Raycast based auto-rigging method for humanoid meshes

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Problem

- Rigging consists of placing a skeleton inside a mesh in order to animate it by moving the bones.
- Auto-rigging is doing this technique automatically.
- Can we provide such a process without any human intervention?

Previous work

- Database based
  [*Miller, Arikan and Fussel, 2010*]
- Mesh discretization
  [*Baran, Popovic, 2007*]
- Mesh contraction
  [*Madaras, Durikovic, Agoston and Nishita, 2010*]

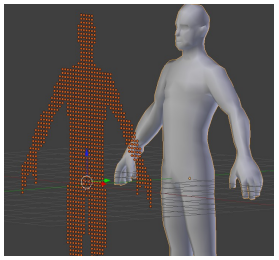
Motivation

- Rigging has no artistic value and is time consuming

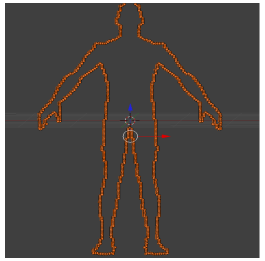
Our method

- The process is fully automated and requires no human intervention
- It's working only on humanoid meshes which are the most commonly rigged meshes.
- The process is in two parts:
  - A body map which identifies the different limbs.
  - The bones placement is done using the body map, raycasting and bones ratios.

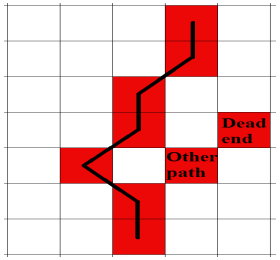
Part 1: Body map



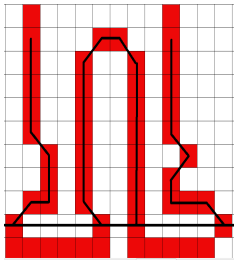
- RayCasting toward the mesh with regular spacing. Intersection points are kept.



- The resulting projections is outlined. We know the spacing between two points.

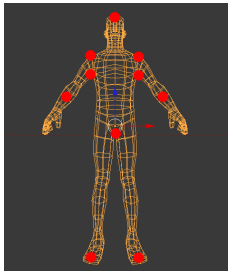


- So we can find point neighborhood and build three tracks.

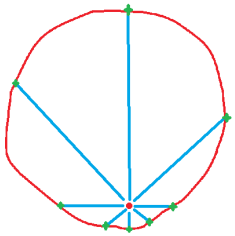


- The highest point of the middle track will be the crouch. Using its height, we find the hips on the two other tracks. Other limbs have other algorithms.

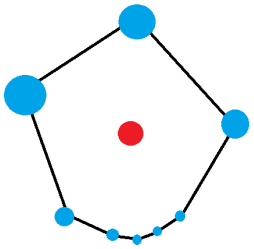
Part 2: Bones placement



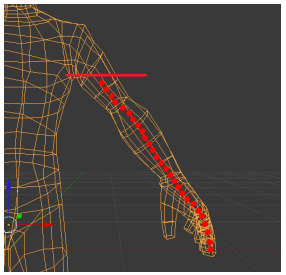
- The body map is used to find the entry points in the different limbs



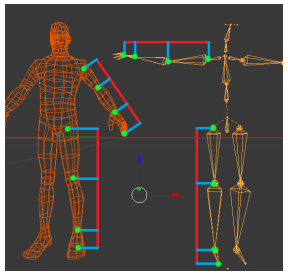
- From the entry point inside the mesh, rays are cast all around on a horizontal (or vertical) slice.



- The intersections points define polygon. A barycenter is found by applying weights to the points depending on the distance to their neighbors.

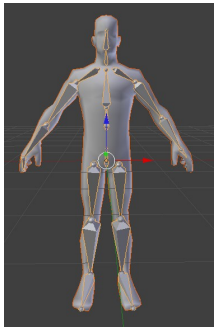


- The next centers are found by going through the limb and repeating the process.

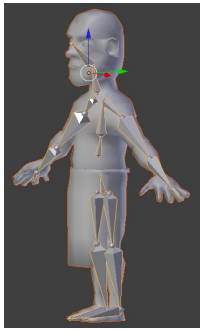


- The armature bone relative ratios are used to determine which centers' locations will be the joints.

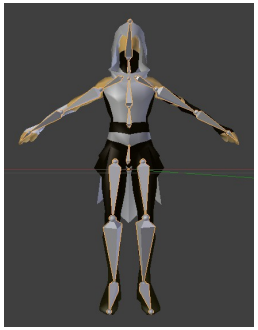
Results



- 1004 faces
  4 seconds

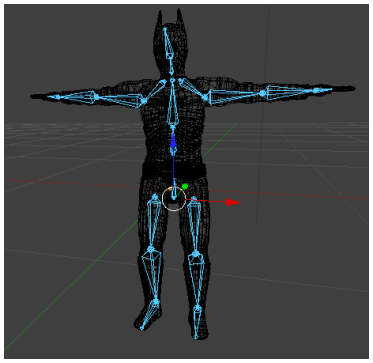


- 2026 faces
  3.6 seconds



- 824 faces
  3 seconds

Future work



- Enhancing shoulder positioning
- Hand rigging

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