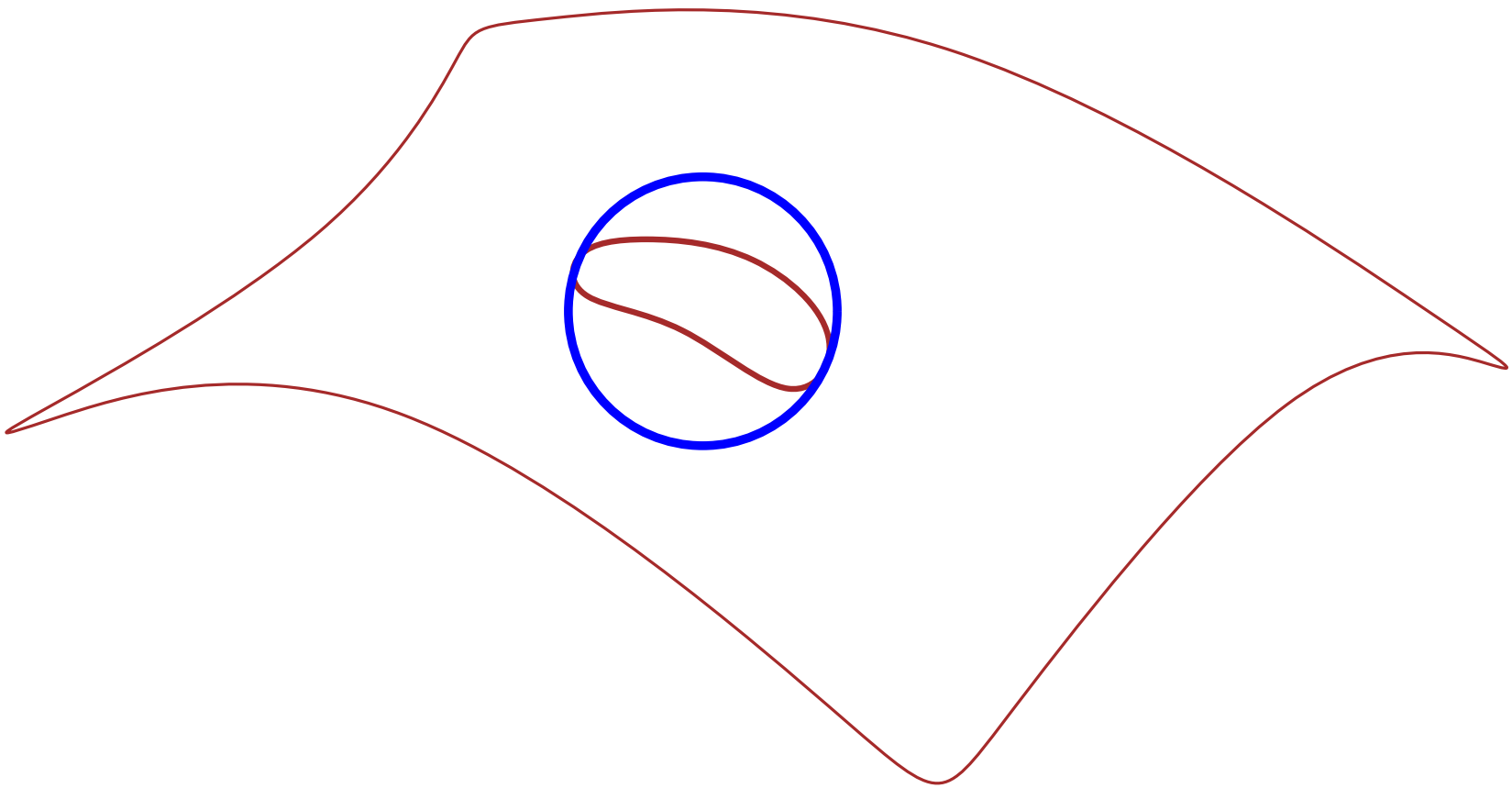
Difficulty: sliver



Reconstruction 3D

Difficulty: sliver

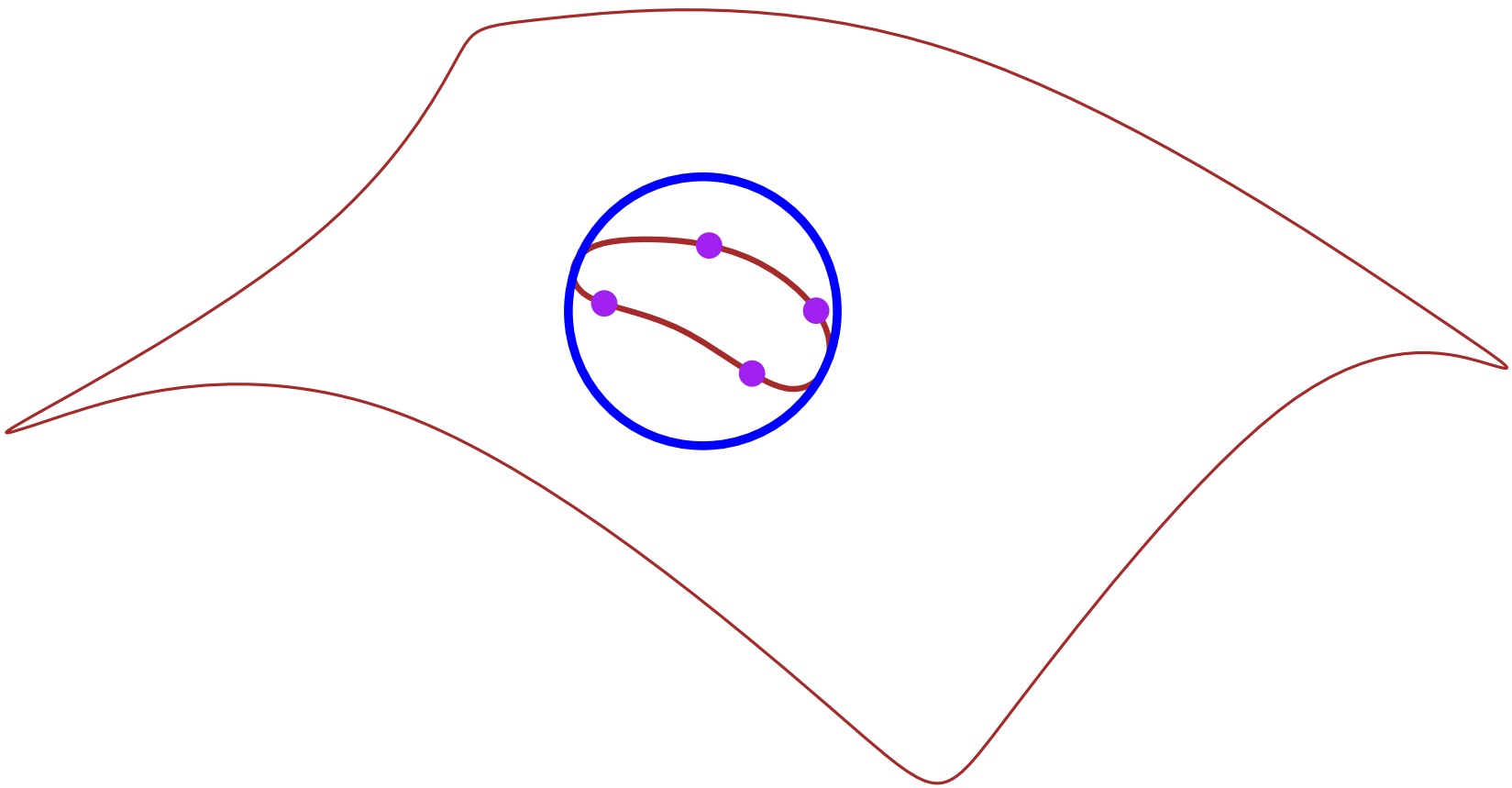
small sphere



Reconstruction 3D

Difficulty: sliver

