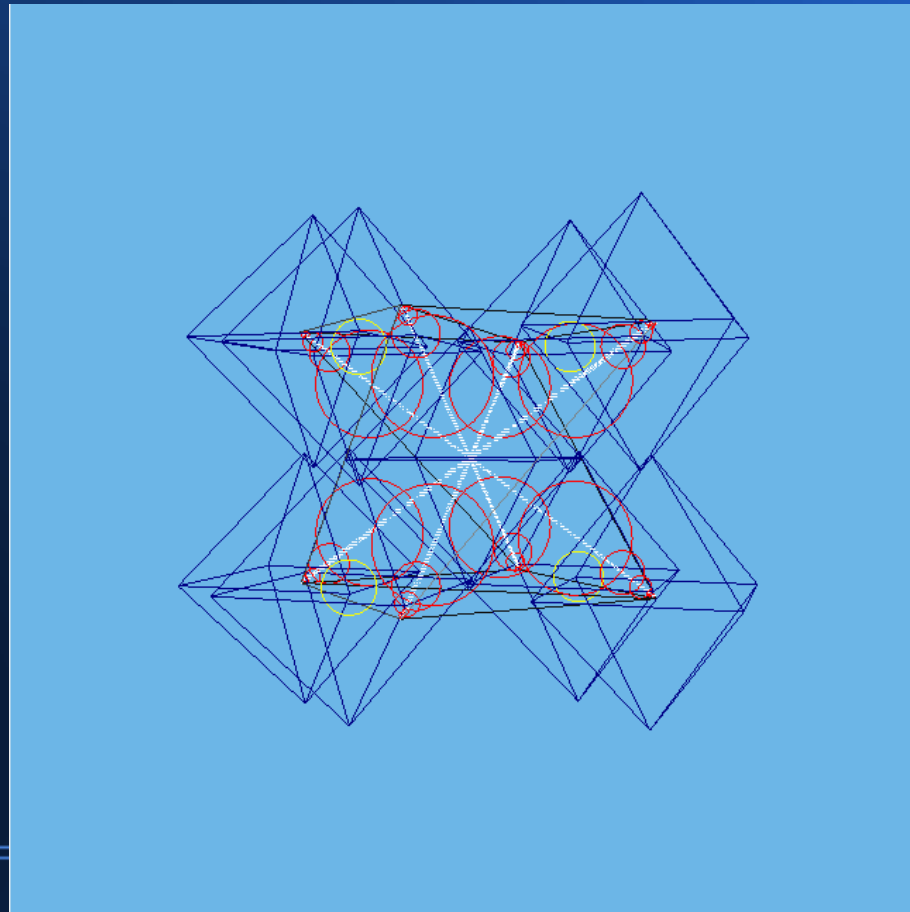# Automatic Rigging System

## Adam Mally

Why an automatic rigging system?

- Manual rigging is tedious and time-consuming

- Skin weight painting is especially so

- This system requires minimal user input while providing accurate skeleton creation and skin binding

How does it work?

- The user specifies the mesh he or she wishes to rig

- To create a skeleton, the given mesh must be reduced to its core points

- These core points are also known as a medial axis

What is a medial axis?

- The set of points inside a mesh that are, locally, the furthest from the mesh surface

- Can also be though of as the edges of a 3D Voronoi diagram
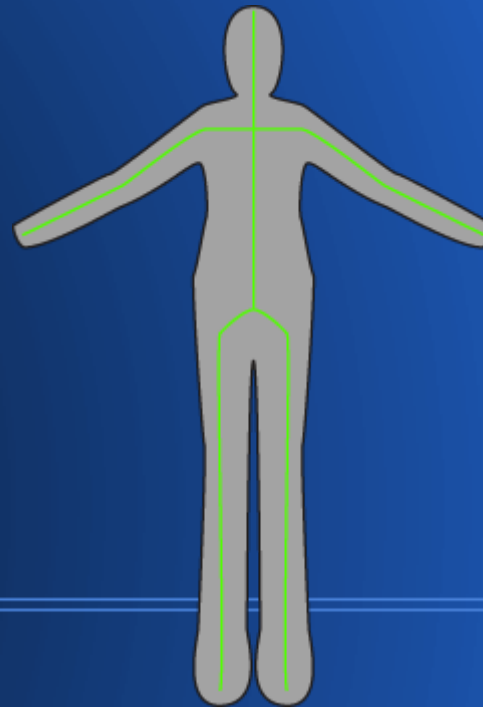
How is the medial axis computed?

