# Exercise 5 - Shape from Silhouettes

**Computer Vision**

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## Silhouette extraction

The first task consists on setting the best threshold to extract the image silhouette. With the given images, the best threshold found was 100 which extract all the figure including the darkest zones because of shadows. It also extract some other places of the environment, but with the bounding box, the noisy extracted parts disappear. On Figure 1 there a snapshot of the silhouette extraction.

Figure 1: Silhouette extraction

## Volume of interest

Once the silhouette is extracted, it is required to specify the bounding box that will define the volume of interest for the computation of the Visual Hull. After some iterations, the final values for the bounding box to fit the object has been:

$$\begin{bmatrix} x_{min} & y_{min} & z_{min} \\ x_{max} & y_{max} & z_{max} \end{bmatrix} = \begin{bmatrix} 0 & -0.5 & -2 \\ 2.5 & 2 & 3 \end{bmatrix} \tag{1}$$

On Figure 2 there is a snapshot of the bounding box represented over the silhouette.

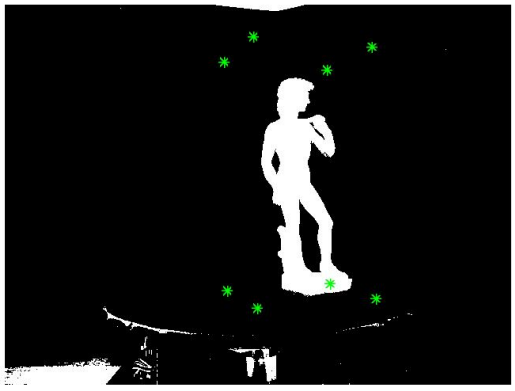


Figure 2: Volume of Interest

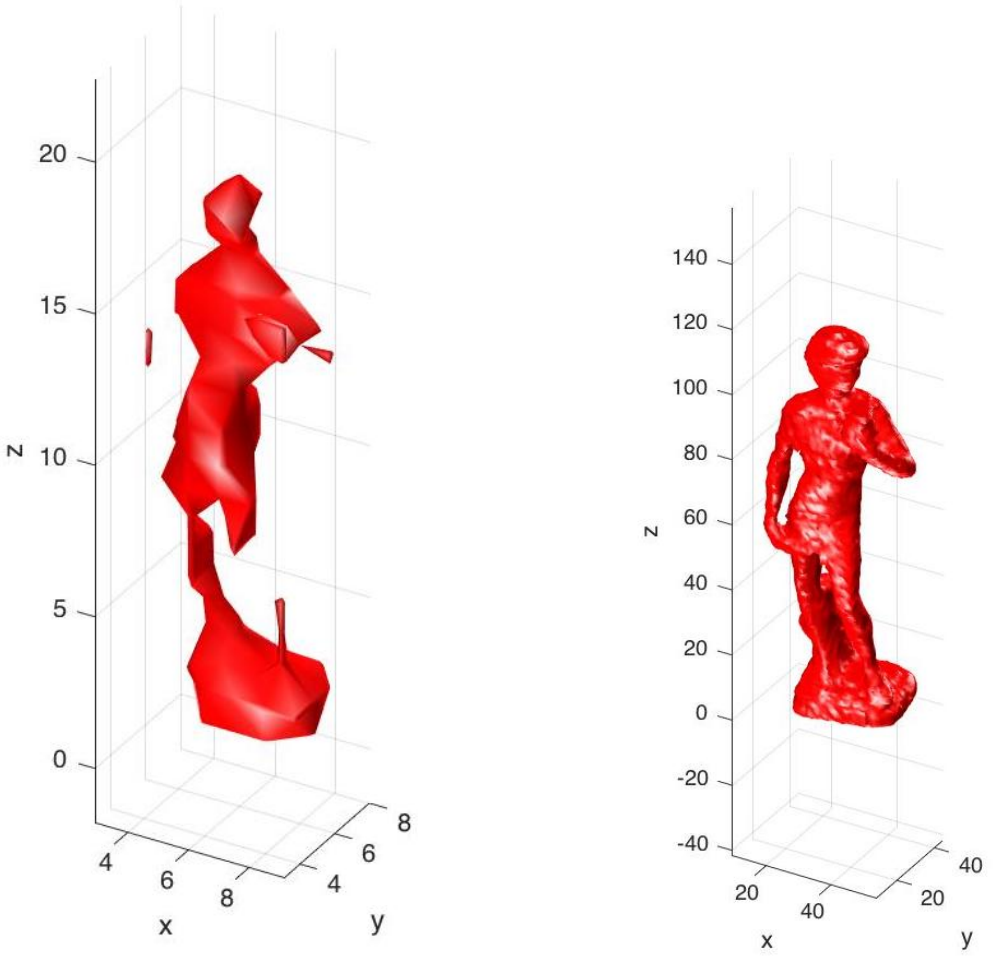
# Visual Hull

```
if computeVisualHull
    % Define volume.
    volume = zeros(volumeX,volumeY,volumeZ);

    % Visual hull computation
    % Task 7.3 Visual hull computation
    %   - add one to volume if projection is within silhouette region
    for n = 1:numCameras
        for i = 1:volumeX
            for j = 1:volumeY
                for k = 1:volumeZ
                    p = [i-.5 j-.5 k-.5 1]';
                    p_img = Ps{n} * T * p;
                    p_img = round(p_img ./ p_img(3));

                    % Check if the projected point ends out of the image
                    if p_img(1) <= 0 || p_img(1) > size(sils{n}, 2) ||
    ...
                       p_img(2) <= 0 || p_img(2) > size(sils{n}, 1)
                        continue;
                    end
                    volume(i,j,k) = volume(i,j,k) + sils{n}(p_img(2),
    p_img(1));
                end
            end
        end
    end
```

Listing 1: computeVisualHull




(a) Volume size: $(10, 10, 20)$

(b) Volume size: $(64, 64, 128)$

Figure 3: Volume Hull for different resolutions

## Improvements