small sphere four sample points

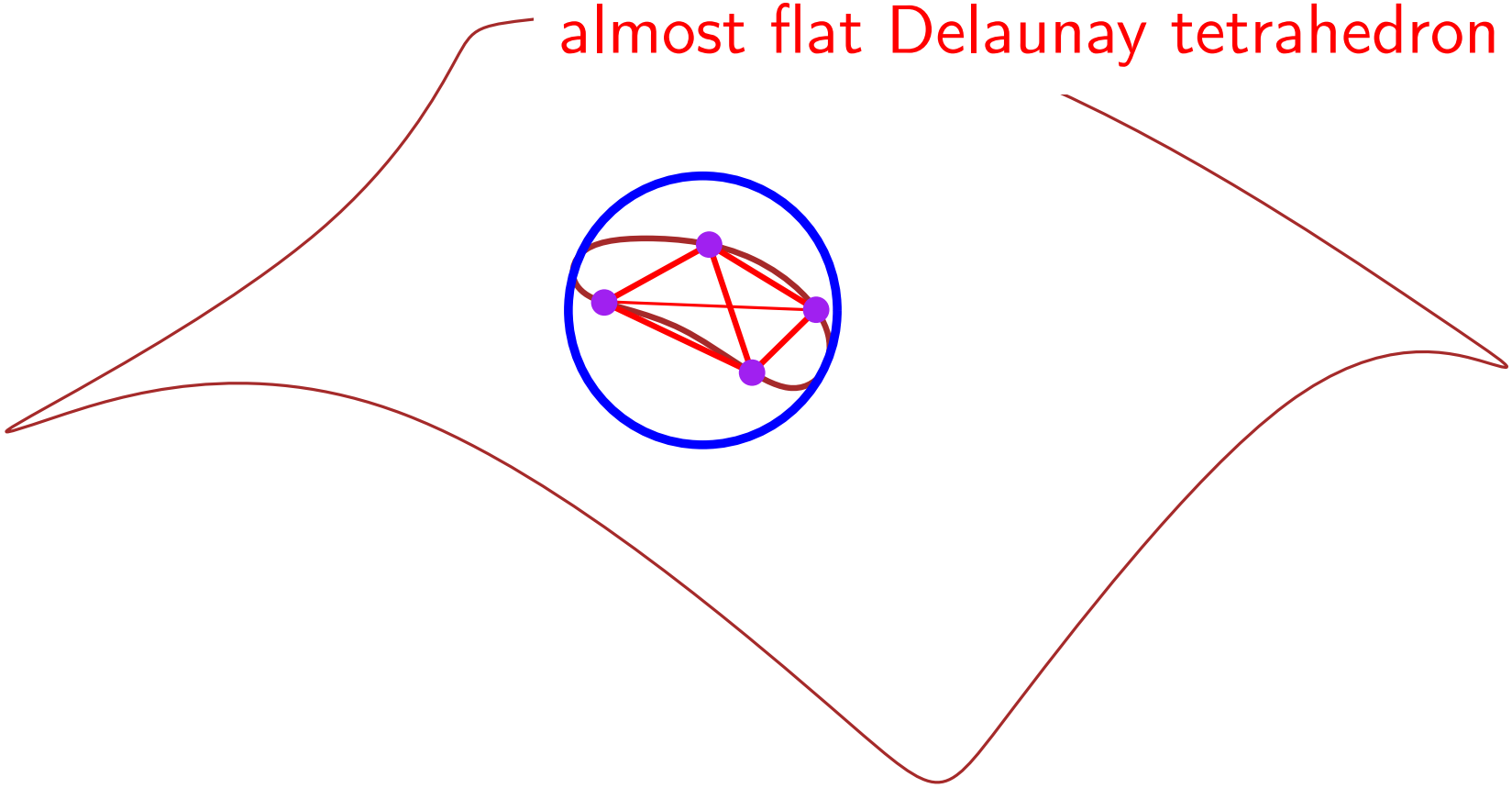


Reconstruction 3D

Difficulty: sliver

small sphere four sample points

almost flat Delaunay tetrahedron

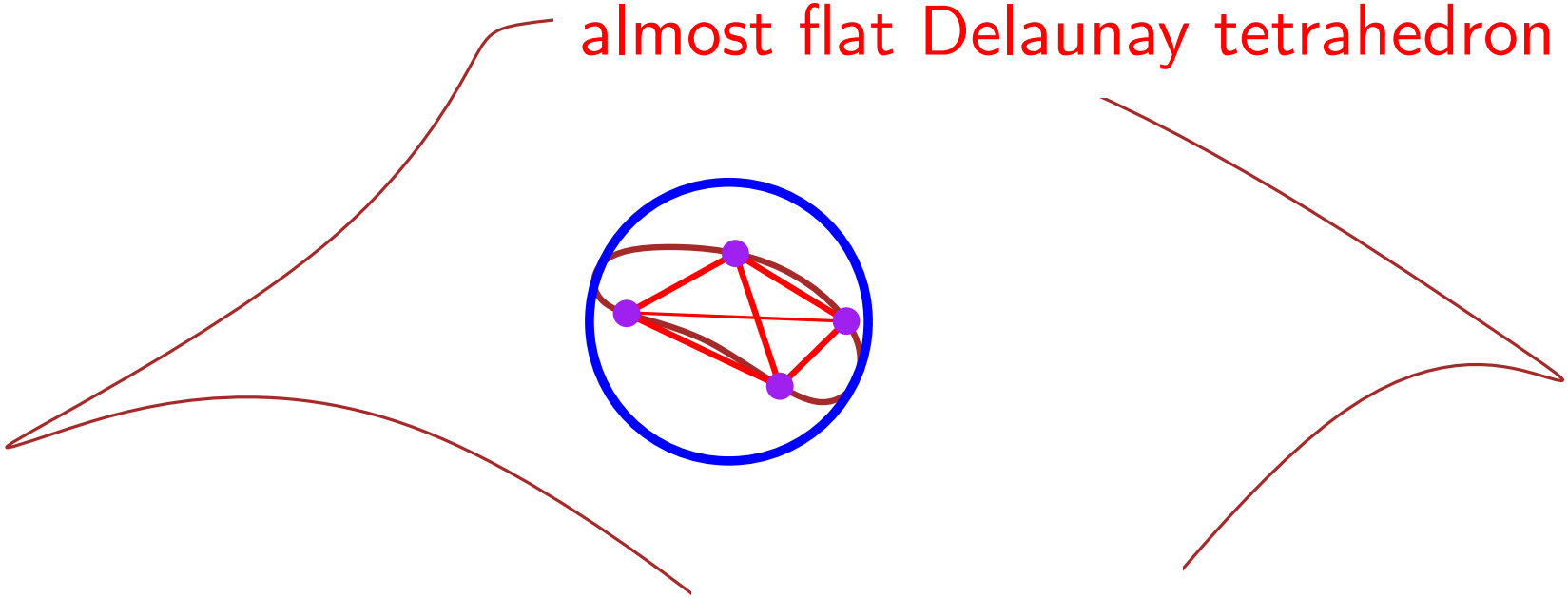


