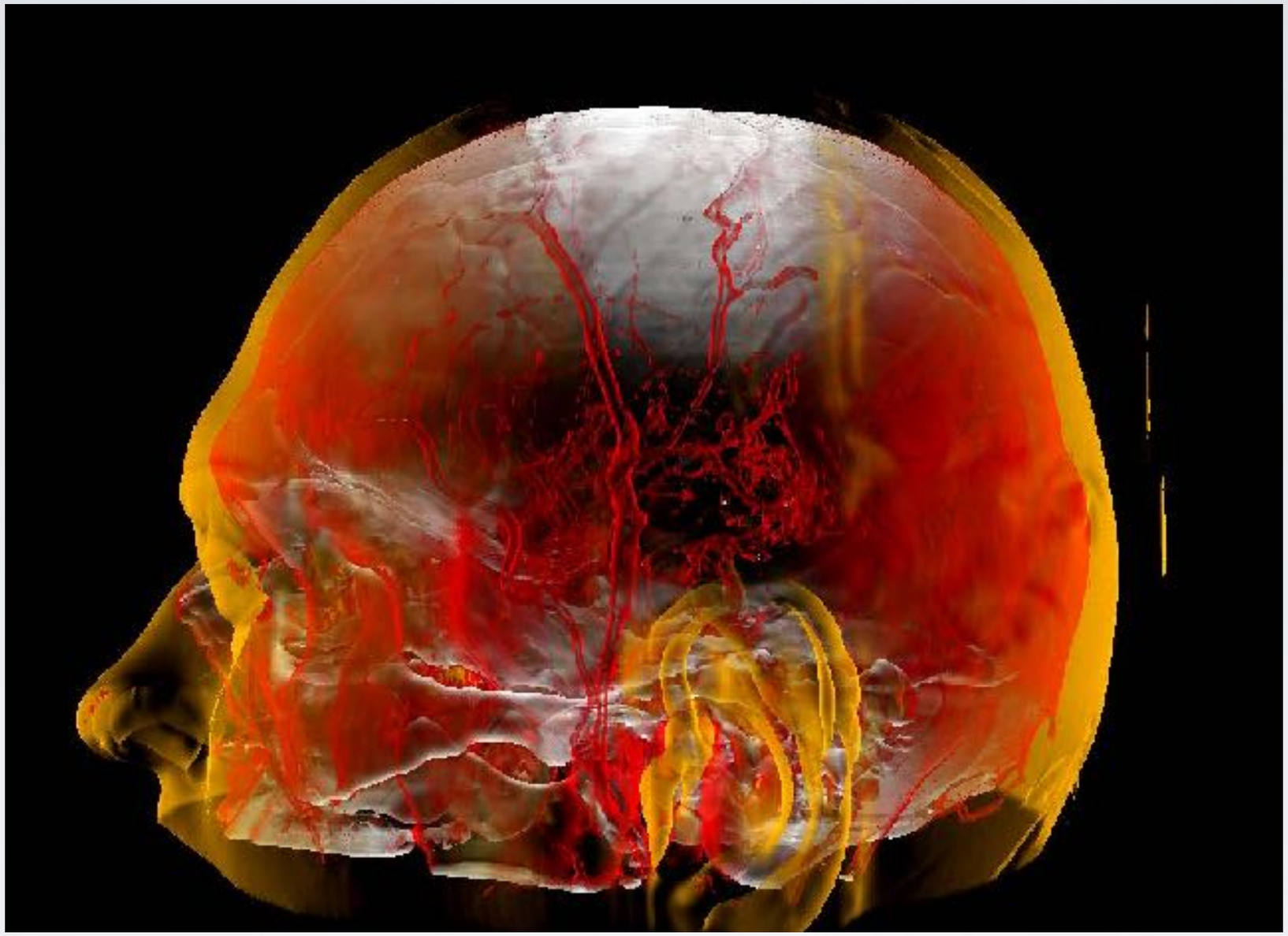


VOLUME RENDERING

BY AMANDA FODE

VOLUME RENDERING WHAT IS IT?

- Set of techniques used to display a 2D projection of a 3D discretely sampled data set.

