Efficient processing of dense UAV point clouds

Class project presentation

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GIS595/MEA792: UAV/lidar data analytics course

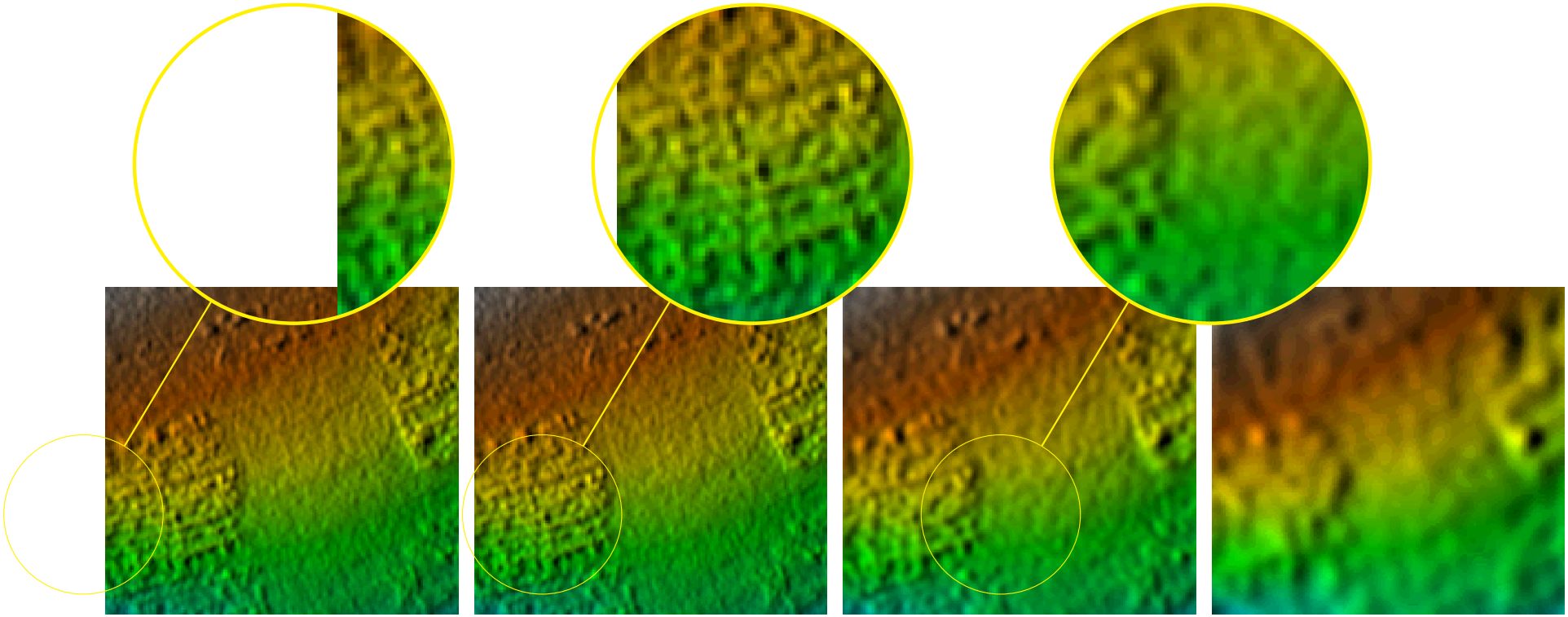
Questions

- How many points are really necessary to create a detailed DEM?
- Which method of point decimation preserve more information?

Implementation

- Open source implementation for further review and improvement.
- Methods implemented in GRASS GIS so that they can be used by a broad audience.

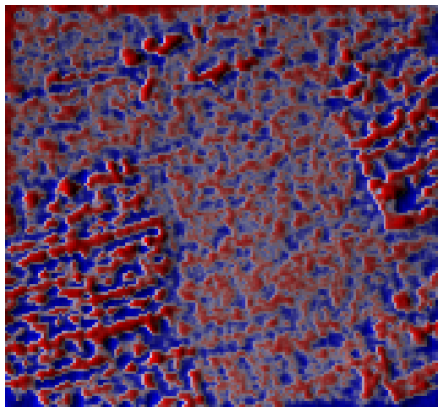
Count-based decimation influence on interpolated elevation



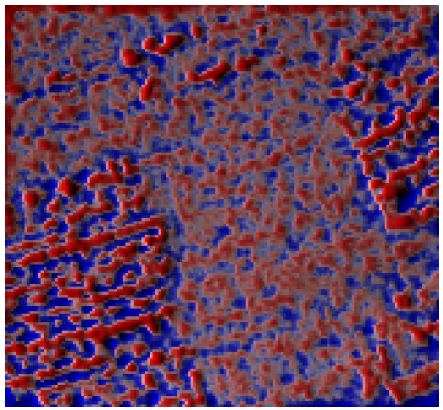
all	skip=5	preserve=20	preserve=100
0 %	20 %	90 %	99 %

```
g.region nsres=0.3 ewres=0.3 rows=149 cols=161
(cells=23989)
v.surf.rst ...  npmin=120 tension=20 smooth=2 segmax=40
```