Reconstruction 3D

Difficulty: sliver

small sphere four sample points

almost flat Delaunay tetrahedron



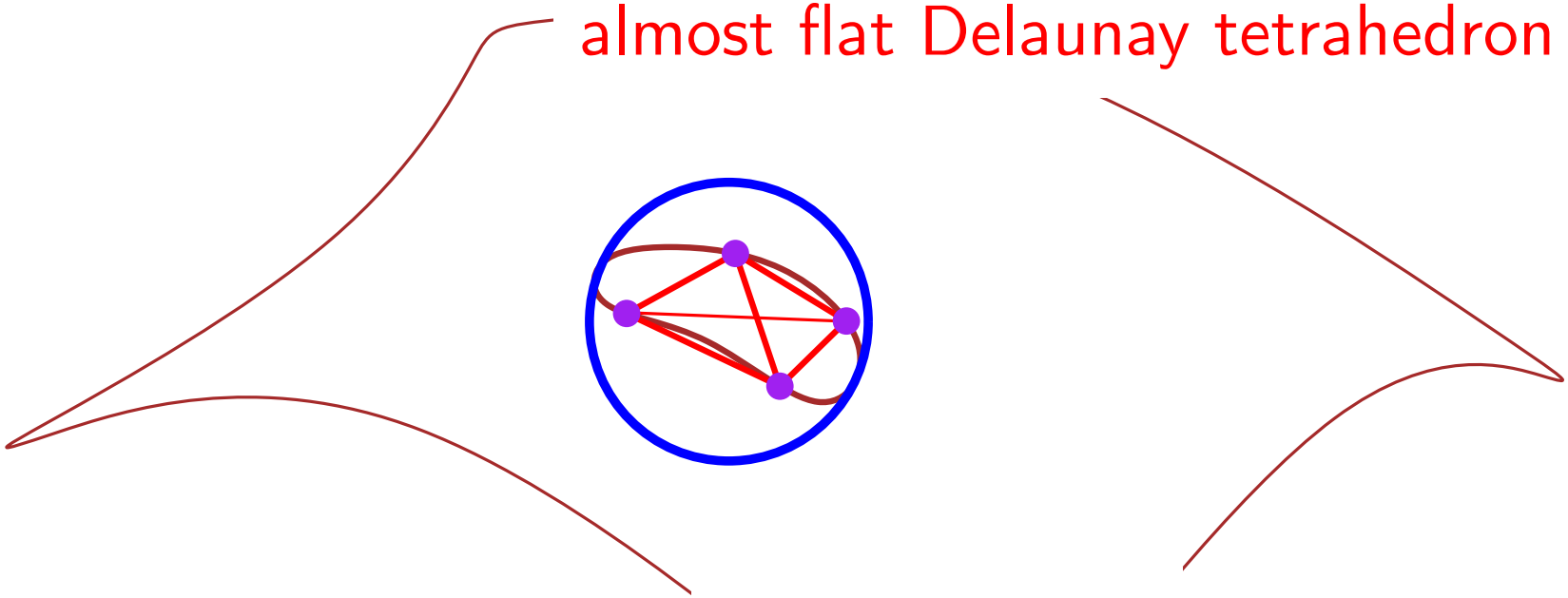
Which triangle belongs to reconstruction ?

