

OPC for SurferManipulator Instructions

Instructions Version 1.1
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SurferManipulator is a VisualBasic program originally written to interface with the GIS software Surfer for Windows (Golden Software). In addition to this, it implements the stand-alone simple custom GIS software for calculation of Orientation Patch Count (OPC), as outlined in Evans *et al.* (2007, *Nature* **445**: 78-81).

The instructions below explain the software and 3D files required, the options available for OPC calculation, and the results files that are outputted from the program. OPC calculation does not require Surfer for Windows.

The software has been thoroughly tested, but only on a limited number of computer configurations (Windows 2000 and Windows XP). If you have any comments or ideas for improvement, I'd be very glad to here them: arevans-at-fastmail.fm.

Software

SurferManipulator

Download from <http://users.monash.edu.au/~arevans/software.html>. Unzip into a new directory.

Requires Windows 2000 or Windows XP.

Cortona VRML Client

Must be installed from <http://www.parallelgraphics.com/products/cortona/>

Grid Point Files

Grid point files should be in comma-delimited x,y,z format, with a single point on each line, e.g.

1.00,1.00,3.25

2.00,1.00,5.23

1.00,2.00,2.93

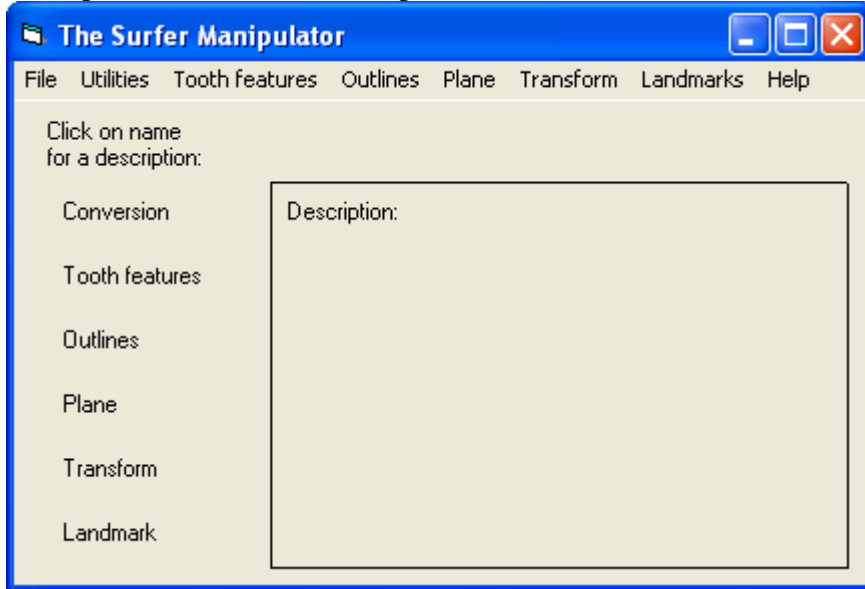
2.00,2.00,4.12

Points can be listed in any order. Grid points that are not part of the tooth surface should be left out of the file, so that the points only represent the tooth surface. The remainder of the grid outside the tooth will be left blank and not processed. The length of the longest side of the grid is usually less than 200 grid lines; the maximum side length tested is 400.

