

Extract Boundary plugin for ParaView

Siavash Ameli *

*Shadden Research Group
University of California, Berkeley*

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Abstract

This is user guide of Extract Boundary program for two dimensional grids. This program can be used as ParaView plugin or a stand alone program. Users will find building and installation process and usage examples in both terminal and ParaView.

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*Email address: sameli@berkeley.edu

1 Introduction

This package has been created to facilitate ParaView users that interact with two dimensional data grids. This package is utilized as a ParaView plugin, so the end users could take advantage of it as a new Filter. The *Extract Boundary* filter extracts boundaries of a 2D grid. It is robust to concave geometries, unusual cell links in a boundary point and acute and narrow bay-like shapes. Furthermore, user may opt for extracting all inner boundaries, such as lakes. This filter also identifies points with zero velocity. Inward or outward normal vectors are also calculated at each point.

The program accepts various grid types such as structured or unstructured grids. Also it works well with different two dimensional cell types, for instance triangular, polygons, etc. Moreover, multiple file formats are supported. Common file formats are legacy `*.vtk` and binary `*.vtu` extensions.

2 Build Source

User can build the code from source. You can obtain the source code from github repository¹. Please install `git` package:

```
sudo apt-get install git
```

Then, create a build directory and download the source code inside the build directory:

```
$ mkdir /tmp/ExtractBoundary
$ cd /tmp/ExtractBoundary
$ git clone git://github.com/ameli/extract-boundary
```

Now, build the code:

```
$ cmake .
$ make
$ sudo make install
$ cd ..
$ rm -r /tmp/ExtractBoundary
```

Installation is system-wide for all users.

¹<https://github.com/ameli/extract-boundary>

3 Install Binary

You may use binary package instead of building code from source. Binary installation is available for Ubuntu operating system. Follow these commands in Ubuntu terminal:

```
$ sudo add-apt-repository ppa:ameli/extractboundary  
$ sudo apt-get update  
$ sudo apt-get install extractboundary
```

4 Options

Filter has the following options:

Search Boundary Mode can be Outer boundary or outer and all inner boundaries. Default is on searching only outer boundaries, which is $\mathcal{O}(\sqrt{n})$. Inner and outer boundary search is in order of $\mathcal{O}(n)$.

Extract Velocity Boundary is boolean. Default is on `true`.

Calculate Normals is boolean. Default value is set to `true`.

Normals Outward is boolean. Default value is set to `false`.

5 Program Usage

You can use the program either in terminal or as a ParaView plugin. Here are examples to use it in terminal:

```
$ extractboundary /input-path/inputfile.vtk /output-path/outputfile.vtk
```

You can also define only output filename without path. In this case, program writes output file in the same directory of input path.

```
$ extractboundary /input-path/inputfile.vtk outputfile.vtk
```

You may not define any path. So it considers the current directory for both input and output path:

```
$ extractboundary inputfile.vtk outputfile.vtk
```

If user do not specify output file, it writes output file with the same name as input file name with a `-boundary` suffix and the same file extension of input file.

```
$ extractboundary /input-path/inputfile.vtk
```

or

```
$ extractboundary inputfile.vtk
```

In this case, output file name would be `inputfile-boundary.vtk`.

For help, use `-h`, for get program information use `-i` and for see the license, use `-l` options.

```
$ extractboundary -h
$ extractboundary -i
$ extractboundary -l
```

A sample vtk output file is similar to the following:

Listing 1: Sample output vtk file

```
0 # vtk DataFile Version 3.0
vtk output
ASCII
DATASET POLYDATA
POINTS 55 float
5 4 14 0 1 12 0 2 11 0
1 10 0 1 9 0 2 8 0
3 6 0 2 5 0 4 2 0
...
10 VERTICES 55 110
1 0
1 1
1 2
...
15 POLYGONS 3 30
14 0 1 2 3 4 5 6 7 8 9 10 11 12 13
8 26 27 28 29 30 31 32 33
8 34 35 36 37 38 39 40 41
20 POINT_DATA 55
NORMALS NormalVectors double
0.0621374 -0.998068 0 0.995133 -0.0985376 0 1 0 0
0.92388 -0.382683 0 0.92388 0.382683 0 0.811242 0.58471 0
25 0.987087 -0.160182 0 0.995133 -0.0985376 0 0.471858 0.881675 0
...
FIELD FieldData 1
VelocityBoundary 1 55 unsigned_int
30 0 1 1 1 0 0 0 0 0
0 0 0 0 0 0 0 1 1
1 0 0 0 0 0 0 0 0
...
```

6 ParaView Plugin Usage

Figures 1 to 4 show how to load the plugin and use it. Also Figures 5 to 10 illustrate how the filter is implemented on a 2D unstructured grid.