Reconstruction 3D

Difficulty: sliver

small sphere four sample points

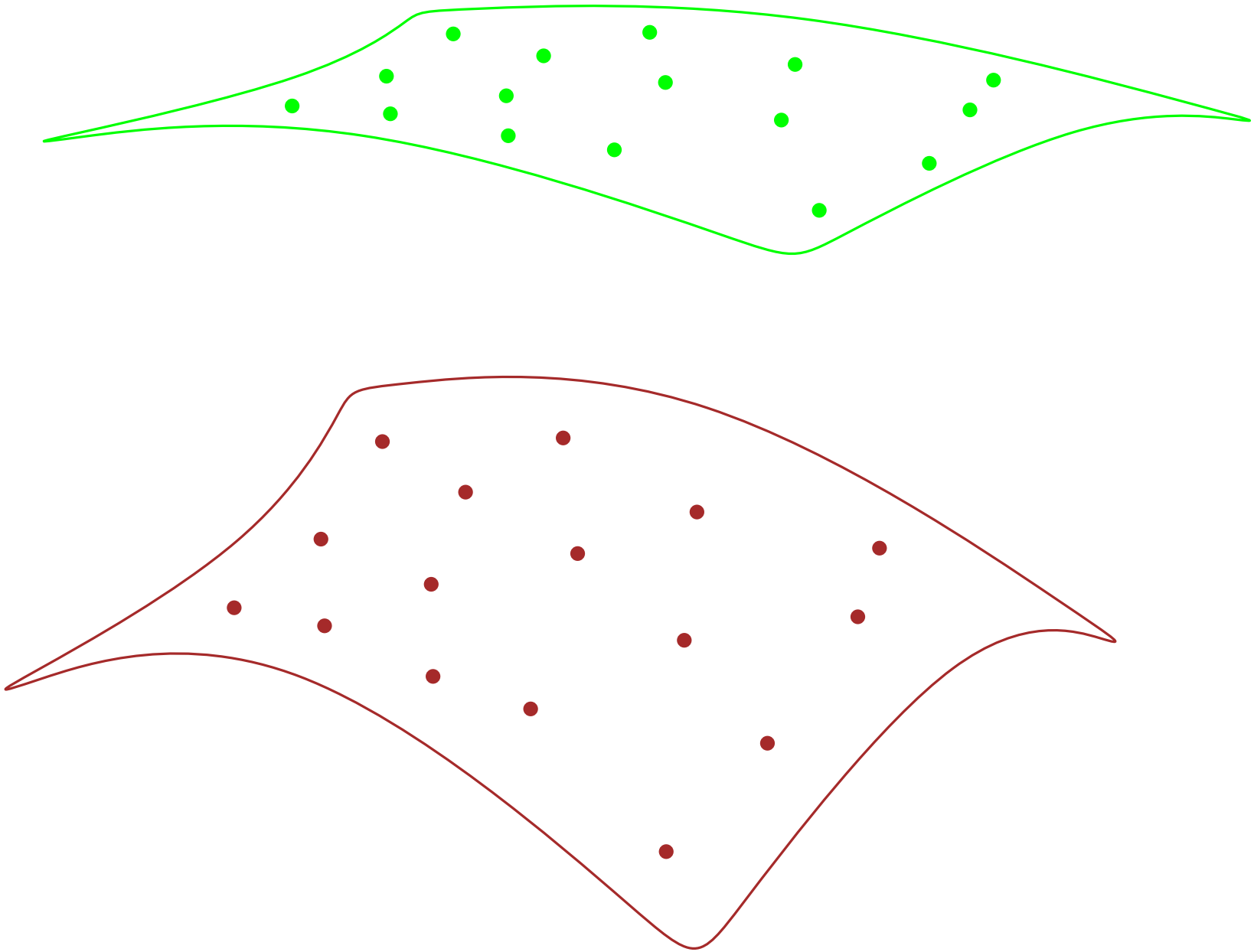
almost flat Delaunay tetrahedron



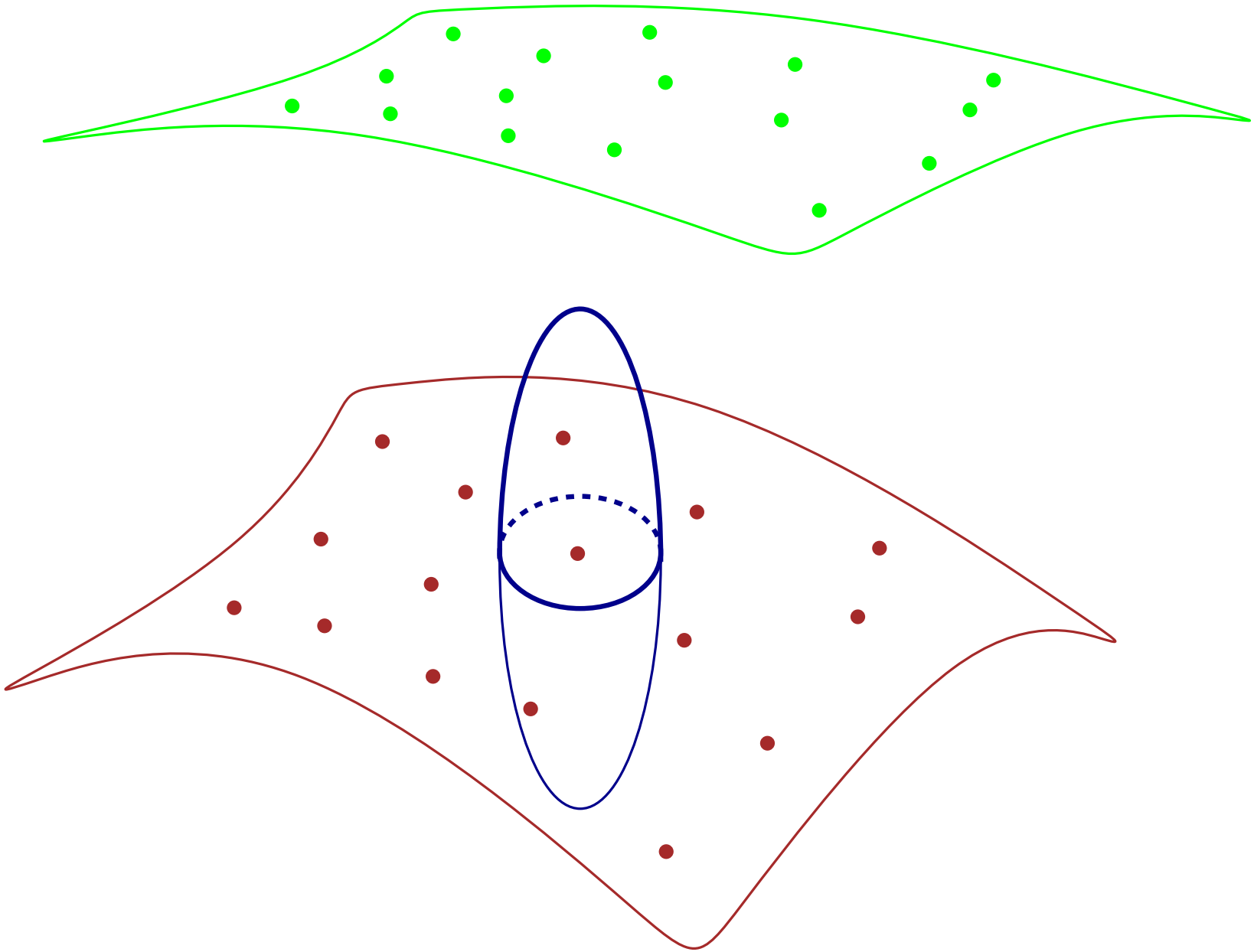
Which triangle belongs to reconstruction ?