OPC Calculation

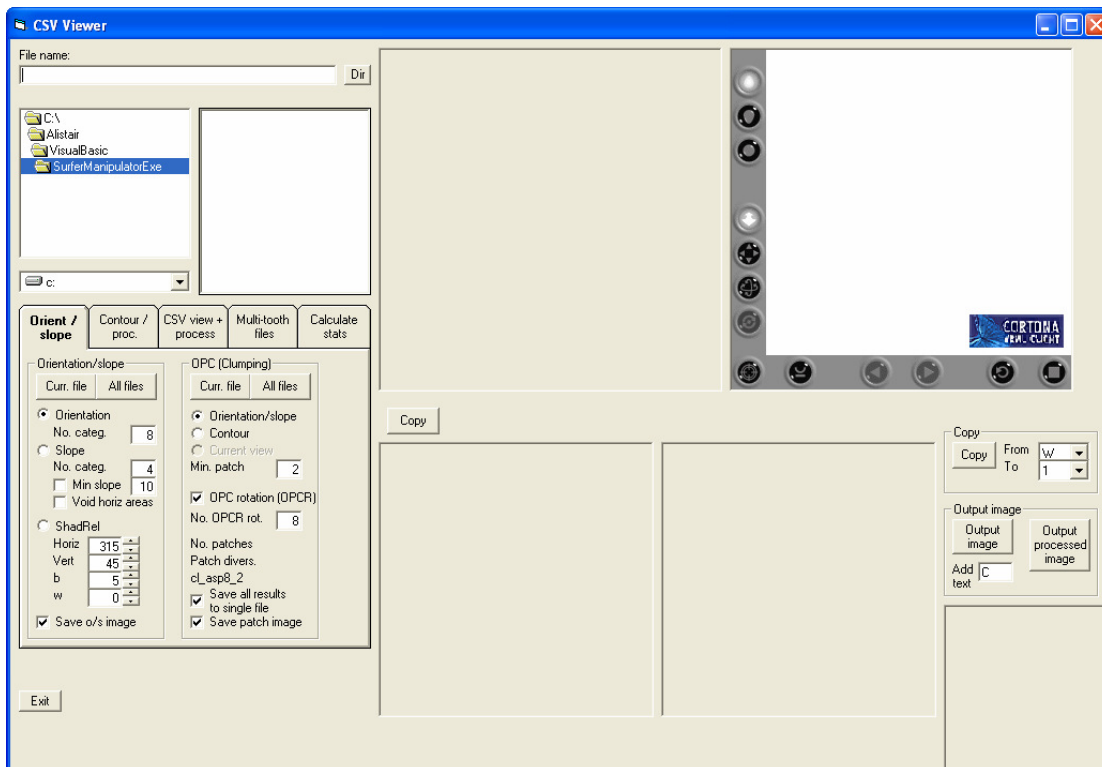
Run SurferManipulator (SurferManipulator.exe)

Startup window of SurferManipulator:



In the Startup window, open Utilities > CSV viewer

CSV Viewer window:

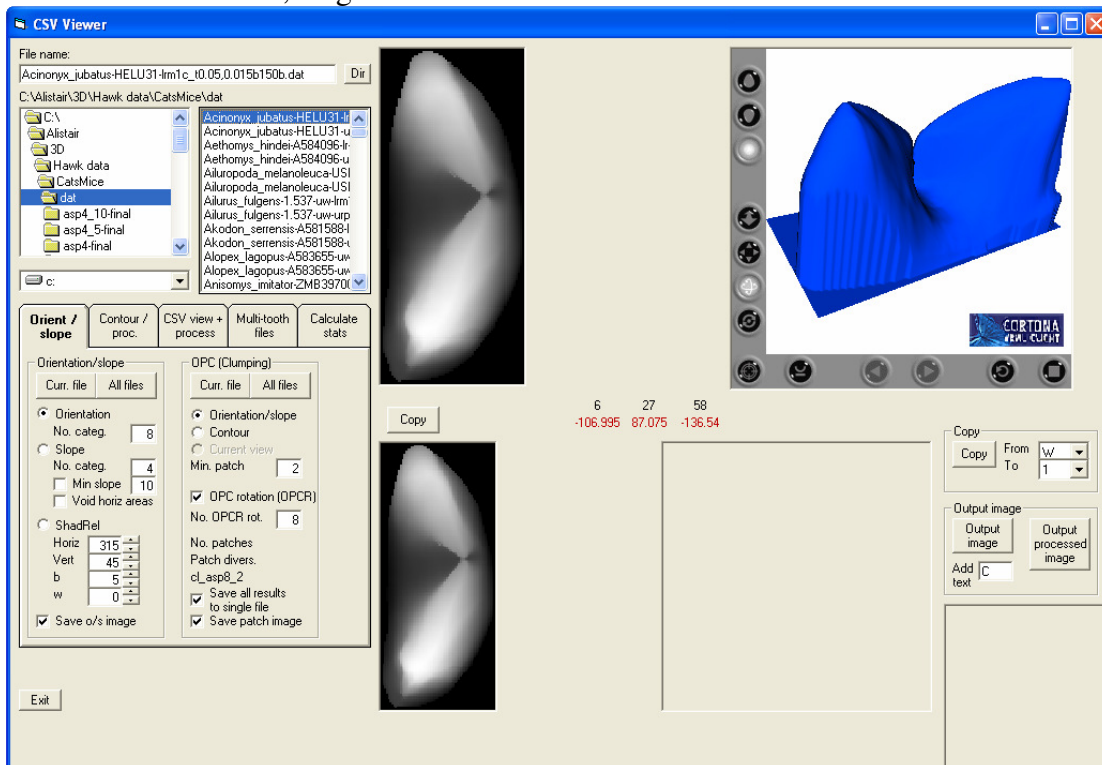


To process single or multiple files for OPC and OPCR:

