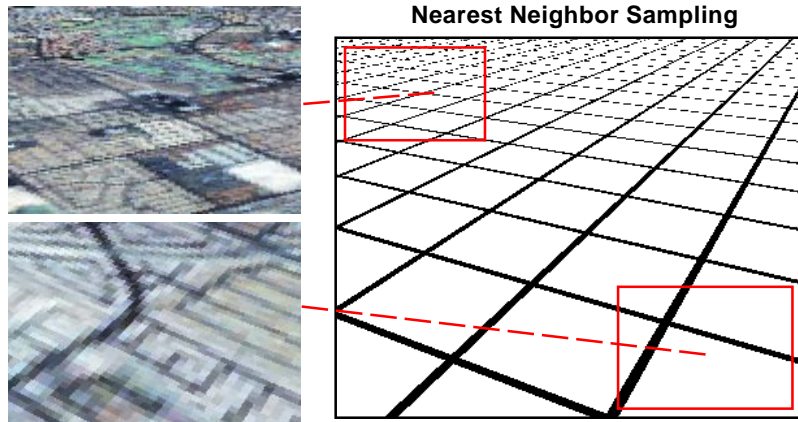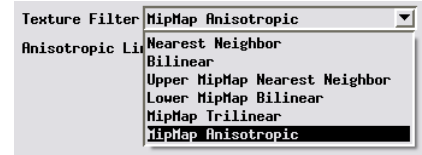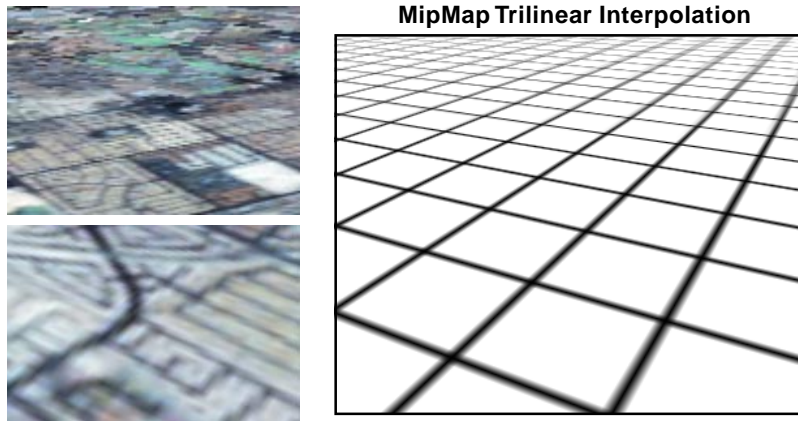# Texture Filters for 3D Rendering

In a 3D perspective view of a raster layer the foreground is magnified (one raster cell projects to a cluster of screen pixels) while background parts of the raster are "minified" (a cluster of raster cells project to each screen pixel). This perspective view geometry gives rise to aliasing artifacts that become more extreme at lower view angles. The Display process in TNTmips provides a set of texture filters (available from the Texture Filter menu on the Raster Layer Controls window's 3D panel for each drape raster) designed to suppress these 3D view artifacts.

The Nearest Neighbor and Bilinear Interpolation filters utilize only the full-resolution raster object in the Project File to create each screen pixel. The MipMap filters ea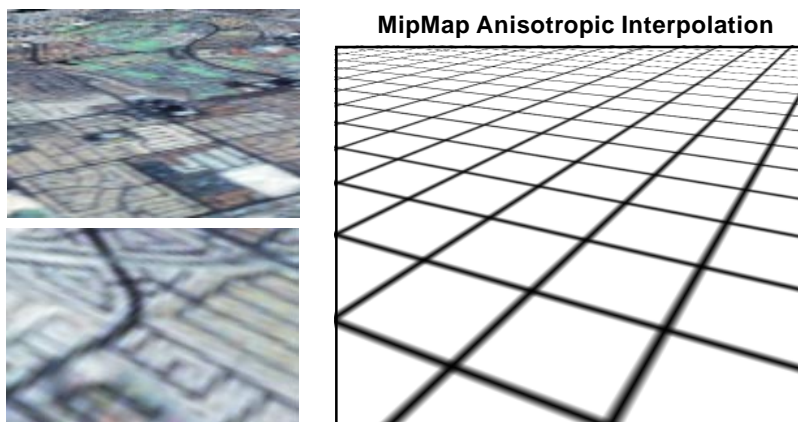ch use either one tier or pairs of tiers in the raster pyramid structure to create filtered screen pixels appropriate to their foreground/background position. The properties of selected filters are illustrated below for a texture raster showing a regular grid and a pan-sharpened Landsat 7 image of a city.

The **Nearest Neighbor** simple sampling filter uses the single full-resolution texture cell closest to the center of each screen pixel. The foreground of the resulting texture image is blocky and has jagged edges (lower inset image). The background areas appear speckly, and linear features lose continuity (upper inset image) as a result of undersampling (aliasing).

The **MipMap Trilinear** interpolation filter computes for each screen pixel a resolution value within the set of reduced-resolution pyramid tiers. The resulting resolution value can fall between tiers and is a fraction of the distance between the adjacent tiers. The filter retrieves the appropriately-located cell from each of these two tiers, then performs a weighted bilinear interpolation with the weights depending on the distance from the resolution value to each tier. The MipMap Trilinear Interpolation filter does a good job smoothing the image foreground, but in low-angle views it can produce excessive blurring, as illustrated in the box below.

Nearest Neighbor Sampling

MipMap Trilinear Interpolation

MipMap Anisotropic Interpolation

Projection of a screen pixel (red outline) onto texture raster (black grid). Arrow shows local direction of view.

full-resolution texture (tier 0)

MipMap Trilinear
Single pair of cells from adjacent pyramid tiers used in interpolation (shades of blue); longest edge of projected screen pixel selects tiers used (tiers 1 and 2 in this example).

MipMap Anisotropic
Interpolates using multiple pairs of pyramid cells along direction of view (shades of yellow, green); shortest edge of screen pixel selects tiers used (tiers 0 and 1 in this example).

The **MipMap Anisotropic** interpolation filter uses the smaller rather than longer side of the screen-pixel's projected footprint to determine the resolution value. It therefore uses smaller, higher-resolution pairs of pyramid cells than the other MipMap filters. Depending on the degree of elongation of the projected screen pixel, it can also take multiple samples along the direction of view (the line of anisotropy) up to the number you set for the Anisotropic Limit parameter. The filter provides good smoothing in the foreground and reduces background aliasing without excessive blurring.