- A typical 3D data set is a group of 2D slide images acquired by a CT, MRI, or MicroCT scanner.

- Indirect volume rendering involves extracting isosurfaces from the volume and rendering them as polygon meshes.

- Direct volume rendering involves rendering directly as a block of data.

WE WILL FOCUS ON:

DIRECT VOLUME RENDERING

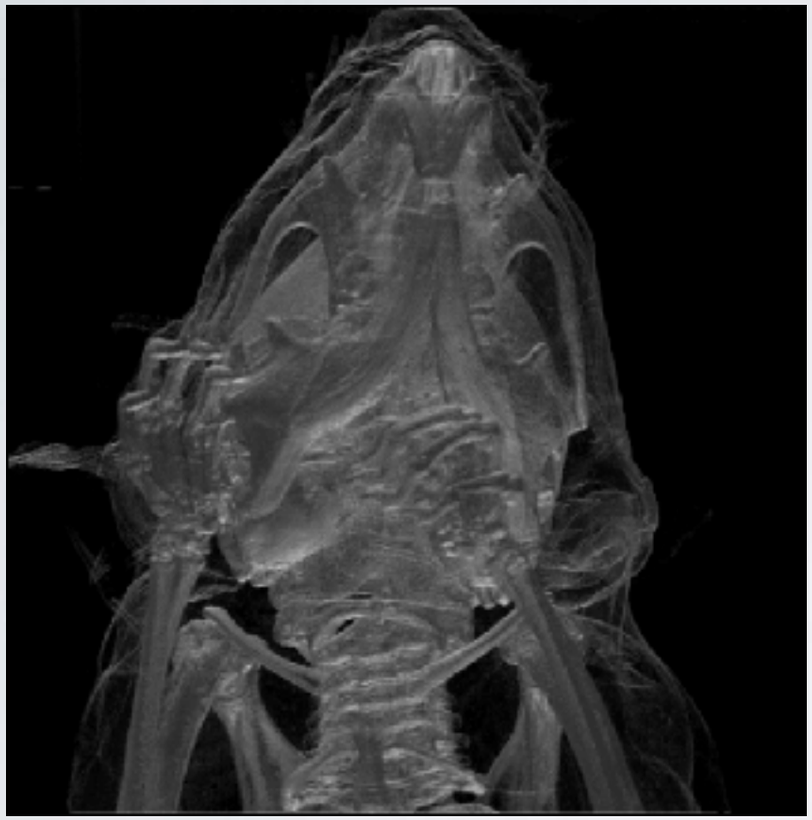
- Every sample value is required to be mapped to opacity and color. This is done using a Transfer Function, which defines the RGBA (red, green, blue, alpha) value for every possible voxel value in the volume.

- A closer look into direct volume rendering:

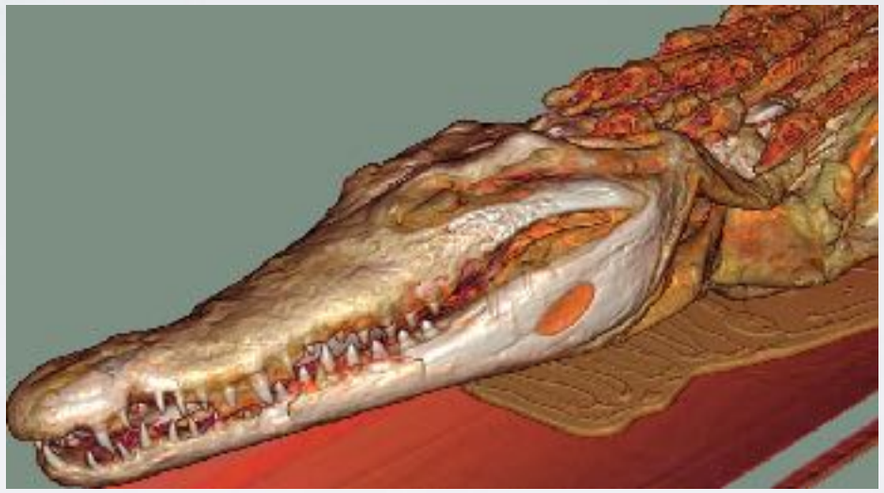
  - Once converted to an RGBA value, the composed RGBA result is projected on corresponding pixel of the frame buffer. The way this is done depends on the rendering technique.