- Treat the medial axis as the edges of a 3D Voronoi diagram

- For a set of points in a mesh, find the closest point on the surface of the mesh to each point

- If there are three or more points on the mesh that are approximately the same (minimum) distance from the point, then the point is part of the medial axis
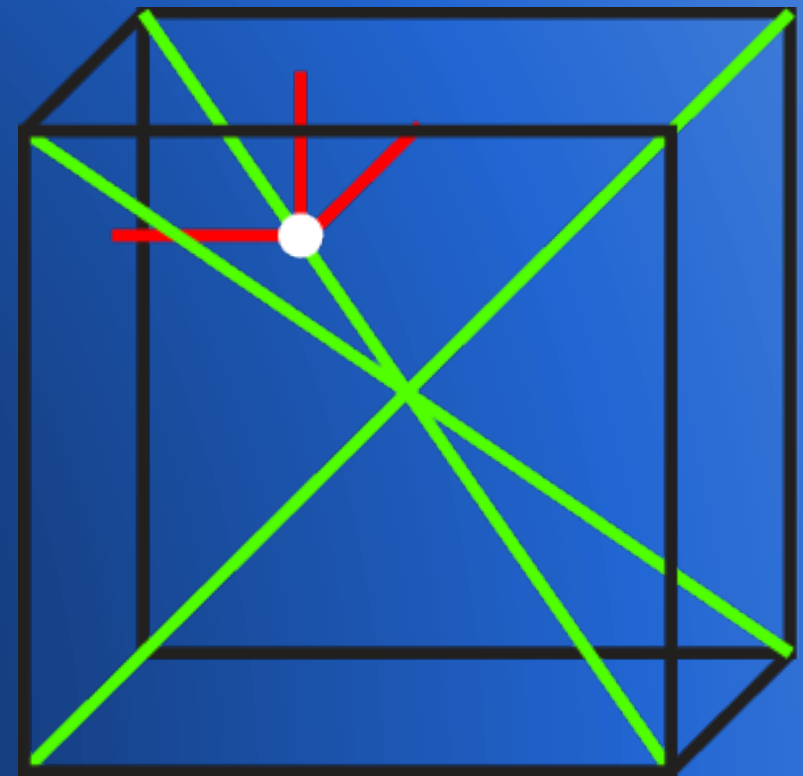
Point is equidistant from three faces

The next step – sphere packing

- The medial axis can be used as the basis for fitting a set of spheres within the mesh

- Sort the medial axis points by distance from mesh surface, with farther points being first