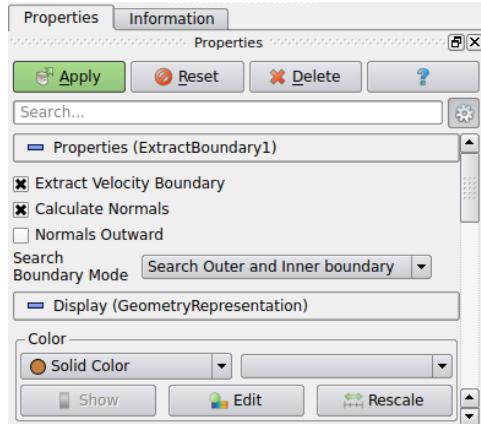


Figure 1: Options of the filter in Properties toolbar

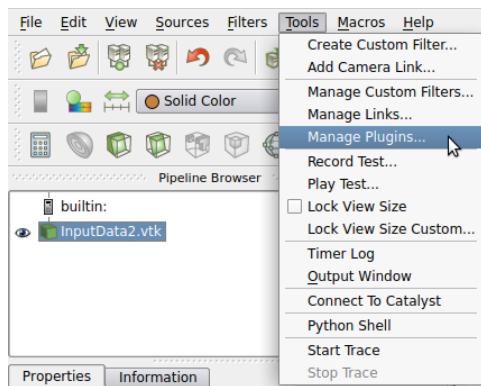


Figure 2: Manage Plugins

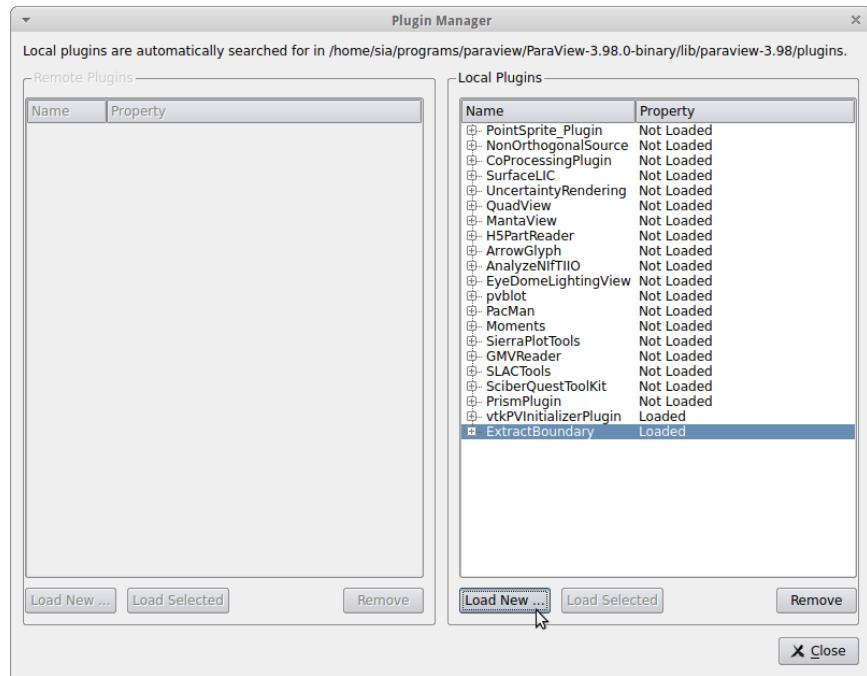


Figure 3: Plugin Manager

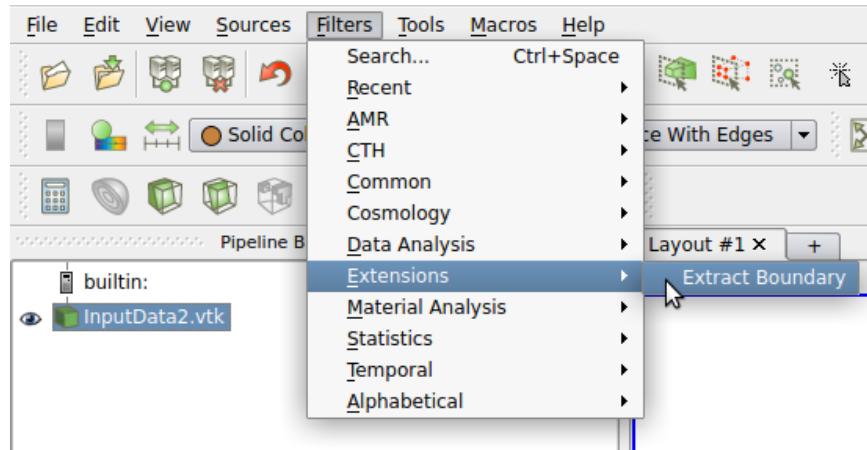


Figure 4: Find Extract Boundary filter in Extension sub-menu

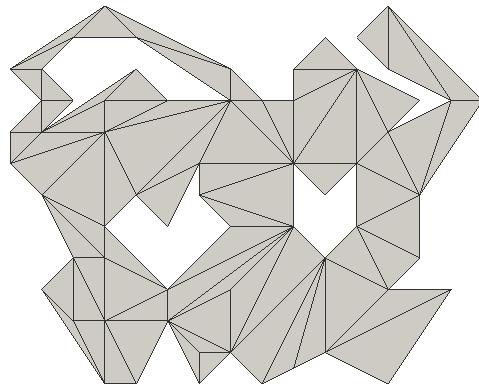


Figure 5: An unstructured 2D grid with cavities, bay and acute boundary edges

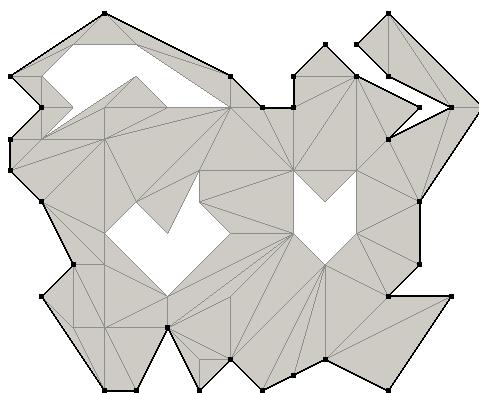


Figure 6: Outer boundary is extracted from rest of the grid

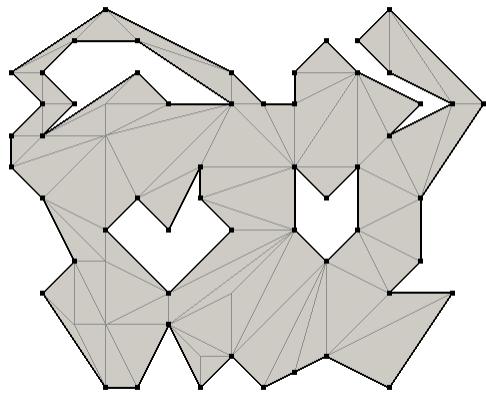


Figure 7: Outer and all inner boundaries are extracted from rest of the grid

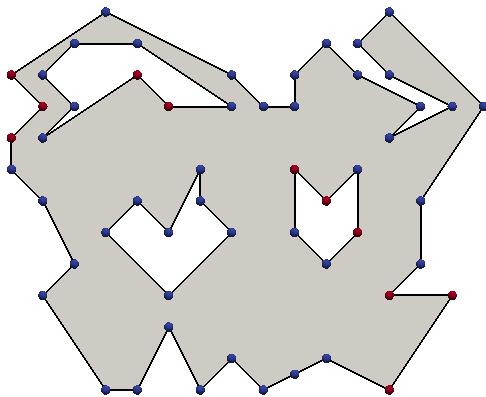


