

MapViewer Tutorial 3 – Tools for Altering Maps

MapViewer provides a number of tools for changing maps. These are:

- Convert grid map to vector map with box fitting
- Convert grid map to vector map with line fitting
- Average grid map with another grid map
- Generate Configuration Space
- Reduce map to values 0 and 1
- Smooth grid map

Each of these options are explained in this tutorial.

Convert grid map to vector map with box fitting

For people using vector maps (Saphira users mostly), this is a very useful feature. If you already have a map of an environment, either from architectural drawings or drawn in a paint package, you can use this tool (and the line fitting conversion algorithm) to convert it from a grid map (or image) into a vector map. Simply load in a map or image, and click “Tools/ Convert grid map to vector map with box fitting”. You will be prompted for the value at which cells are considered to be occupied. The default of 0.5 means that any cell with a value of 0.5 or greater will be turned into a vector.

When MapViewer has finished processing, the vector map will be displayed. All occupied grid cells have been turned into rectangles.

Convert grid map to vector map with line fitting using cell value

This is similar to the box fitting tool insofar as it converts a grid map into a vector map. However, it arguably creates a more accurate representation of the map since it doesn't just fit rectangles around groupings of cells. Instead it takes into account the orientation of groups of cells and fits lines to them. This is based on the sweep line Voronoi algorithm devised by Steven Fortune along with some filtering techniques. I've also added extra logic to reduce the dimensionality of the map by joining lines together.

To use this tool, load in a grid map or image, and click “*Tools/Convert grid map to vector map with line fitting using cell value*”. You are prompted to range of values that will be considered to be occupied cells. The cells that fall within this range will be converted to vectors.

This conversion tool is more computationally expensive and memory hungry than the box fitting algorithm, but is generally worth it since it creates superior vector maps.

Convert grid map to vector map with line fitting using contrast

This is very similar to the previous tool. However, a different cell-filtering technique is applied. Rather than choosing cells to be vectorised based on their value, all cells that have a neighbouring cell with a value sufficiently different to it are turned into vectors. This is essentially an edge-detection filter.

To use this tool, load a grid map or image and click “*Tools/Convert grid map to vector map with line fitting using contrast*”. You will be prompted for the contrast

value to use. If you choose, for example, 0.1, then any cell that has a neighbouring cell with a value of more than 0.1 next to it will be turned into a vector.

Average grid map with another grid map

Averaging one map with another means superimposing one grid map over the loaded map, and changing each cell to the average of the corresponding cells of both maps. One useful application of this is to collate together the maps generated in multiple different test runs i.e. averaging the results of a large sample space. To properly average more than two maps, a running average is kept of maps. This means that if two maps are averaged, the value of a cell is

$$\frac{Cell1 + Cell2}{2}$$

If three maps are averaged, the value of each cell is

$$\frac{Cell1 + Cell2 + Cell3}{3}$$

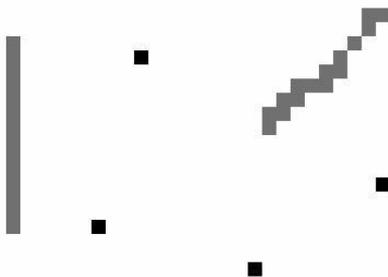
and so on for all subsequent maps.

To average maps, first load a map by clicking the Load button . Now, click “Tools/Average Grid Map With Another Grid Map”. You are prompted to load the map that will be averaged with.

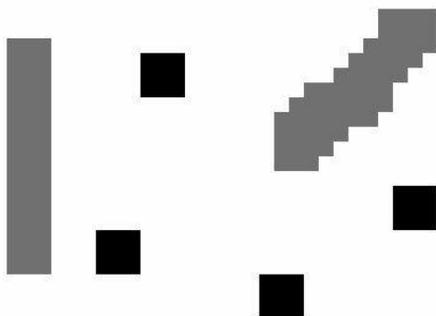
This tool only makes sense to use if the two maps have the same origin point. Averaging two completely different maps will give less useful results.

Generate Configuration Space

The configuration space of a map specifies the areas in the map which the robot can be placed without colliding with an obstacle. The easiest way of defining this is to “grow” the occupied cells in the map by a distance equal to the radius of the robot. For example, given the (not very impressive) map below,



the map after the configuration space of 1 cell has been generated looks like this:



This technique is widely used in path planning, as it can be pre-computed, and afterwards the robot can be treated as a single point rather than as a 2D shape, which makes the path planning algorithm less computationally expensive.

Reduce map to values 0 and 1

This is a thresholding tool which sets all values in a certain range to 1, and all others to 0. This technique is used by some path planning algorithms, as well as in line fitting algorithms - both the box and line fitting algorithms in this application use this as part of converting the grid map to a vector map.

To use this, click “Tools/Reduce map to values 0 and 1”. This brings up a dialog box asking the range of values to set to 1. For example, if you set it to 0.5 and 1, all values between 0.5 and 1 are set to 1, while all cells between 0 and 0.5 (not inclusive of 0.5) are set to 0.

Smooth grid map

This smooths the map. Any cell (or pixel) in a defined range that is surrounded by three or more cells that are *not* in that range has its value changed to be an average of the values of the cells surrounding it. This can be useful in grid maps where there are many individual cells that you’d like to ‘clean up’ and remove.

To use this, click “Tools/Smooth Grid Map”. This brings up a dialog box asking the range of values to smooth away. Change the default values if you like, and click OK.