- Create a sphere at any medial axis point not already contained within a sphere

- The sphere's radius is equal to the point's distance from the surface
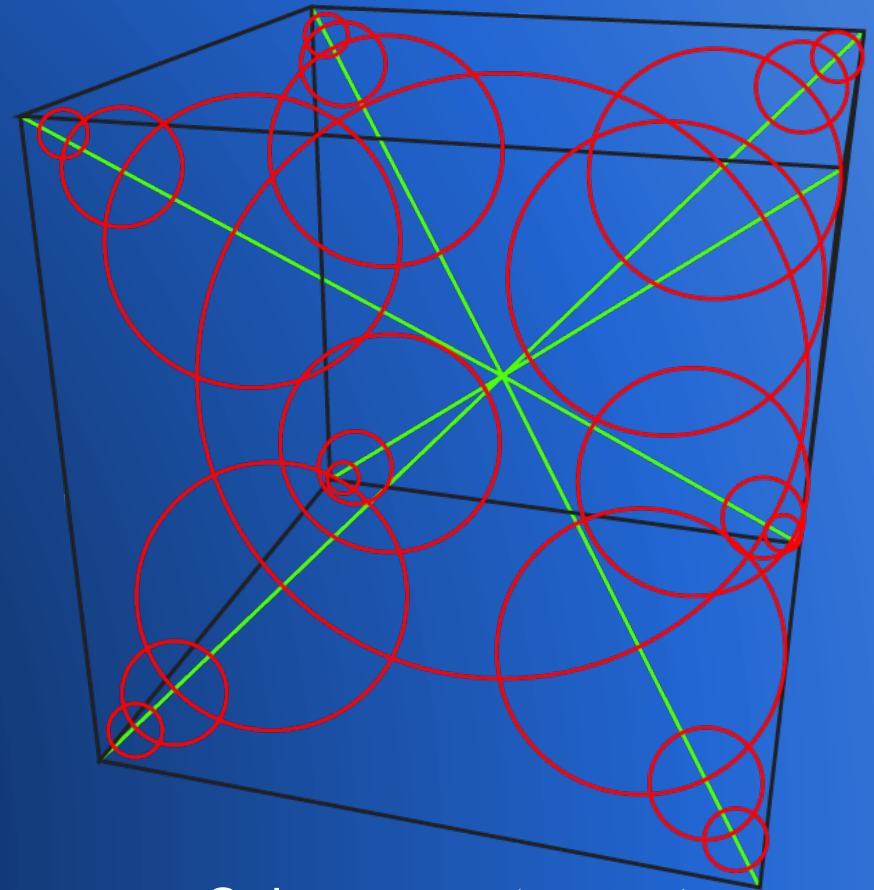
Spheres are tangent to mesh; they do not pass through it

Using spheres for joint placement

- The spheres generated can be used to guide the placement of skeleton joints

- Find sphere nearest the center of the mesh and place a joint there

- Radially search outward for next-closest spheres to determine "limb joint" placement
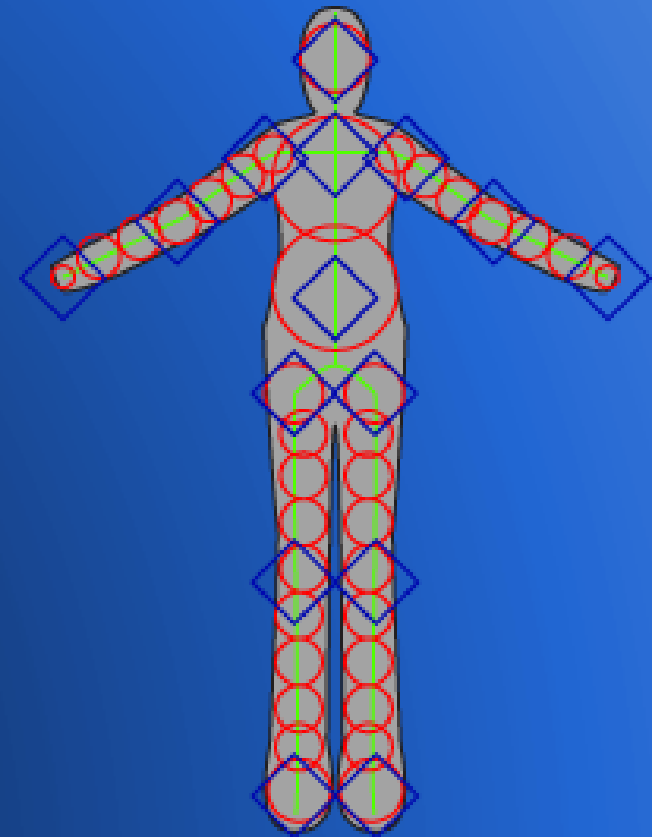
Binding the skin

- Once the joints have been created, the mesh may be bound to them

- A heat-based distance weighting formula is used

- In short, the closer a vertex is to a joint the more influence it receives from it

Influence radiates from each joint into the mesh's vertices