  - Rendering techniques include Volume ray casting, Shear warp, Splatting, and Texture-based volume rendering. A combination of these techniques is possible.

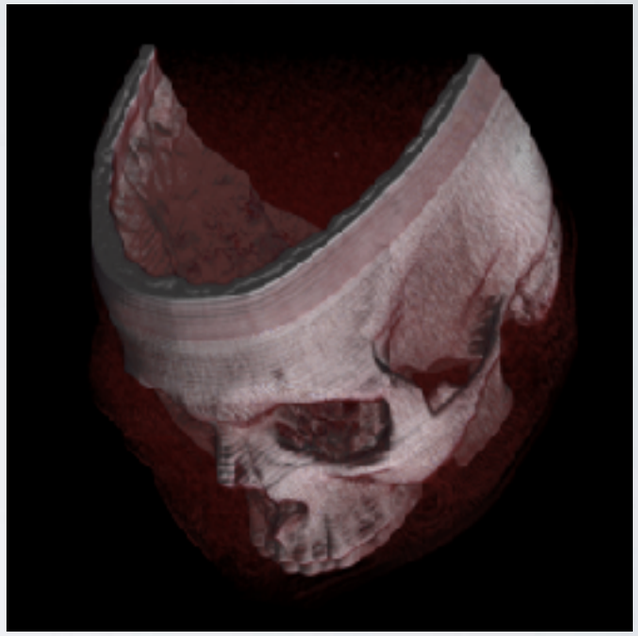
DIRECT VOLUME RENDERING TECHNIQUES



Shear Warp



Volume Ray Casting



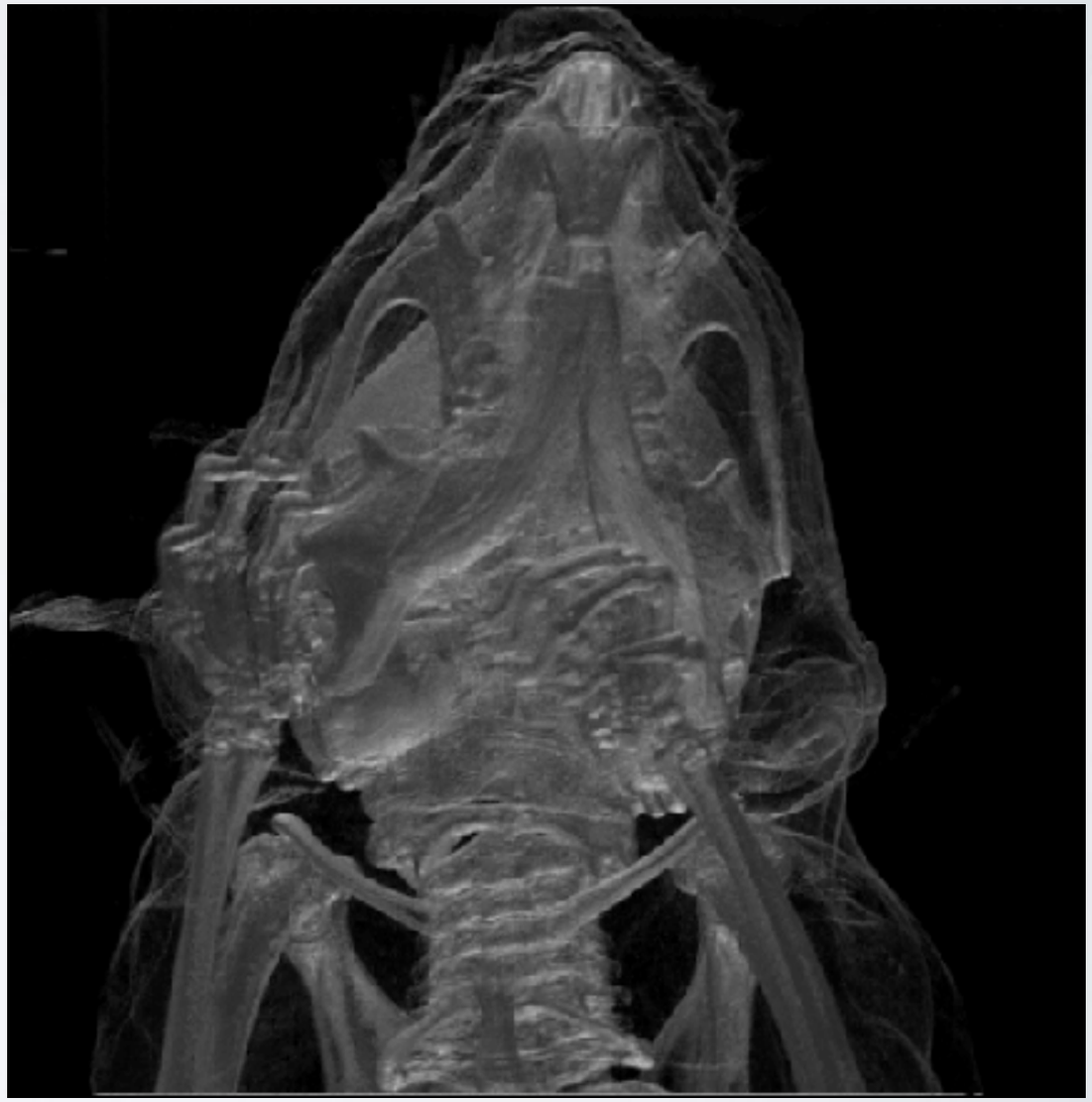
Texture-Based

Splatting

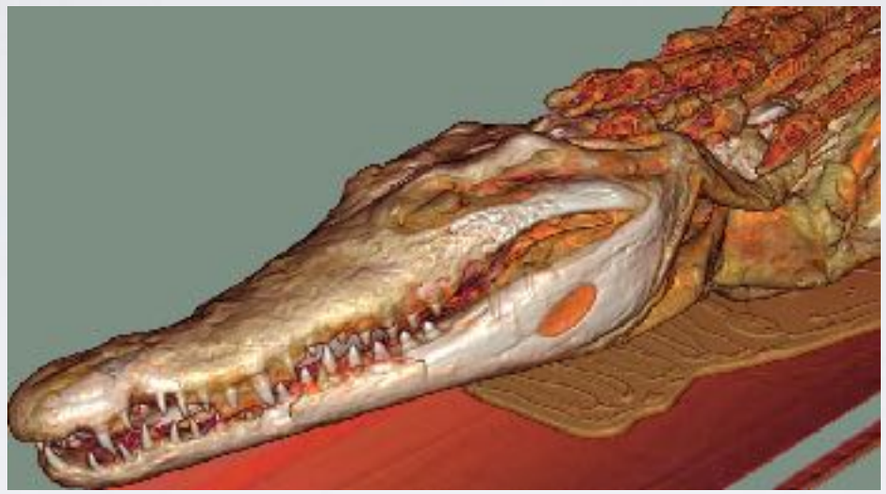
SHEAR WARP

- In this technique, the nearest face of the volume is axis aligned with an off-screen buffer (with a fixed scale of voxels of pixels). Once all slices of the volume have been rendered, the buffer is then warped into the desired orientation and scaled in the image display.

- This technique is relatively fast in software at the cost of less accurate sampling and potentially worse image quality compared to ray casting.

