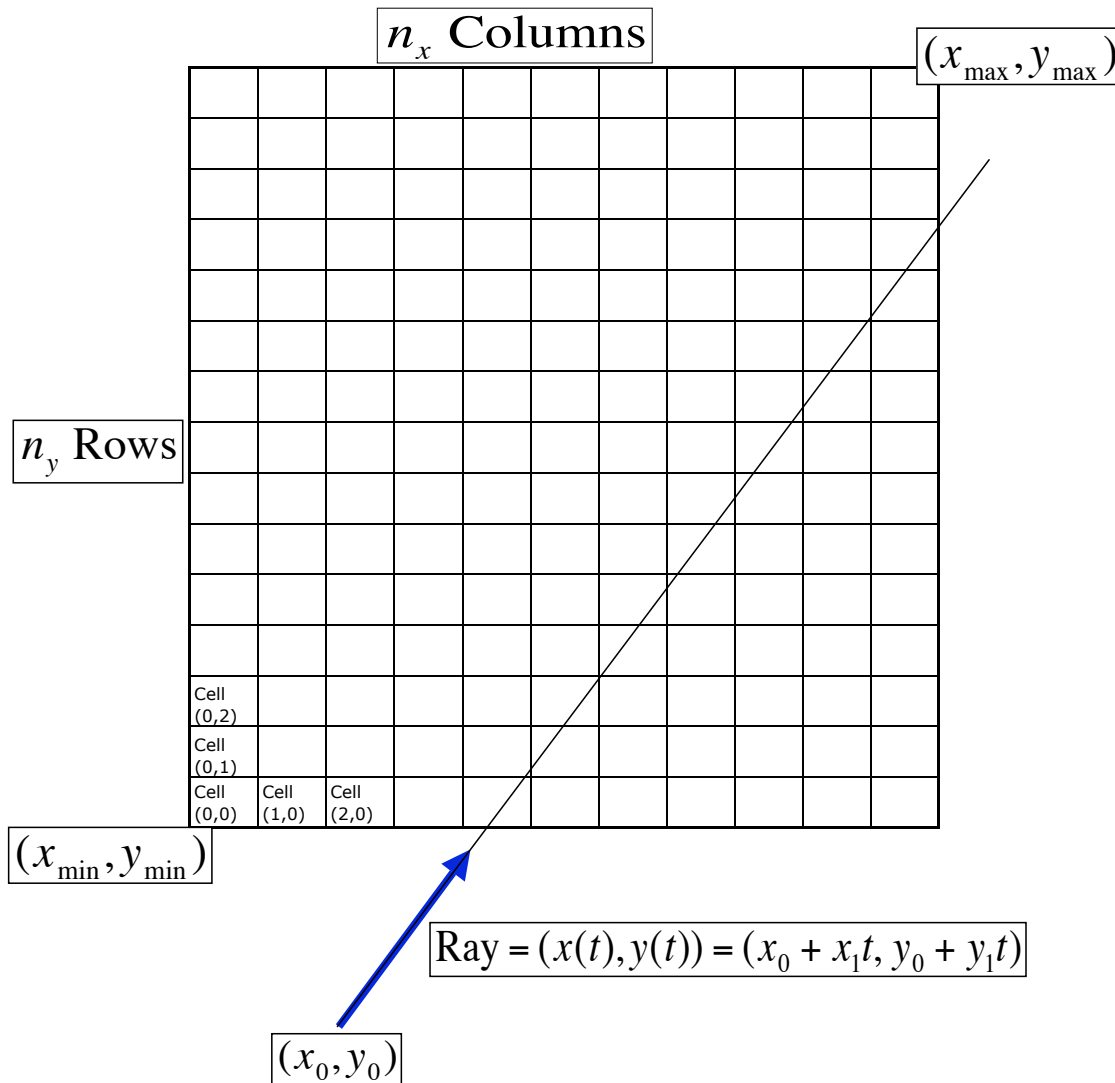


3DDDA (in 2D)



1. Find which boundary the ray hits first. This is done by computing the t value at which the ray intersects each of the four lines containing a boundary line segment. For example, the t value at which the ray hits the bottom line (call it t_b) is found by setting $y_{\min} = y_0 + y_1 t$ and solving $t_b = (y_{\min} - y_0) / y_1$. Likewise, solve for t_t , t_L , and t_R (the t values at which the ray intersects the top, left, and right edges). The first boundary hit will be the one corresponding to the smallest value t_t , t_b , t_L , t_R for which the intersection between the ray and the boundary line occurs within the limits of the boundary line segment. Call that parameter value t_c . Furthermore, define $dx = (x_{\max} - x_{\min}) / n_x$, $dy = (y_{\max} - y_{\min}) / n_y$, $sign_x = 1$ if $x_1 > 0$ and -1 if $x_1 < 0$, and $sign_y = 1$ if $y_1 > 0$ and -1 if $y_1 < 0$.
2. Find which cell contains the point $(x(t_c), y(t_c))$ (or in other words, which cell does the ray hit first). For example, if $t_c = t_b$, then the initial cell will be $(i, 0)$ where $i = (\text{int})(x_0 + x_1 t_c - x_{\min}) / dx$.
3. Compute dt_x and dt_y , the change in t values as the ray completely crosses a cell in the x and y directions. $dt_x = dx / x_1$ and $dt_y = dy / y_1$.
4. Find the t value at which the ray intersects the next horizontal cell boundary line. Call this value t_h . In the figure above, $t_h = (x_{\min} + (i+1)dx - x_0) / x_1$.
5. Find the t value at which the ray intersects the next vertical cell boundary, Call this value t_v . In the figure above, $t_v = t_c + dt_h$.
6. All of the above steps were initialization. Now to traverse the grid of voxels, we proceed as follows:

```

While( 0 <= i < nx and 0 <= j < ny){
    if(t_h < t_v){
        i += sign_x;
        t_h += dt_x
    }
    else{
        j += sign_y;
        t_v += dt_y;
    }
}

```