Figure 8: Points with red colors are zero velocity points. Blue points have non zero velocities.

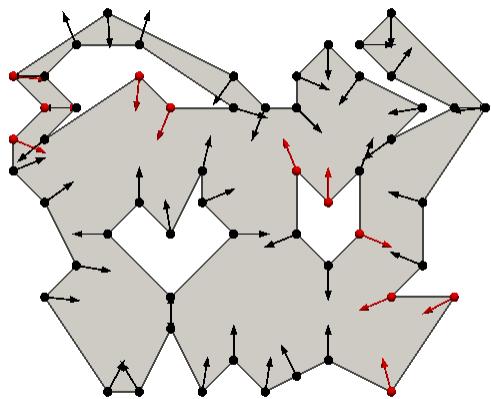


Figure 9: Inward Normal vectors at each boundary point

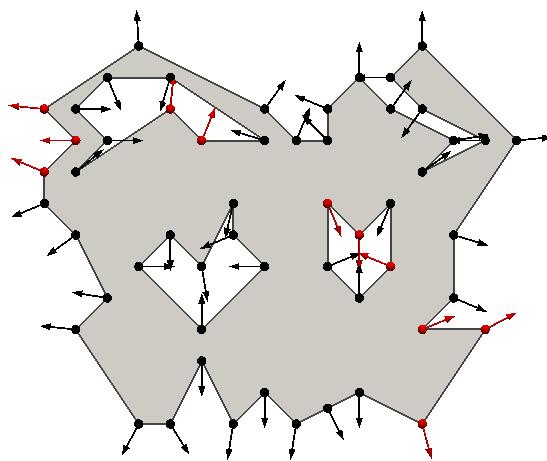


Figure 10: Outward Normal vectors at each boundary point

7 License ²

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8 Bug Report

Any bug reports and comments are appreciated. You may report bugs in github ³, Launchpad ⁴ or send email ⁵.

9 Acknowledgement

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²Copyright © 2013 Siavash Ameli

³<https://github.com/ameli/extract-boundary>

⁴<https://bugs.launchpad.net/~ameli>

⁵sameli@berkeley.edu