

ASSIGNMENT-3 REPORT

Description: - Volume visualization using isosurfacing (marching cubes or marching tetrahedra algorithm) and a basic software-based direct volume rendering.

Data Set Information:- Dataset is available at: <http://volvis.org>. CT scan of a leg of a bronze statue. The data set is provided by German Federal Institute for Material Research and Testing ([BAM](#)), Berlin, Germany.

Data Format:-

A summary of the data can be found below:

- **Dimensions:** 341x341x93 (1:1:4)
- **Format:** The data is in .raw format. It consists of a volume of data values at each position in space.

Visualization Algorithm And Implemenatation: -

1. Isosurfacing Using Marching Cube Method :- For every grid cell and an isolevel, the triangluar facets are calculated that required to represent iso surface through the cell. 0 will be returned if either totally above or below the isolevel.

The algorithm proceeds through the scalar field, taking eight neighbor locations at a time (thus forming an imaginary cube), then determining the polygon(s) needed to represent the part of the isosurface that passes through this cube. The individual polygons are then fused into the desired surface.

This is done by creating an index to a precalculated array of 256 possible polygon configurations ($2^8=256$) within the cube, by treating each of the 8 scalar values as a bit in an 8-bit integer. If the scalar's value is higher than the iso-value (i.e., it is inside the surface) then the appropriate bit is set to one, while if it is lower (outside), it is set to zero. The final value, after all eight scalars are checked, is the actual index to the polygon indices array. Finally each vertex of the generated polygons is placed on the appropriate position along the cube's edge by linearly interpolating the two scalar values that are connected by that edge. The gradient of the scalar field at each grid point is also the normal vector of a hypothetical isosurface passing from that point. Therefore, we may interpolate these normals along the edges of each cube to find the normals of the generated vertices which are essential for shading the resulting mesh with some ilumination model.

Insights :-

1. The marching algorithm extracted isosurface from volume data.
2. The iso surface extraction for the bones and skin is different, so that is visible.