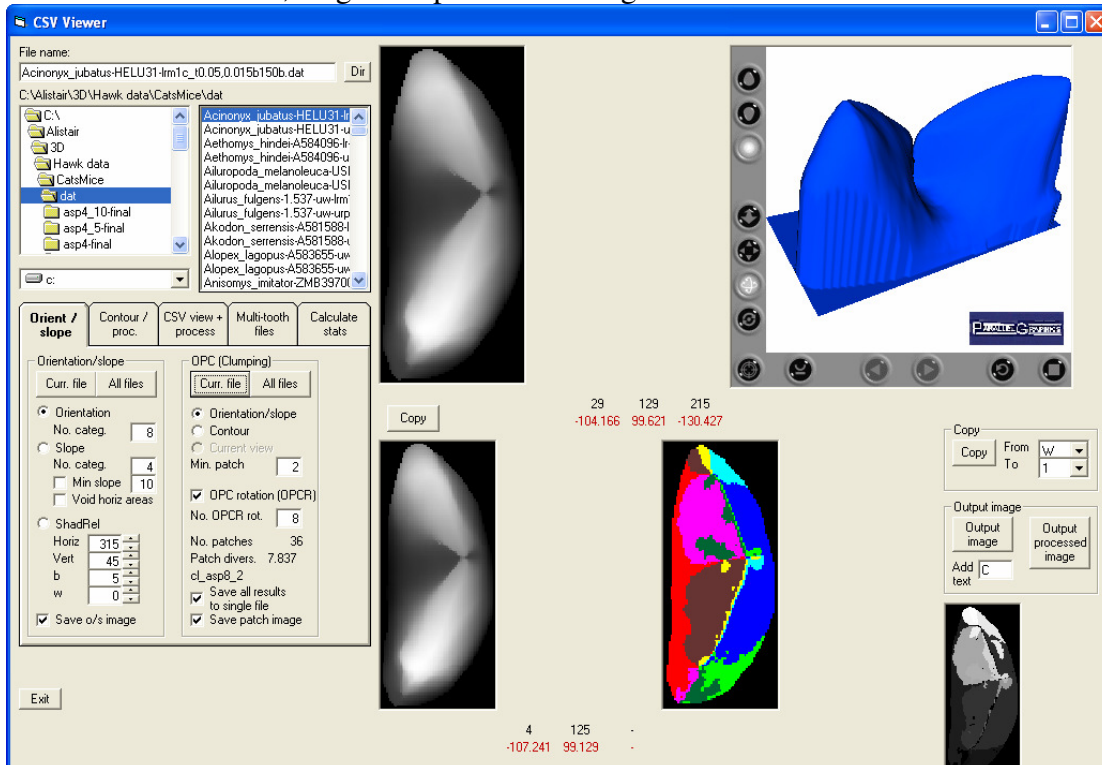
1. Navigate to desired directory using Drive and Folder boxes.
2. Select required options in 'OPC (Clumping)' frame:
 - a. 'Orientation/slope' – select to use orientation or slope settings in the 'Orientation/slope' frame for the processing; this is the option to use for calculating OPC;
 - b. 'Contour' – select to use contour settings in the 'Contour / proc.' tab;

- c. 'Min. patch' – minimum patch size in pixels; only patches above this size will be counted;
 - d. 'OPC rotation (OPCR)' – select this option to run OPCR at the same time as OPC; as this option repeats the OPC calculation n times, it takes n times as long to run each file;
 - e. 'No. OPCR rot.' – number of rotations around the z axis to repeat the OPC calculation;
 - f. 'Save all results to single file' – creates a file with a summary of the results for all files processed; only available when processing All files in directory;
 - g. 'Save patch image' – save bmp image of final clumped patch processing in the current directory.
3. To process one or more files, either:
 - a. Select file from File box and click 'Curr. file' in 'OPC (Clumping)' frame to process a single file; or
 - b. Click 'All files' in 'OPC (Clumping)' to process all files in the current directory.