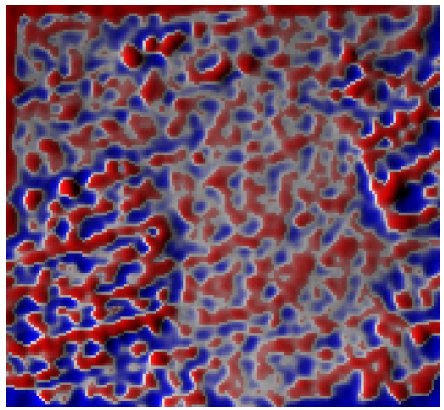
Count-based decimation influence on local relief model



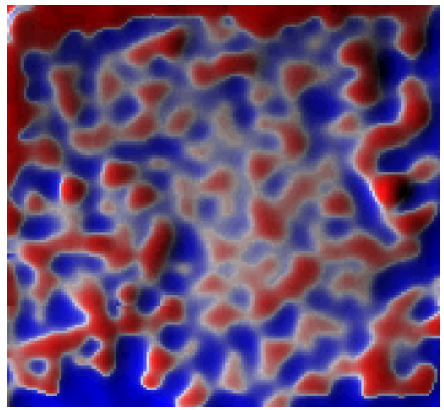
all
0 %



skip=5
20 %



