Center of Pixel

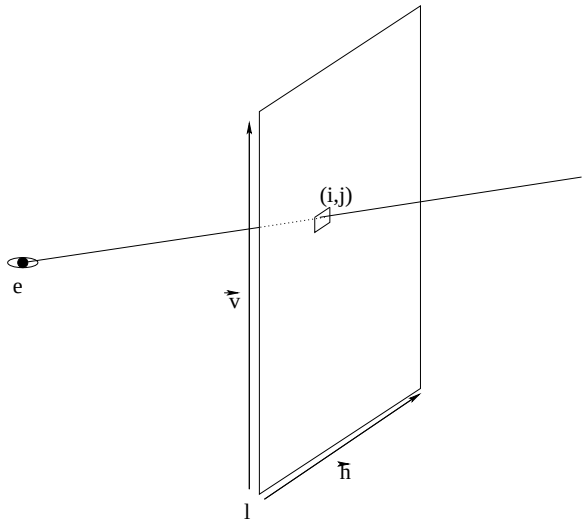

Figure 1: Screen in the virtual world and ray through the center of a pixel (i, j).

The eye ray for the pixel at (i, j) is described by:

Origin: e, the viewpoint.

Direction: $\big(l + \frac{(i+0.5)}{m} * \vec{h} + \frac{(j+0.5)}{n} * \vec{v}\big) - e$.

Geometric interpretation: to reach the lower left corner of the pixel from l (the lower left corner of the screen) we need to move i times by the vector running along the horizontal edge of a pixel and j times along the vector running along a vertical edge of a pixel. The vectors running along pixel's edges are $\vec{h}/m$ and $\vec{v}/n$ (assuming the image resolution is $m \times n$). Then, we need to move from the lower left corner to the center of the pixel, i.e. by $0.5 * \vec{h}/m + 0.5 * \vec{v}/n$. Hence the formula for the center of the pixel (i, j) is:

$$\big(l + \frac{i + 0.5}{m} * \vec{h} + \frac{j + 0.5}{n} * \vec{v}\big).$$

Subtracting e gives the coordinates of the vector running from e to the center of the pixel, i.e. the direction vector for the eye ray.