CSV Viewer window; single file selected:



CSV Viewer window; single file processed using OPC:



Orientation/slope settings:

1. 'Orientation' – select to run orientation (otherwise known as aspect) mapping.
 - a. 'No. categ.' is the number of orientation categories into which the 360° of orientation is divided; e.g. if no. categ. = 8, then orientations are divided into eight 45° sections, with the first centred around the 0° direction (to the top of the page).
2. 'Slope' – select to run slope mapping. Slope mapping cannot be used for 'OPC (Clumping)' processing, although the 'Min. slope' and 'Void horiz areas' options do apply to OPC processing.
 - a. 'No. categ.' is the number of slope categories into which the 90° of slope is divided.
 - b. 'Min. slope' – check to set all areas less than the minimum slope value to horizontal. These will be then be set to a separate patch.
 - c. 'Void horiz areas' – check to set all horizontal areas to be excluded from analysis and these areas of the map are blanked.
3. 'ShadRel' – select to create a shaded relief map. Not fully functional at this time.
4. 'Save o/s image' – select to save orientation or slope map as a bmp image in the current directory.

Description of OPC and OPCR Functions and Results Files

Each type of processing generates a new directory with a name (called the 'extension') based on the type of processing.

Extension: cl_asp[no. categories]_[min. patch size]_[min. slope (optional)][vh for void horizontal (optional)]

‘cl’ refers to clumping (the procedure used to create patches), ‘asp’ refers to aspect or orientation mapping.

Examples: cl_asp8_2 8 orientations, min. patch size 2
 cl_asp4_10_5 4 orientations, min. patch size 10, group all areas with slope less than 5° as separate patches
 cl_asp4_20_10vh 4 orientations, min. patch size 20, void all areas with slope less than 10°

For each grid point file, two results files are generated, which are placed into the [Extension] directory. The names of these files end with the processing extension.

[Filename]-[Extension].csv

Lists the x,y coordinates of all points in the file, followed by the identifying patch number, e.g.

1.00,1.00,1
 2.00, 1.00,2
 1.00,2.00,2
 2.00,2.00,3

[Filename]-[Extension]results.csv

First part of the file lists statistics about the analysis and patch (clump) sizes, e.g.

"ClumpInfo"	"NoClumps"	"ClumpSizeMean"	"ClumpSizeSD"	"ClumpSizeMin"	"ClumpSizeMax"	"ClumpSizeMed"	"ClumpSize1Q"	"ClumpSize3Q"	"PatchDiversityClump"
"cl_asp8_2"	40	165.9	385.468333196692	3	1685	3	3	3	7.39910452219915

The basic measure of **OPC** is listed in the column ‘NoClumps’, which indicates the number of clumps or patches found in this file when the ‘ClumpInfo’ type of processing is applied. The other statistics refer to mean, standard deviation (SD), minimum, maximum, median, and 1st and 3rd quartiles of patch size (measured in number of pixels), and patch diversity as defined in Evans et al. (2007).

The second part of the file lists each identifying patch number and its size, e.g.:

"ClumpNo","ClumpSize"
 1,1
 2,2
 3,1

If the ‘All files’ button is pressed and the ‘Save all results to single file’ option is checked, then a third file is generated:

00[Extension]allresults.csv

This file contains the line of statistics for each grid file processed, with the filename (X1, X2) listed in the first column, e.g.

"File"	"ClumpInfo"	"NoClumps"	"ClumpSizeMean"	"ClumpSizeSD"	"ClumpSizeMin"	"ClumpSizeMax"	"ClumpSizeMed"	"ClumpSize1Q"	"ClumpSize3Q"	"PatchDiversityClump"
"X1, X2"	"ClumpInfo"	"NoClumps"	"ClumpSizeMean"	"ClumpSizeSD"	"ClumpSizeMin"	"ClumpSizeMax"	"ClumpSizeMed"	"ClumpSize1Q"	"ClumpSize3Q"	"PatchDiversityClump"

X 1	"cl_as p8_2"	40	165.9	385.4683 3319669 2	3	1685	3	3	3	7.3991045 2219915
X 2	"cl_as p8_2"	40	165.9	385.4683 3319669 2	3	1685	3	3	3	7.3991045 2219915

If the 'OPCR' option is selected, then a fourth file is generated:

00[Extension]_R[No. OPCR rot.]-OPCRallresults.csv

This file has the same structure as the 00[Extension]allresults.csv file, except the results refer to the mean of all statistics for the repetitions of the OPC calculation for each grid file, and these column headings have '_OPCR' at the end.