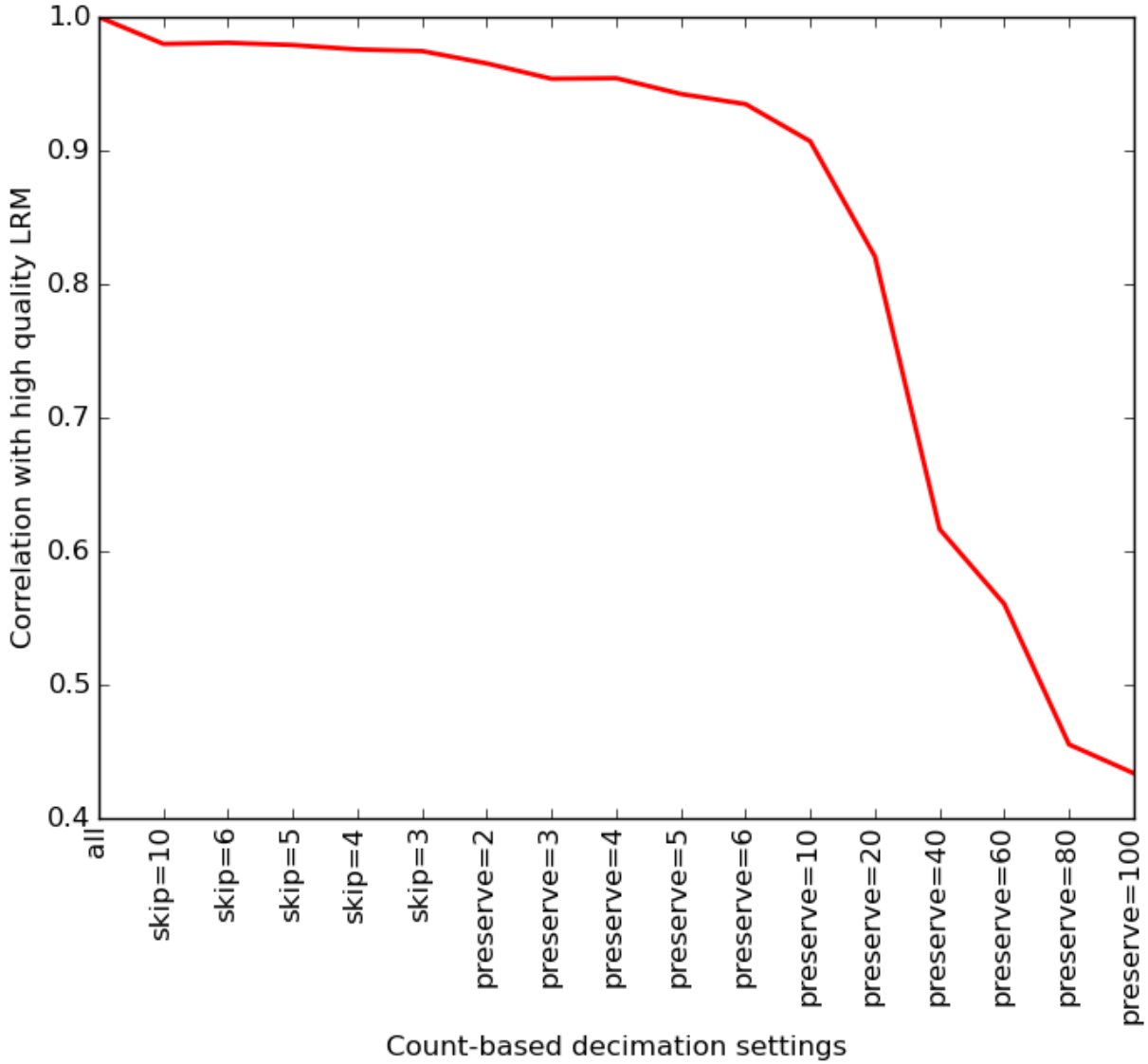
preserve=20
90 %



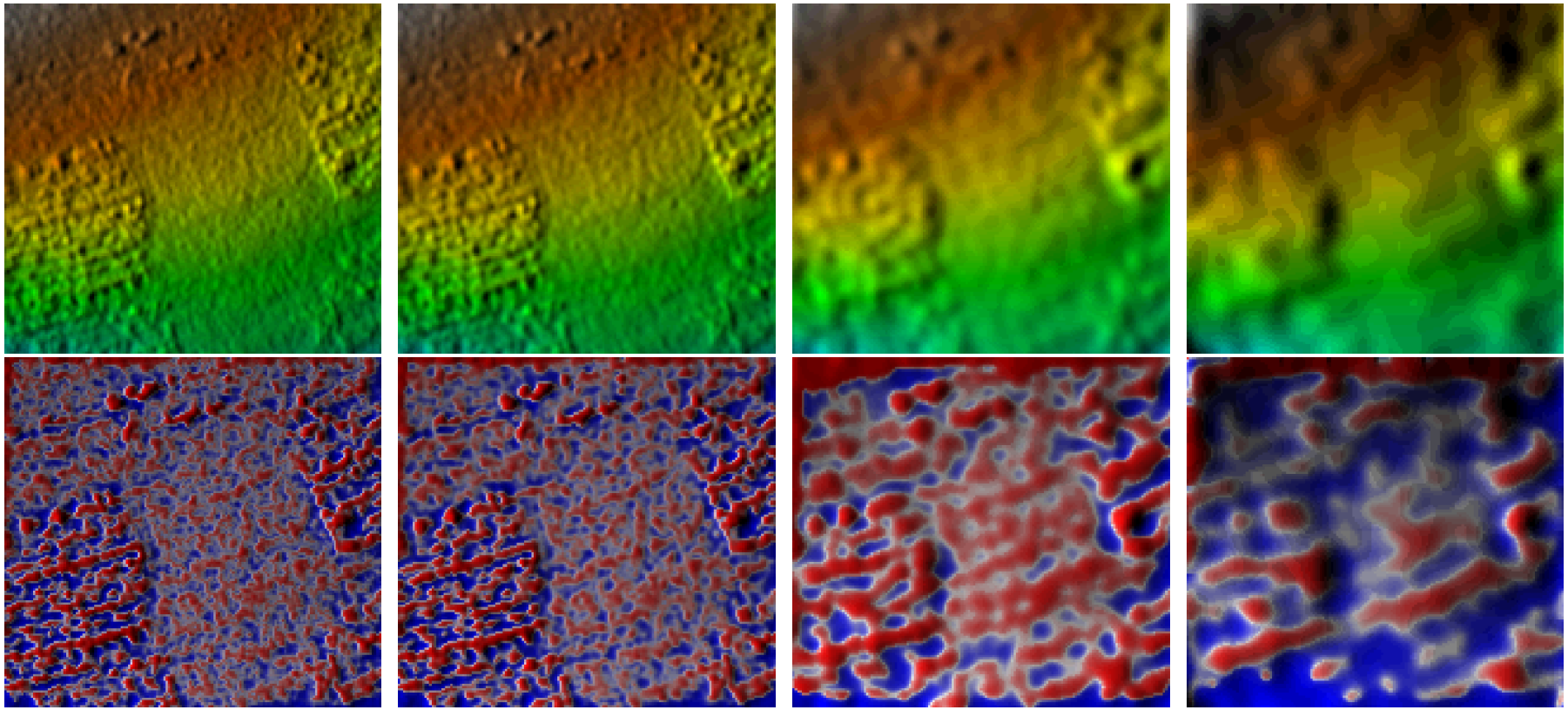
preserve=100
99 %

```
r.local.relief input=... output=... shaded_output=...
neighborhood=11
```