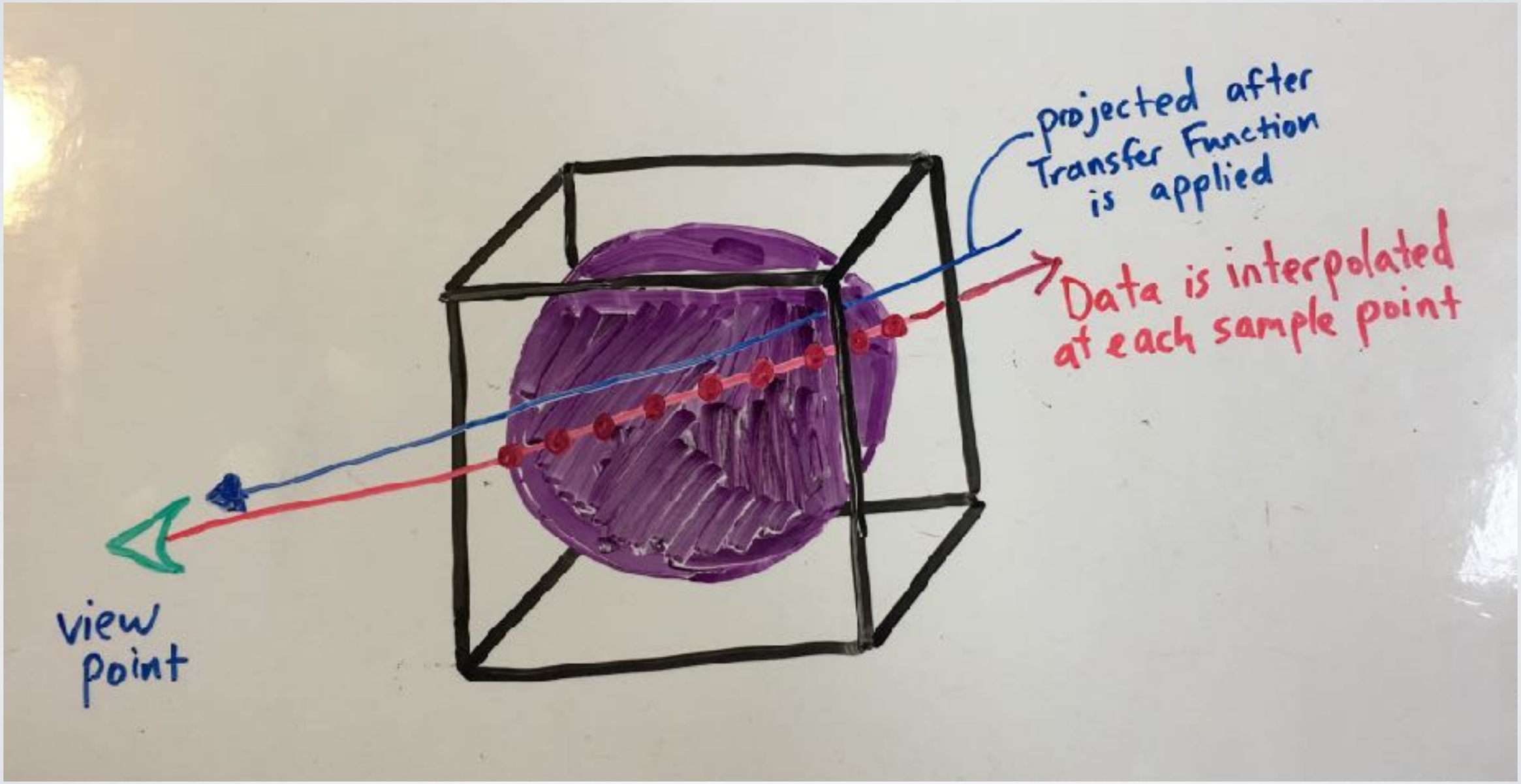


VOLUME RAY CASTING



- image-based volume rendering technique: computation emanates from the output image.
- A ray is generated for each desired image pixel and, from the P.O.V., it "pushes through" the object, sampling the object along the ray.
- The data is interpolated at each sample point and the Transfer Function is applied to form an RGBA sample. The sample is composited onto the accumulated RGBA of the ray, and the process is repeated until the ray exits the volume.
- The RGBA color is converted to RGB color and deposited in the corresponding image pixel. The process is repeated for every pixel on the screen to form the completed image.