Crust: Voronoi vertices may kill useful triangles

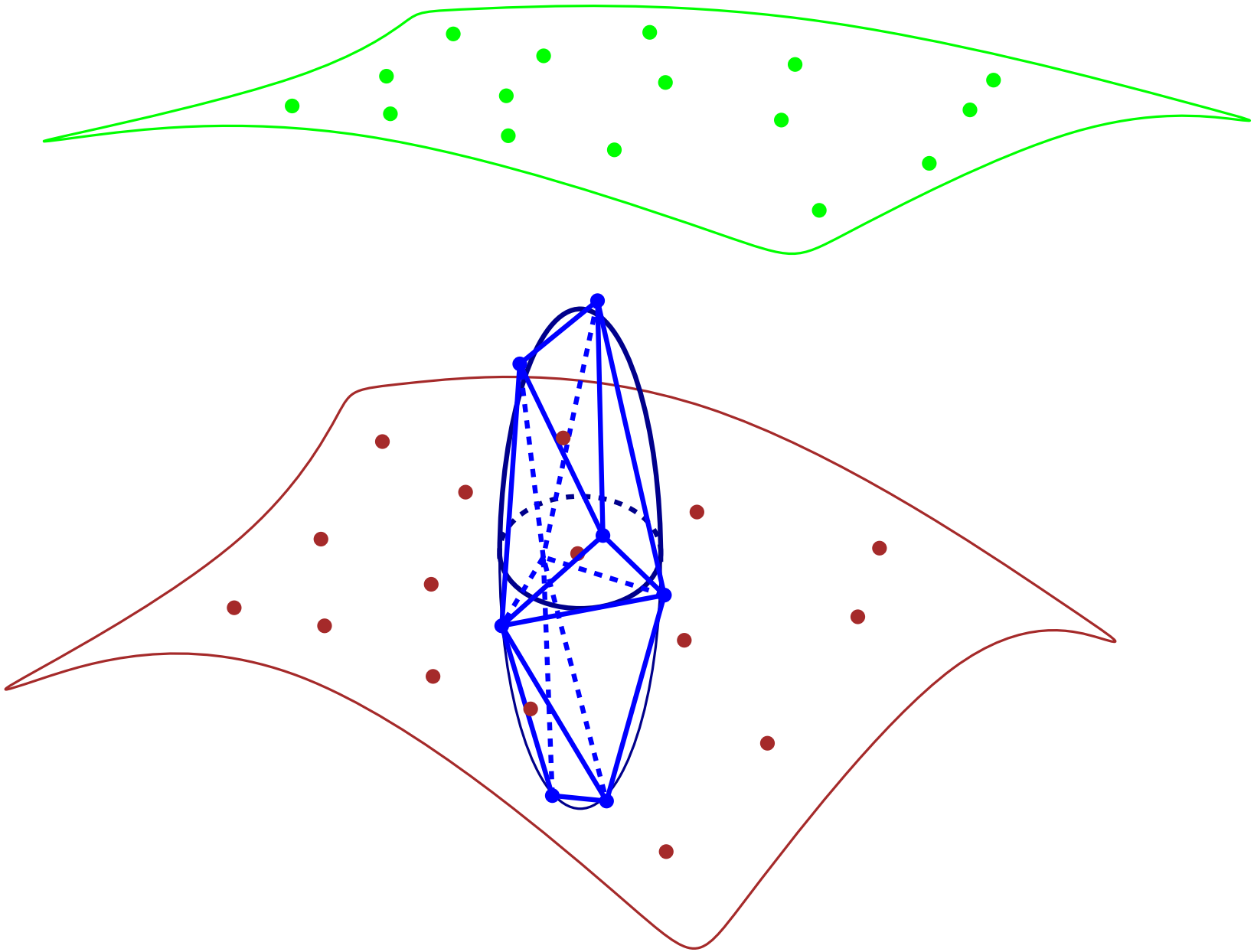
Reconstruction 3D



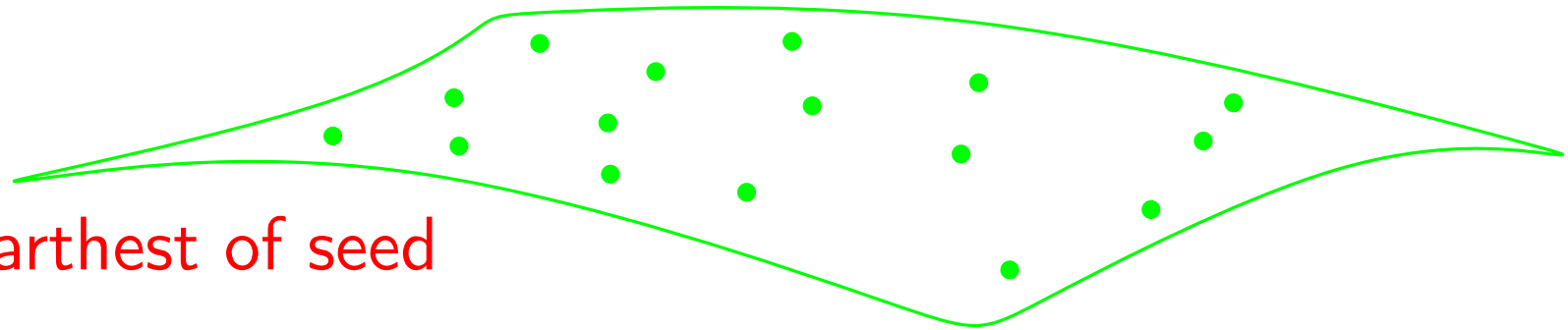
Reconstruction 3D



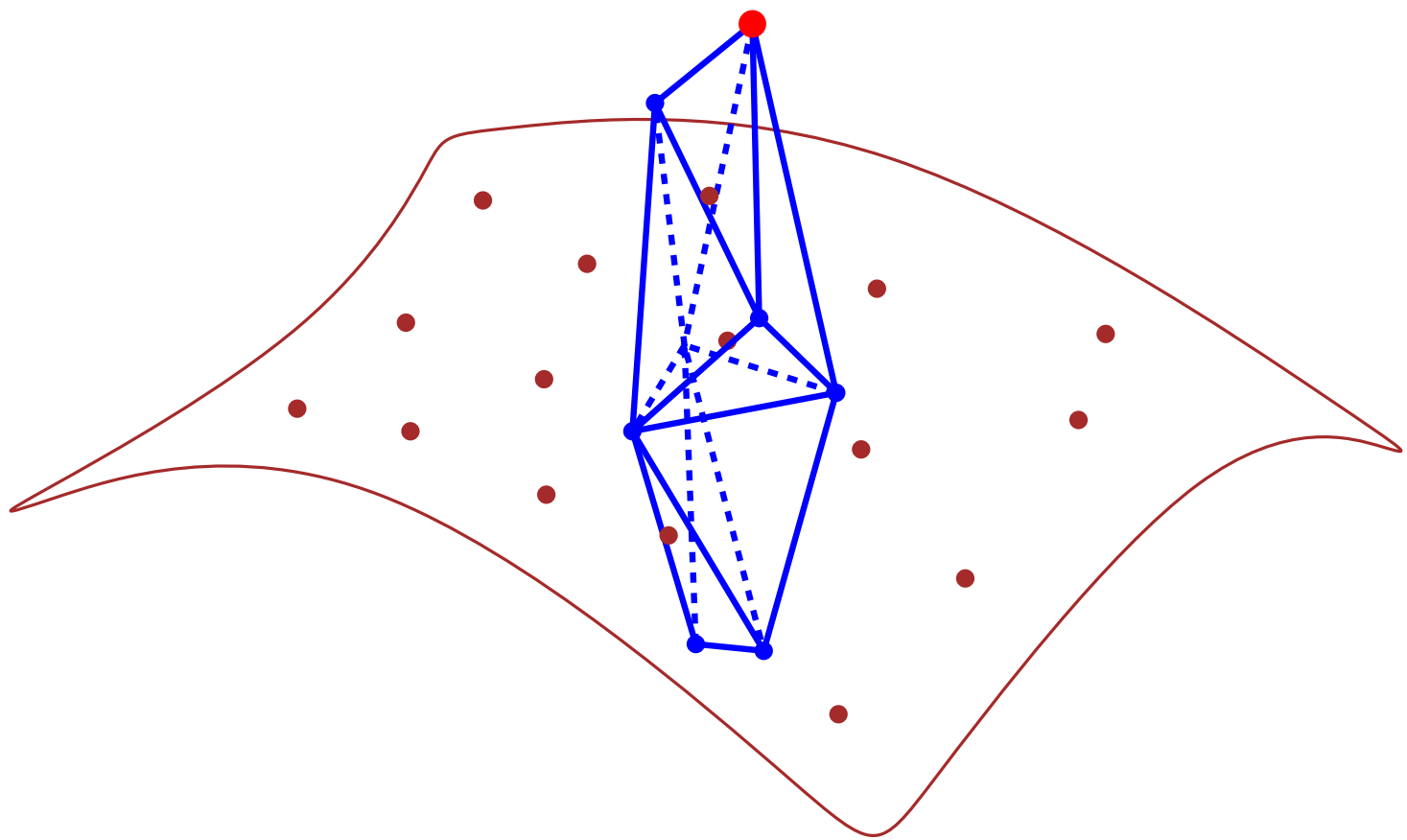
Reconstruction 3D