Progressiveness of count-based decimation

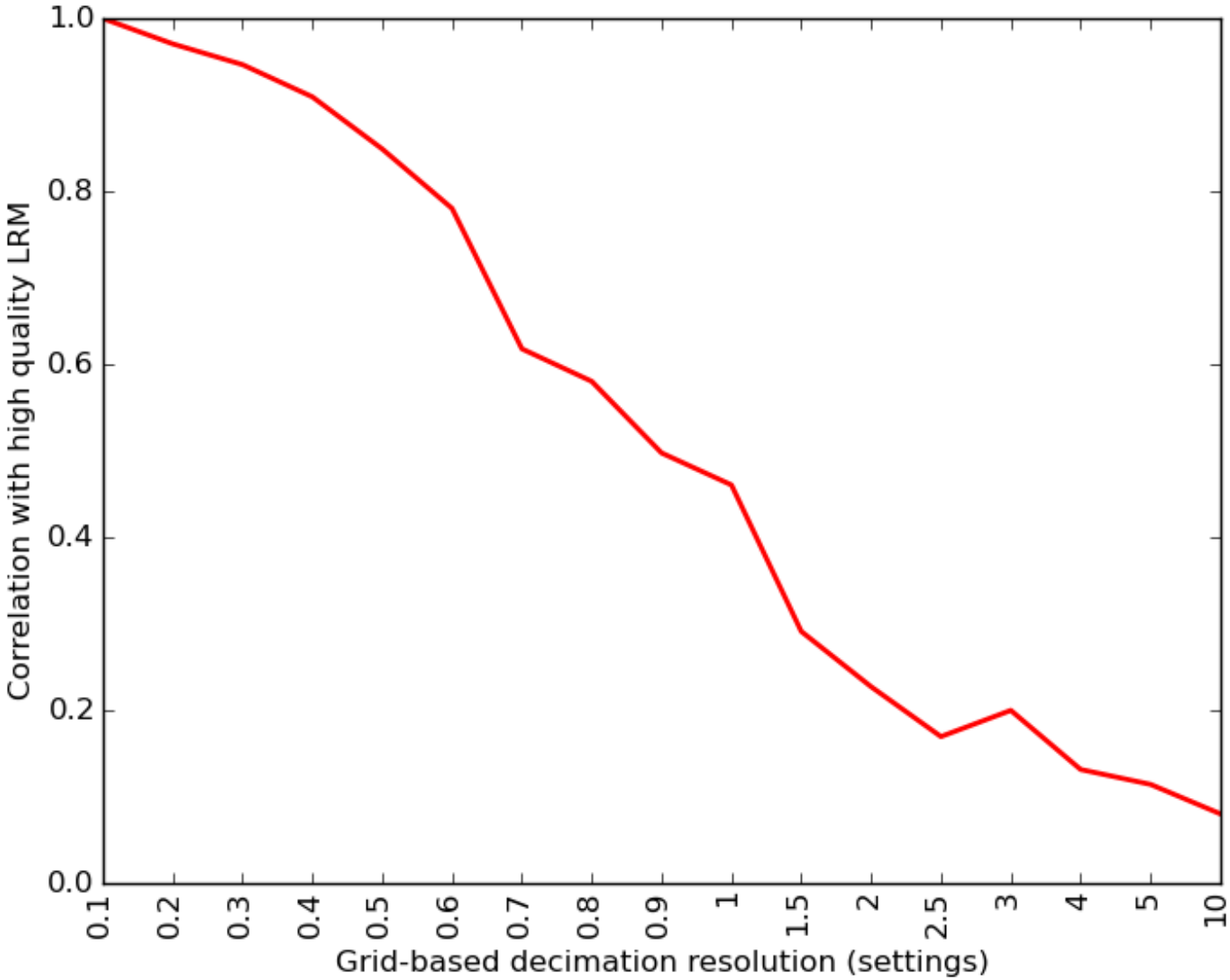


Influence of grid-based decimation resolution

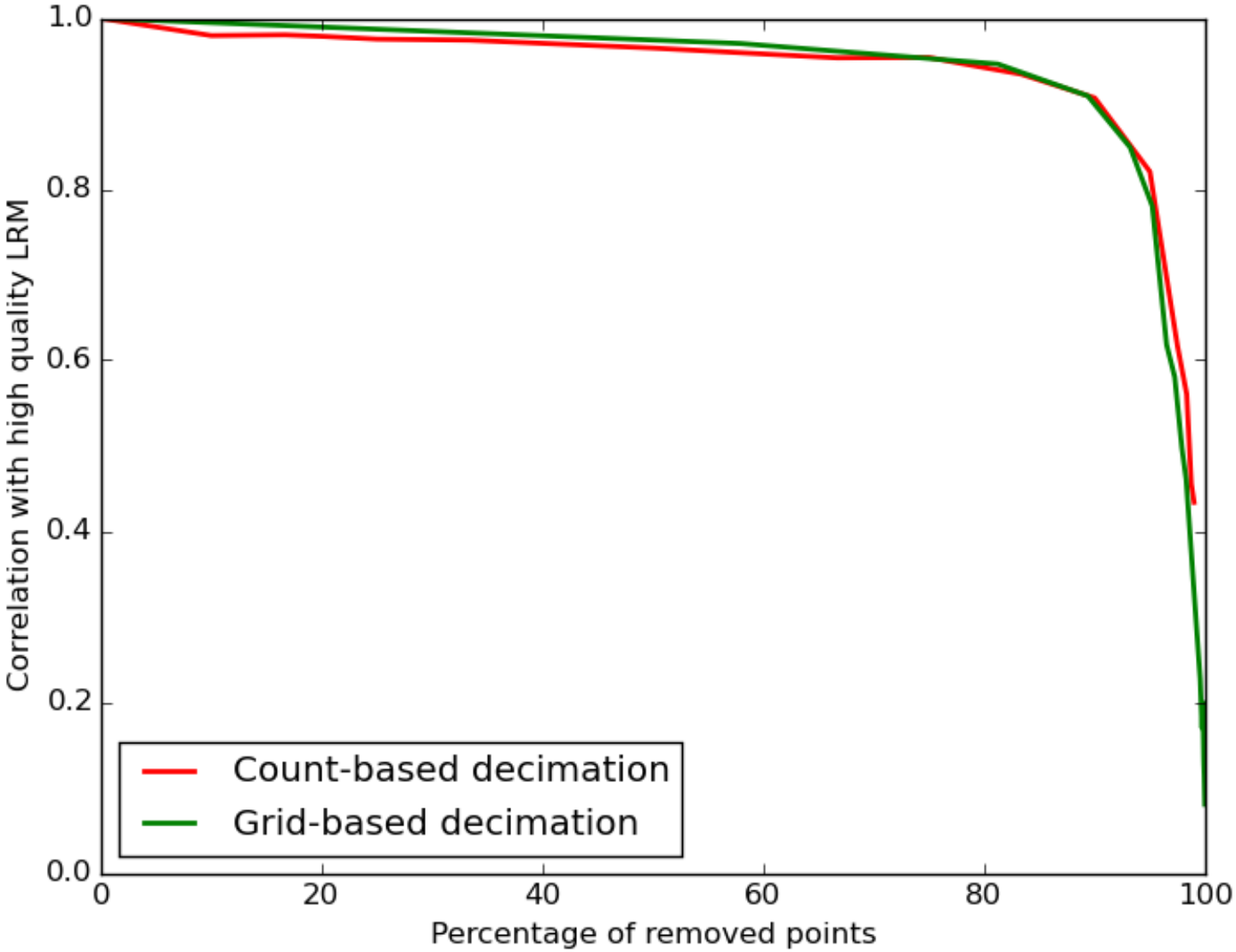


resolution=0.1	resolution=0.3	resolution=0.9	resolution=1.5
0 %	81 %	98 %	99 %

Resolution of grid-based decimation



Comparison of count-based and grid-based decimation



Crop the point cloud by polygon