ROUGH INTERPRETATION OF VOLUME RAY CASTING



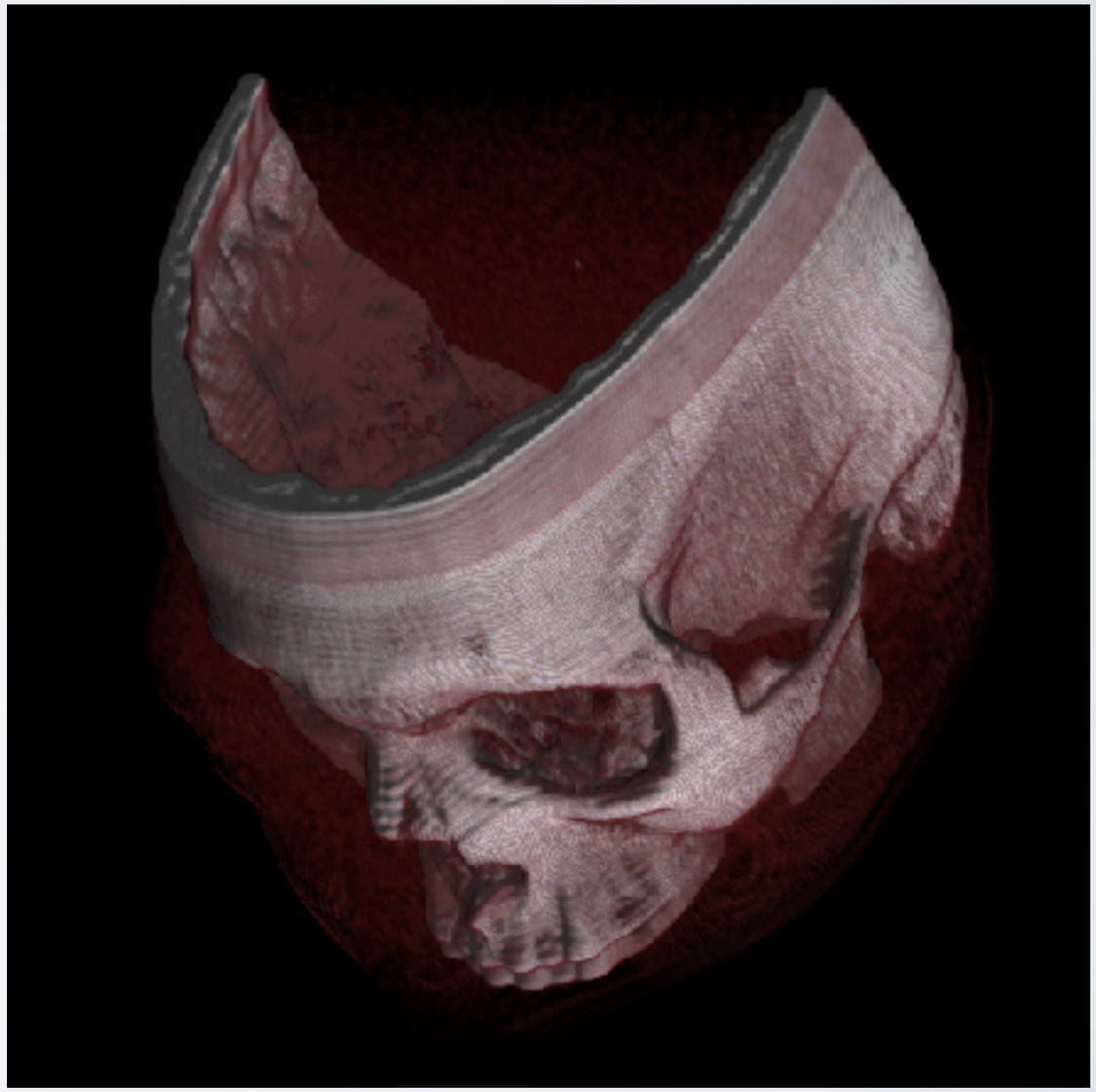
SPLATTING

- This technique is trades quality for speed. Every volume element is splatted onto the viewing surface in back to front order.

- Texture Splatting: A method for combining different textures. The method works by applying an alphamap to higher levels, revealing the layers underneath where the alphamap is partially or completely transparent.

TEXTURE-BASED VOLUME RENDERING

- Using graphics systems, graphics cards, and workstation GPUs to apply images, or textures, to geometric objects.



FINAL PROJECT PROPOSAL

Volume Rendering WebApp with Controls

HOMEPAGE

Requirements:

- Paste Image or URL
- drag image(s) to upload
- Browse Computer
- Press enter to render image

Not sure of ability to upload multiple images… yet.

