

Short Introduction to Point Cloud Processing

PDAL

Use [PDAL](#) for pointcloud analysis, filtering, and classification.

Information about LAS/LAZ files

First, obtain some information about the LAS/LAZ file:

```
pdal info --summary \
  ALS_Golm_May06_2018_Milan_UTM33N_WGS84_6digit_cl_clip.laz

pdal info -p 0 \
  ALS_Golm_May06_2018_Milan_UTM33N_WGS84_6digit_cl_clip.laz
pdal info -p 0-10 \
  ALS_Golm_May06_2018_Milan_UTM33N_WGS84_6digit_cl_clip.laz
```

Ground detection (SMRF)

There are several algorithms used for ground detection - the Simple Morphological Filter ([SMRF](#)) is one of them (described in [Pingel et al., 2013](#)).

Simple SMRF filtering

```
pdal translate \
  ALS_Golm_May06_2018_Milan_UTM33N_WGS84_6digit_cl_clip.laz \
  -o ALS_Golm_cl.laz \
  smrf \
  --writers.las.compression=true --verbose 4
```

In Windows, you will need to replace \ by ^ to continue writing on the next line:

```
pdal translate ^
  ALS_Golm_May06_2018_Milan_UTM33N_WGS84_6digit_cl_clip.laz ^
  -o ALS_Golm_nonoise_cl2.laz ^
  smrf ^
  --writers.las.compression=true --verbose 4
```

Repeat for the UAV datasets:

```
pdal translate \
  UAV_mavicpro2_nadir_15deg_highq_dense_PC_10cm.laz \
  -o UAV_mavicpro2_nadir_15deg_highq_dense_PC_10cm_cl.laz \
```

```
smrf \
--writers.las.compression=true --verbose 4
```

and

```
pdal translate \
  UAV_inspire2_1031cameras_highq_dense_pc_10cm.laz \
  -o UAV_inspire2_1031cameras_highq_dense_pc_10cm_cl.laz \
  smrf \
  --writers.las.compression=true --verbose 4
```

SMRF with noise filtering

```
pdal translate ^
  ALS_Golm_May06_2018_Milan_UTM33N_WGS84_6digit_cl_clip.laz ^
  -o ALS_Golm_nonoise_cl.laz ^
  outlier smrf range ^
  --filters.outlier.method="statistical" ^
  --filters.outlier.mean_k=8 ^
  --filters.outlier.multiplier=3.0 ^
  --filters.smrf.ignore="Classification[7:7]" ^
  --filters.range.limits="Classification[2:2]" ^
  --writers.las.compression=true --verbose 4
```

For Linux/Mac OSX:

```
pdal translate \
  ALS_Golm_May06_2018_Milan_UTM33N_WGS84_6digit_cl_clip.laz \
  \
  -o ALS_Golm_nonoise_cl.laz \
  outlier smrf range \
  --filters.outlier.method="statistical" \
  --filters.outlier.mean_k=8 \
  --filters.outlier.multiplier=3.0 \
  --filters.smrf.ignore="Classification[7:7]" \
  --filters.range.limits="Classification[2:2]" \
  --writers.las.compression=true --verbose 4
```

You can use the file `ALS_Golm_nonoise_cl.laz` for ground interpolation.

If you already have your file classified (through `lasground` or through the `ClothSimulationFilter` in `CloudCompare`), you can create a file with ground points (class 2) only:

```
pdal translate \
  ALS_Golm_May06_2018_Milan_UTM33N_WGS84_6digit_cl_clip.laz \
  -o ALS_Golm_nonoise_cl2.laz \
  range \
  --filters.range.limits="Classification[2:2]"
```

Additional filtering commands

See [voxelcenternearestneighbor](#).

```
pdal translate \  
  ALS_Golm_May06_2018_Milan_UTM33N_WGS84_6digit_cl_clip.laz \  
  -o \  
    ALS_Golm_May06_2018_Milan_UTM33N_WGS84_6digit_cl_clip_voxel.laz \  
    \  
    voxelcenternearestneighbor \  
    --filters.voxelcenternearestneighbor.cell=1.0
```

Creating a DEM and saving a GeoTIFF

We rely on the IDW (Inverse Distance Weighted) Interpolation implemented in [writers.gdal](#). this requires a control file (.json) that defines parameters through a pipeline.

Create the file `ALS_Golm_nonoise_cl2_idw.json`:

```
{  
  "pipeline": [  
    "ALS_Golm_nonoise_cl2.laz",  
    {  
      "filename": "ALS_Golm_nonoise_cl2_1m.tif",  
      "gdaldriver": "GTiff",  
      "output_type": "all",  
      "resolution": "1.0",  
      "window_size": "10",  
      "type": "writers.gdal"  
    }  
  ]  
}
```

Run the pipeline on the command line with:

```
pdal pipeline ALS_Golm_nonoise_cl2_idw.json`
```

Alternatively, you can only output the interpolated DEM values with the `idw` interpolation:

```
{  
  "pipeline": [  
    "ALS_Golm_nonoise_cl2.laz",  
    {  
      "filename": "ALS_Golm_nonoise_cl2_1m.tif",  
      "gdaldriver": "GTiff",  
      "type": "writers.gdal"  
    }  
  ]  
}
```

```
        "output_type": "idw",  
        "resolution": "1.0",  
        "radius": "10",  
        "type": "writers.gdal"  
    }  
]  
}
```

Compiled with:

```
pandoc --listings --variable papersize=a4paper \  
-H auto_linebreak_listings.tex \  
--variable urlcolor=blue \  
-V lang=en-GB \  
-s PC_pdal_for_UP_CampusGolm.md \  
-o PC_pdal_for_UP_CampusGolm.pdf
```