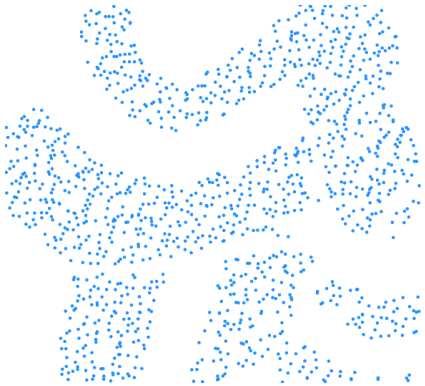
v.in.lidar – limit the import to selected areas (2D)

`areas`

Crop the point cloud by polygon

v.in.lidar – limit the import to selected areas (2D)

areas

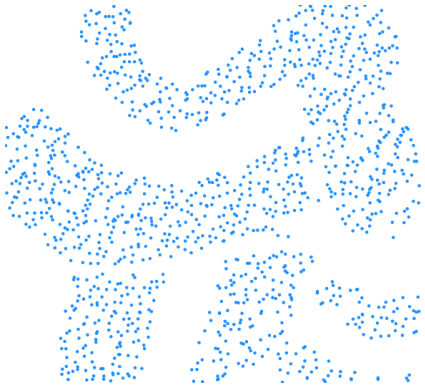


`v.in.lidar mask=`

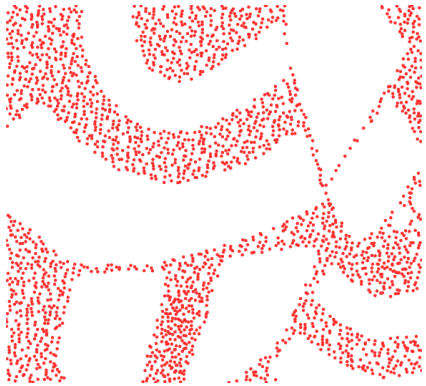
Crop the point cloud by polygon

v.in.lidar – limit the import to selected areas (2D)