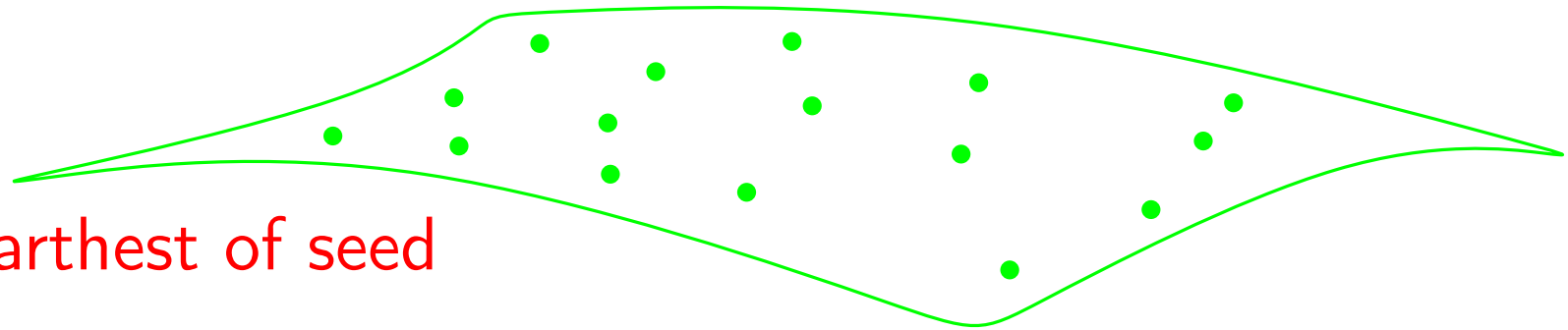
Reconstruction 3D



Pole = farthest of seed

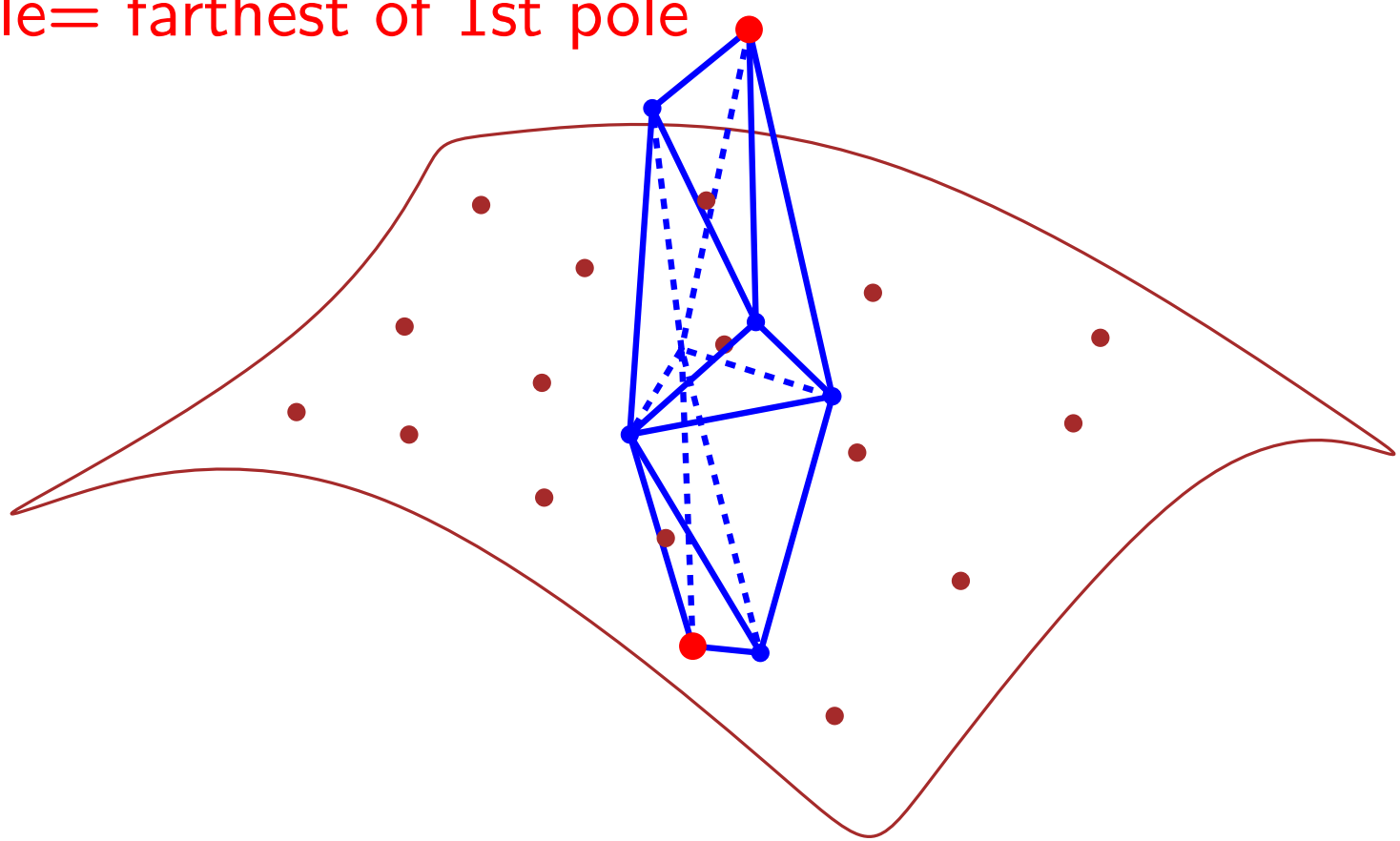


Reconstruction 3D

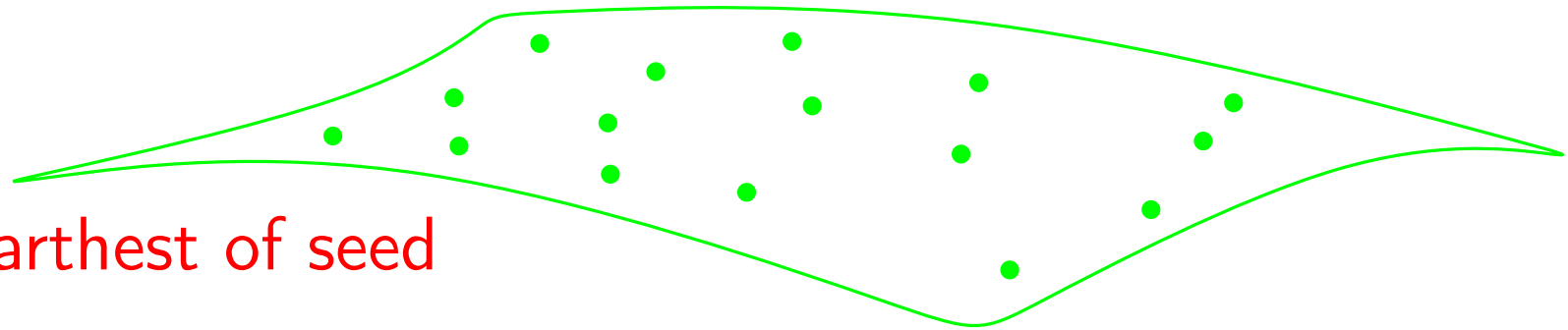


Pole = farthest of seed

2nd pole= farthest of 1st pole