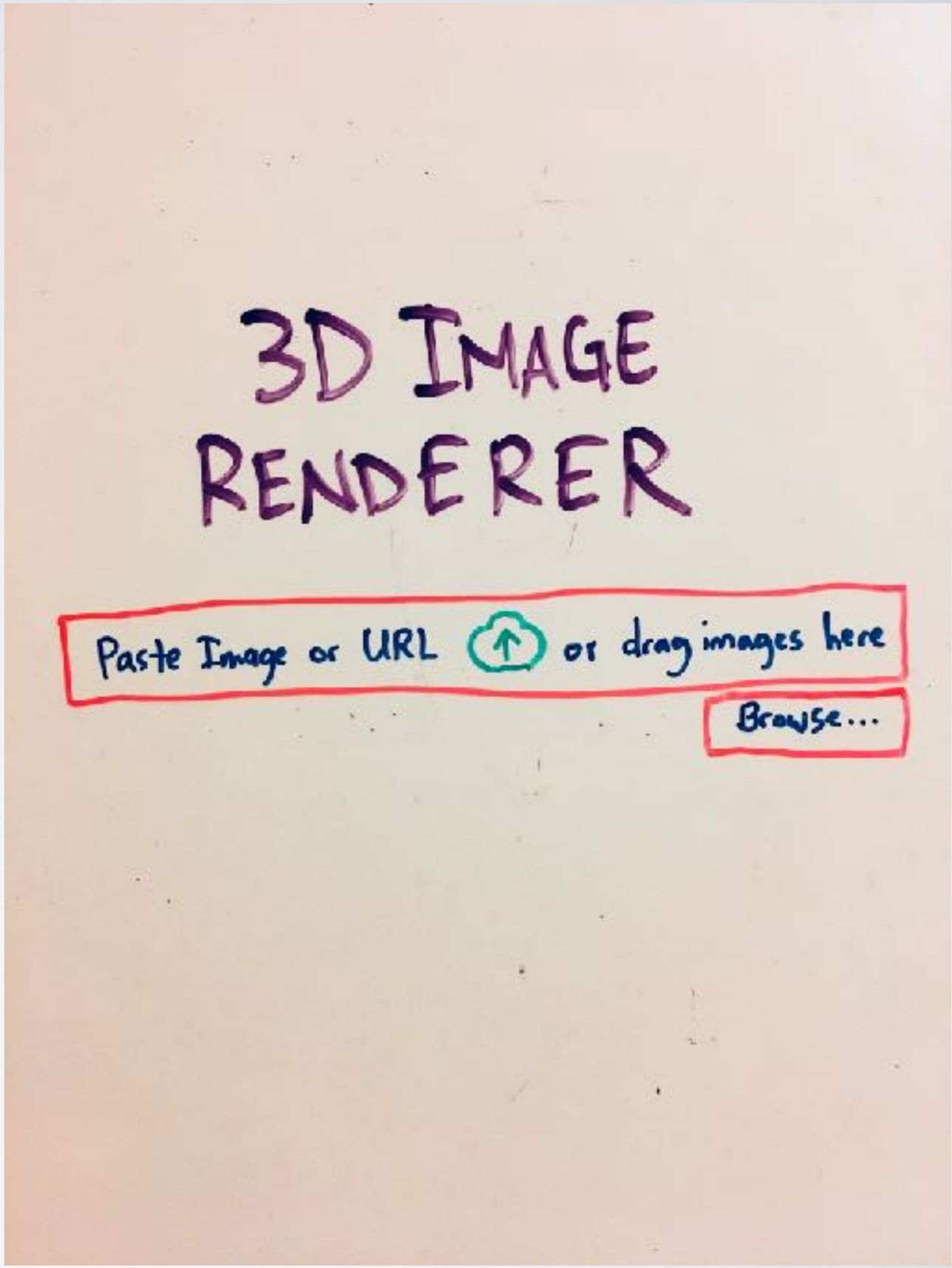
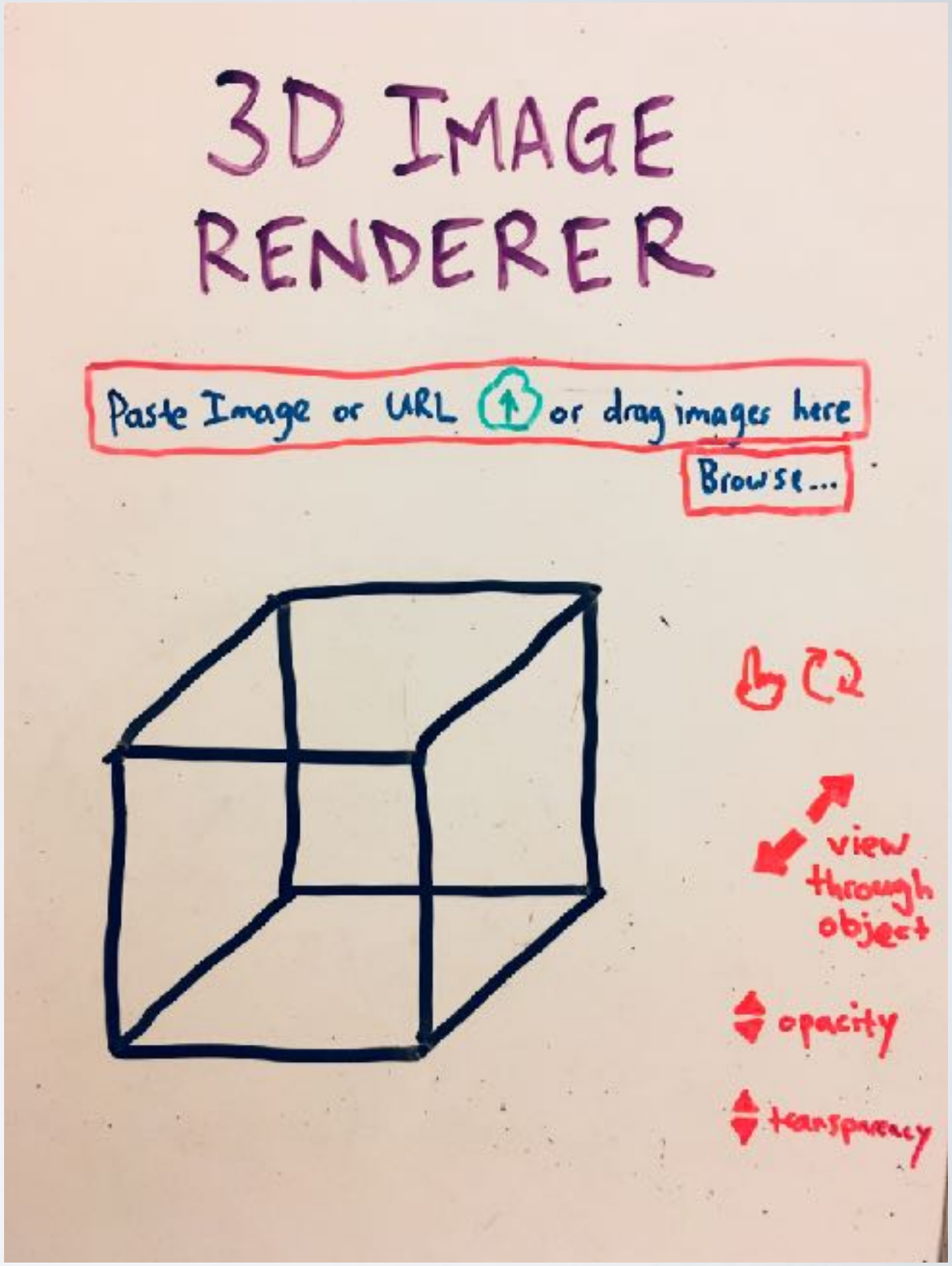


IMAGE PAGE

This page will show a rendered image(s) along with controls.

Something similar to the home page will appear the same above rendered image.



WORKS CITED

- https://en.wikipedia.org/wiki/Volume_rendering
- https://en.wikipedia.org/wiki/Volume_ray_casting
- https://en.wikipedia.org/wiki/Texture_splatting