`areas`



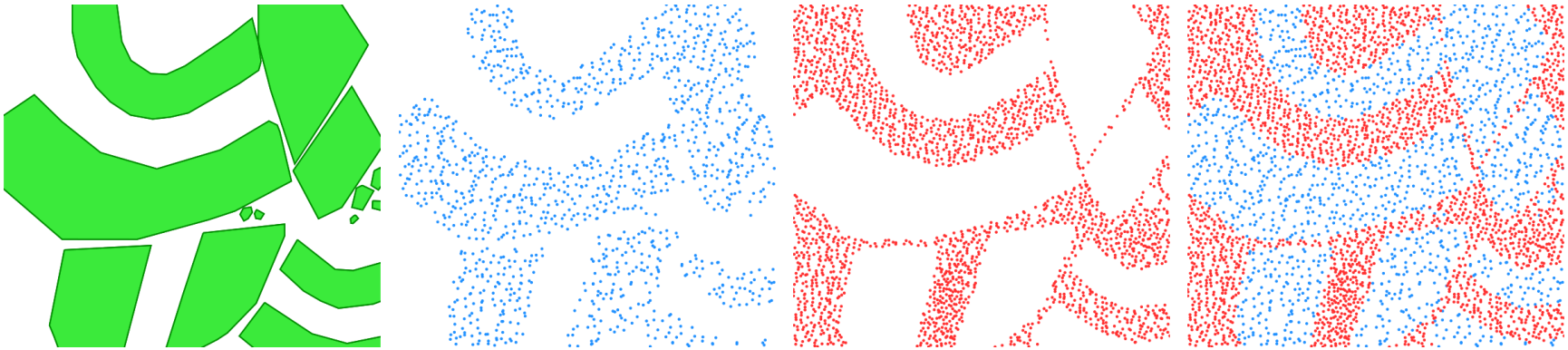
`v.in.lidar mask=`



`v.in.lidar -i mask=`

Crop the point cloud by polygon

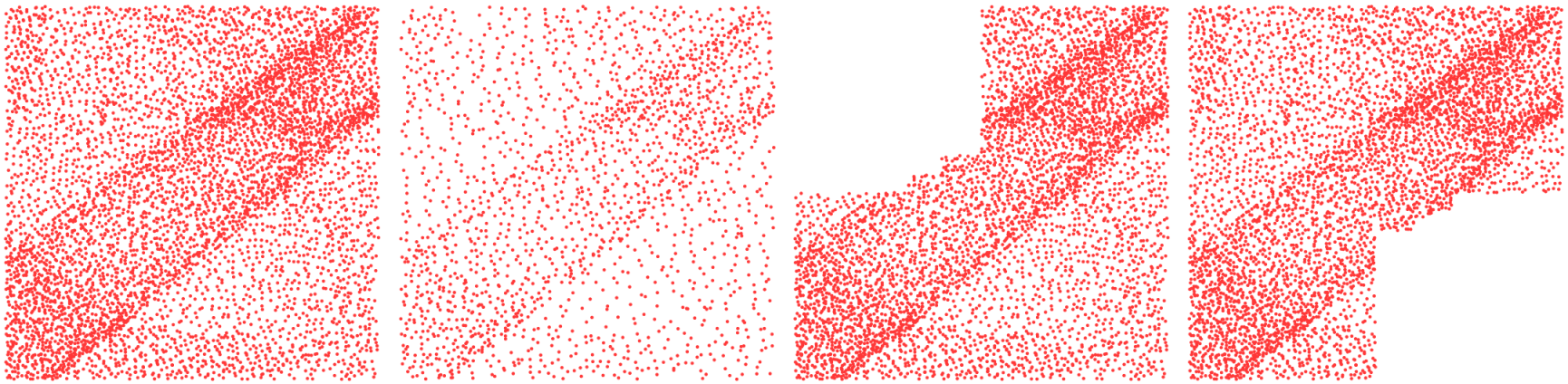
v.in.lidar – limit the import to selected areas (2D)