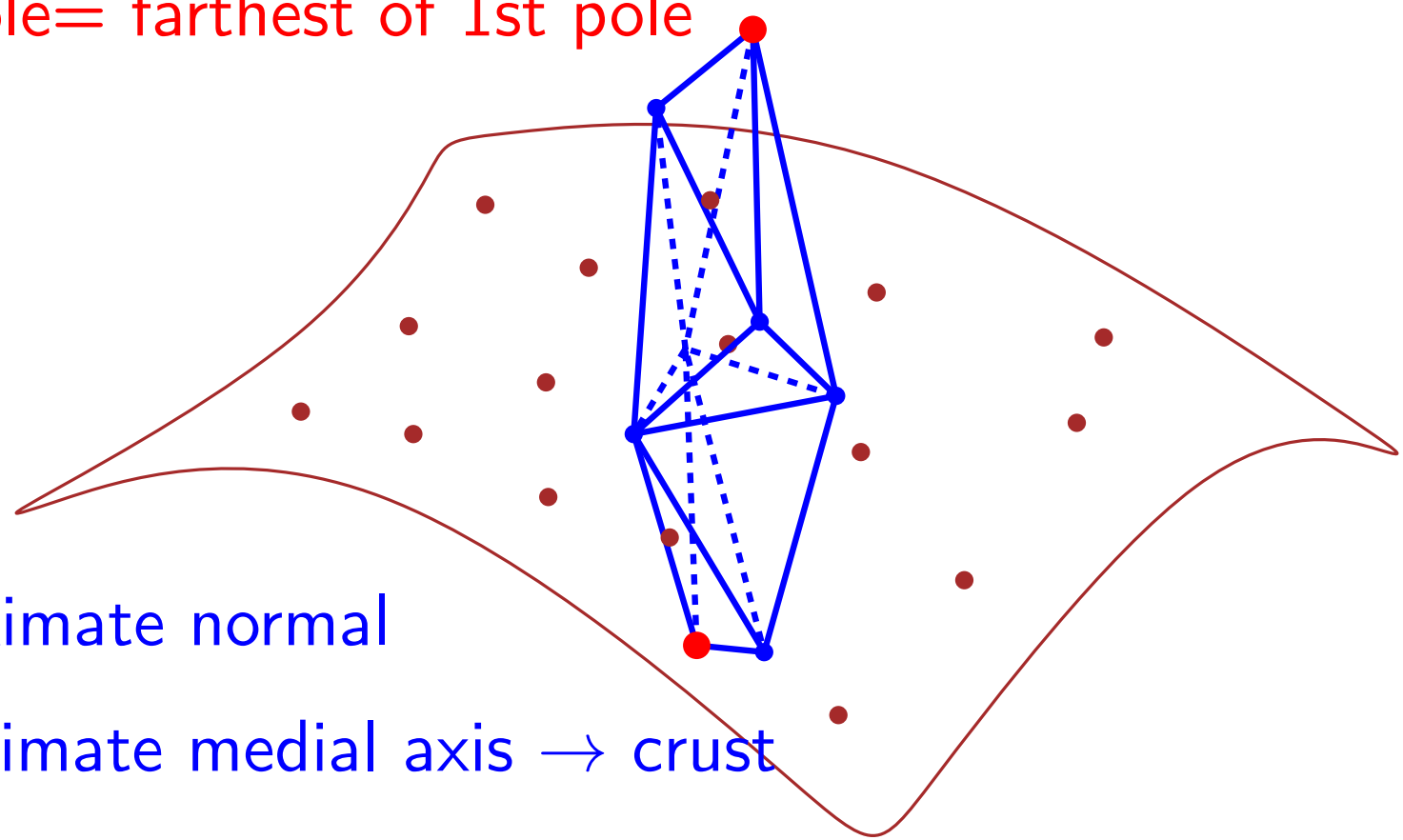


Reconstruction 3D



Pole = farthest of seed

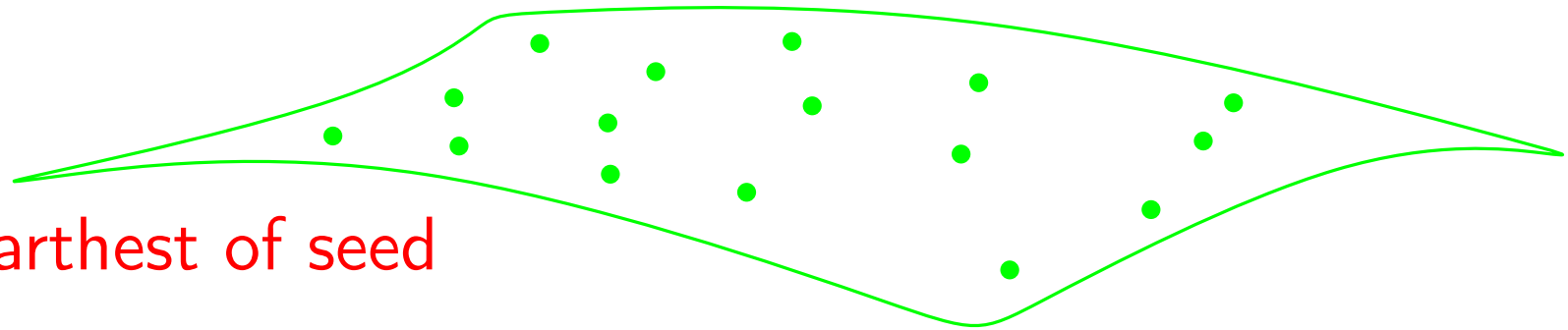
2nd pole= farthest of 1st pole



Approximate normal

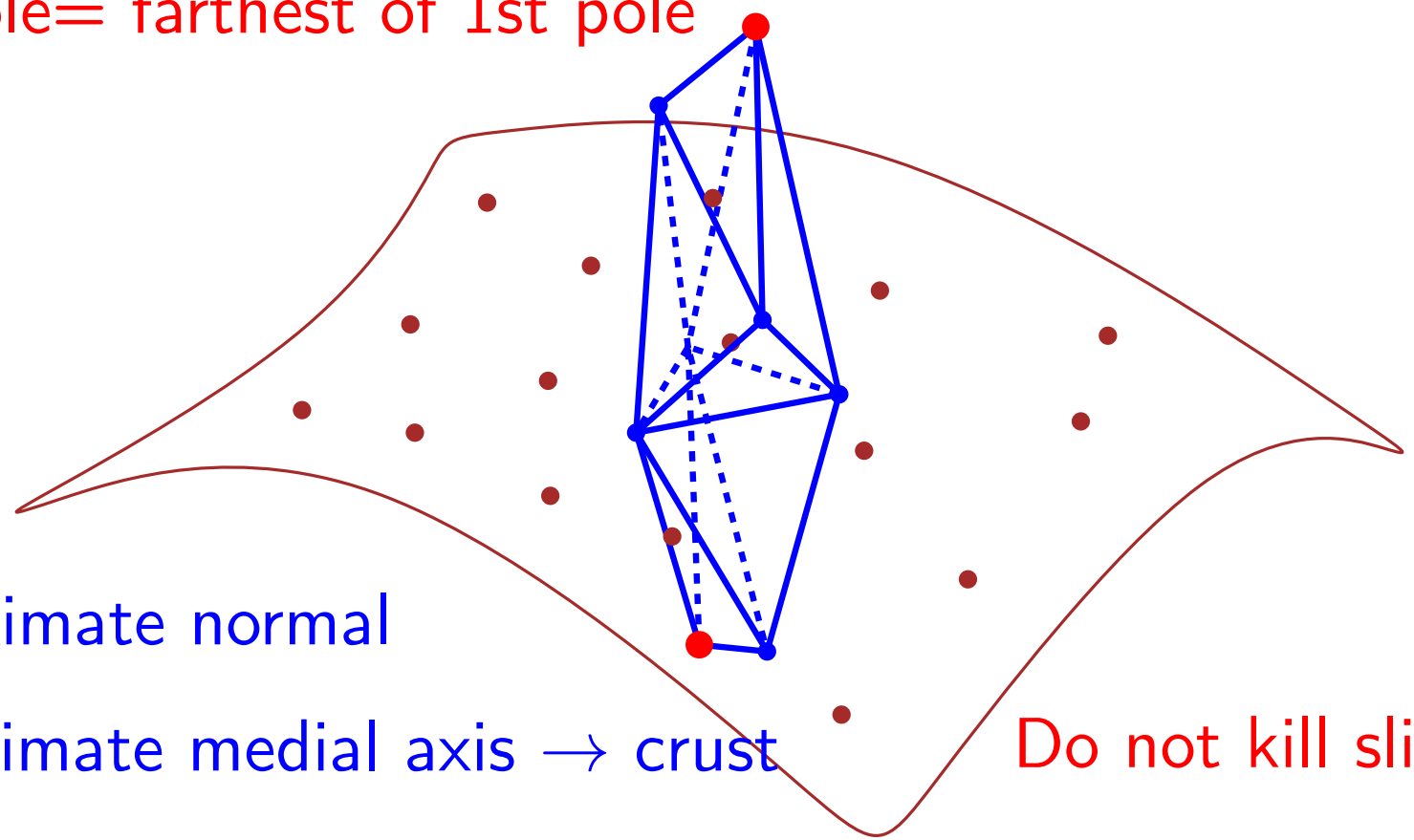