`areas` `v.in.lidar mask=` `v.in.lidar -i mask=` `v.patch -nz`

Count-based decimation

v.in.lidar – count-based decimation during import

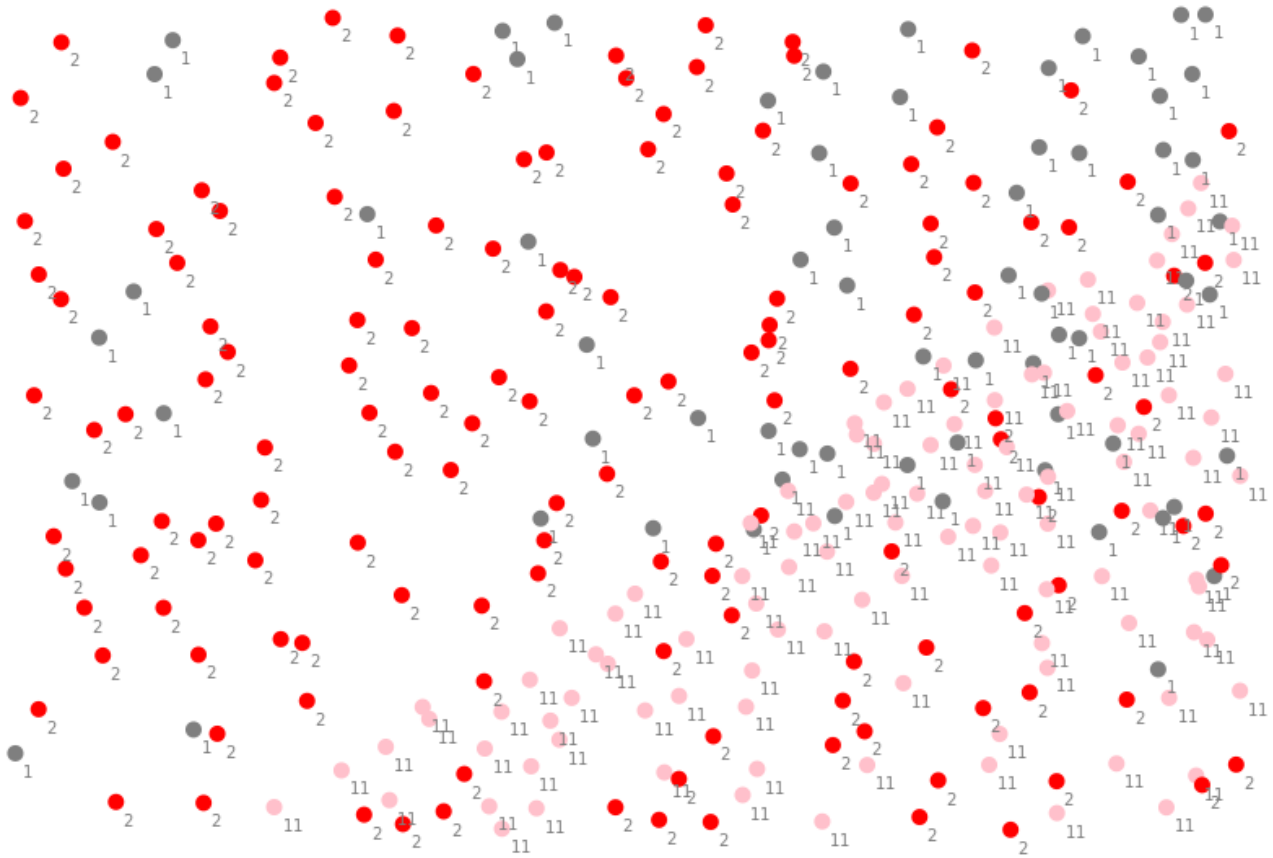


full preserve/skip offset limit

v.decimate – point cloud decimation of vector maps (also supports grid-based decimation with preserving point properties)

Store return and class information as category

v.in.lidar can store return or class information as category using layers and categories for something else than ID and class



Also: read coordinates only – speed improvement (-c flag)

Binning of points from multiple LAS files

r.in.lidar – read multiple LAS files in one run

The original workflow

```
r.in.lidar input=tile_01.las output=tile_01
r.in.lidar input=tile_02.las output=tile_02
...
r.patch input=tile_01,tile_02,...  output=elevation
```

is replaced by

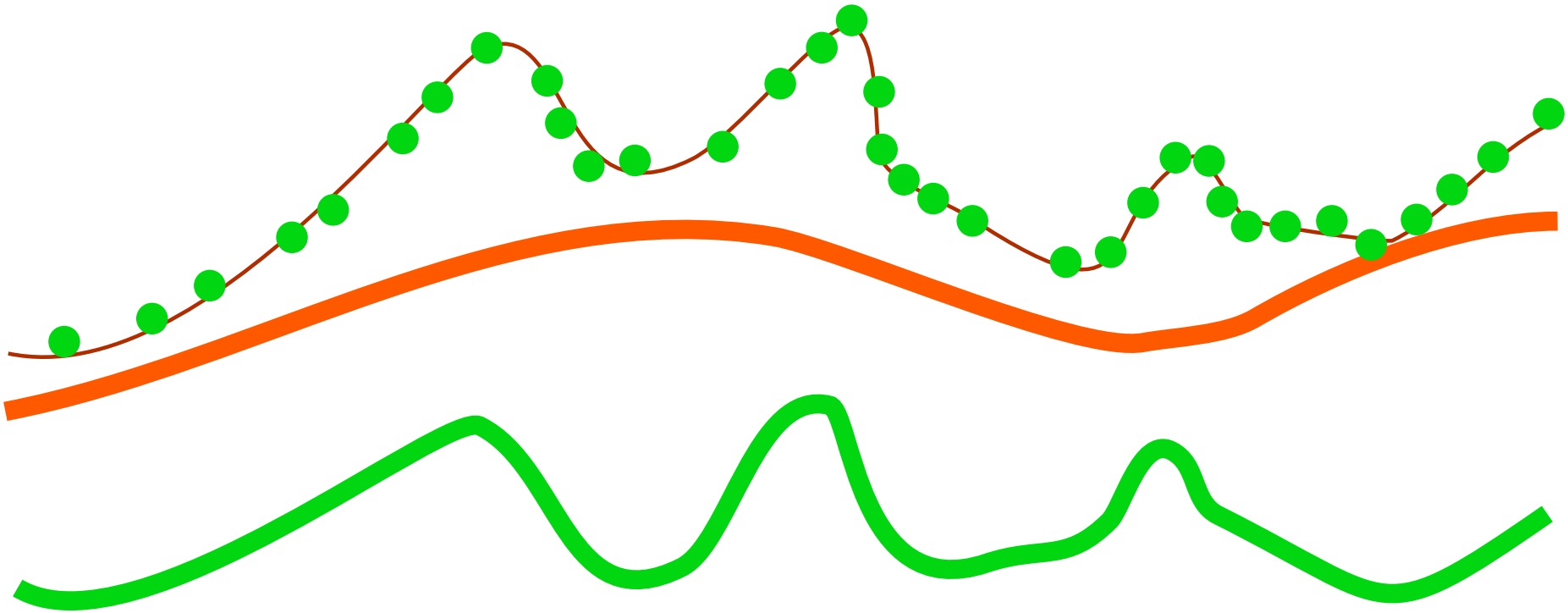
```
r.in.lidar file=tile_list.txt output=elevation
```

where `tile_list.txt` is

```
tile_01.las
tile_02.las
...
```

Compute height above a given raster during binning

r.in.lidar – derive height above ground of features

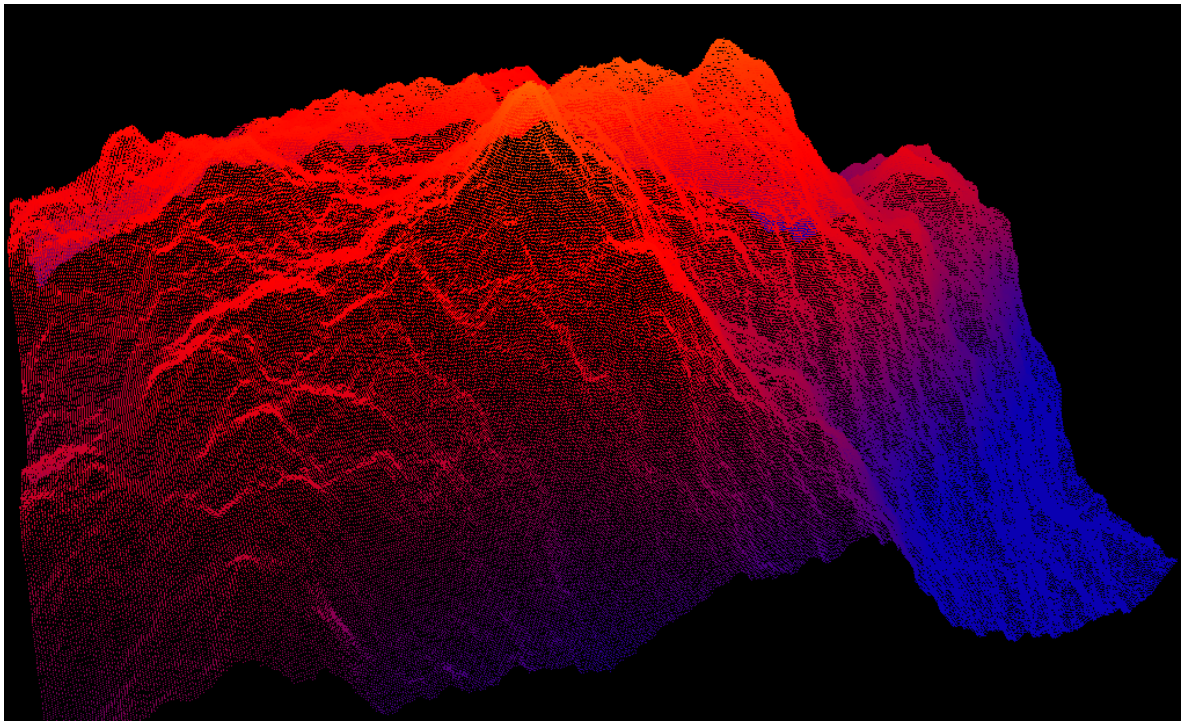


The resolutions of binning and ground raster can differ, so different statistics can be computed during binning.

Export vector points from GRASS GIS as LAS

v.out.lidar – export points in a vector map as lidar points

- visualization (plas.io, CloudCompare)
- further processing (PDAL, libLAS, CloudCompare, . . .)
- testing workflows with generated data



r.surf.fractal output in plas.io

Summary

- count-based and grid-based decimation perform the same on a *given* point cloud
- analysis needed for every dataset → need for tool to create a report
- improvements needed for the project integrated into GRASS GIS

Get GRASS GIS 7.1 development version at
`grass.osgeo.org/download`