Approximate medial axis $\rightarrow$ crust

Reconstruction 3D



Pole = farthest of seed

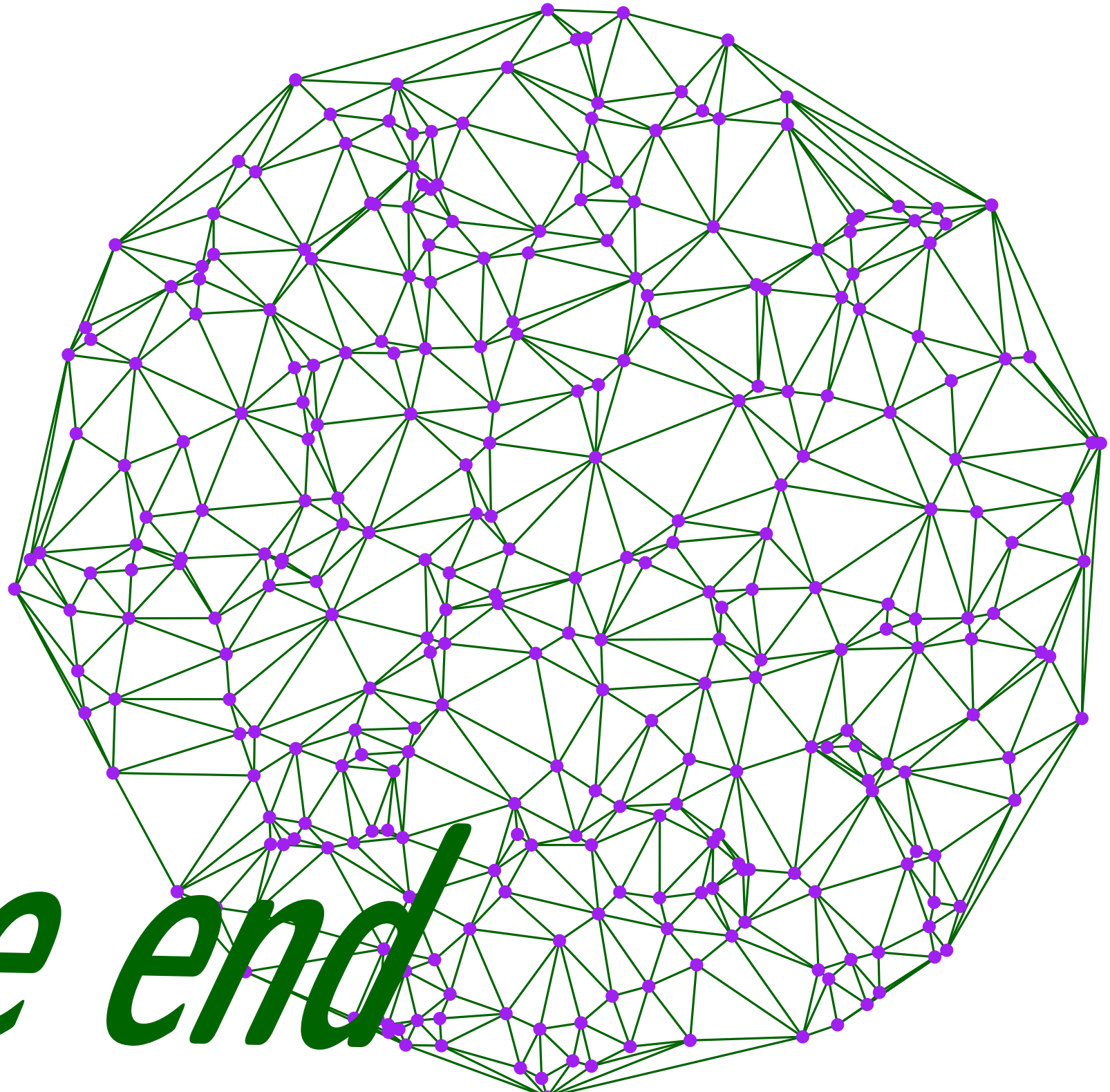
2nd pole= farthest of 1st pole



Approximate normal

Approximate medial axis $\rightarrow$ crust

Do not kill slivers



The end