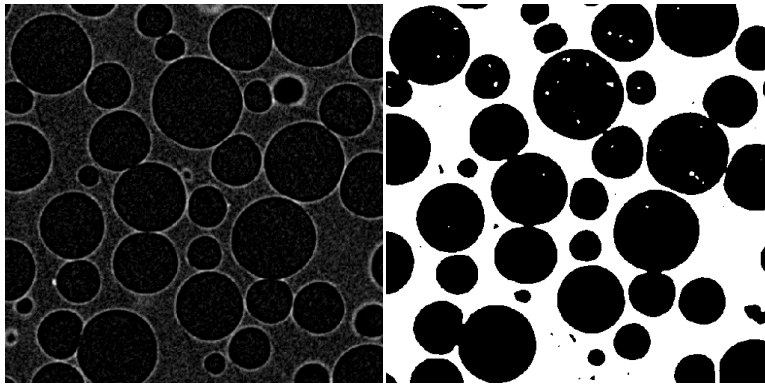


Noise removal by using component labeling

The presence of noise can sometimes be problematic for choosing a threshold when segmenting an image. Noise can be removed by adjusting the parameters for the Gaussian filtering during the segmentation but as a strong filtering also removes the fine structures of the image Component Labeling can be used to remove the remaining noise after a filtering has been applied. Component Labeling is a method for classifying all segmented objects in an image according to their size. In a segmented 3D image the noise can be seen as small dots scattered around the image and by removing all segmented objects that contains less than a certain number of voxels, the noise can be removed. Below you will find an example how this can be done.

The image below on the left is segmented using the SCANCO Software script for segmentation of one object (1: 3D Segmentation of VOI, 1 solid object) with a very strong Gaussian filter. Despite the strong filtering there is still noise present in the segmented image as can be seen below on the right.



To remove this we will now use the Component Labeling function in IPL. First open IPL and then read the `_SEG.AIM` file generated previously by the segmentation script:

```
/read
  -name          in
  -filename      DK0:[MICROCT]EXAMPLE1_SEG.AIM
```

There are two different versions of Component Labeling that you can use depending on how you would like to proceed. You can either keep the largest of your segmented objects or you can remove all objects in the image containing less than a certain number of voxels. If you would like to remove everything except the largest objects use the following function:

```
/cl_rank_extract      Component Labeling Extract Rank
  -input              Input  AIM
  -output             Output AIM
  -first_rank         First ranking
  -last_rank          Last ranking
  -connect_boundary   Connect bondary voxels
  -value_in_range     Value for in range voxels
```

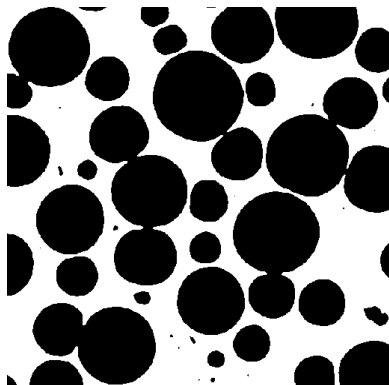
If you for example would like to keep only the five largest objects you set `-first_rank` to 1 and `-last_rank` to 5.

If you have several objects and would just like to remove all smaller segmented objects, assuming that these are due to noise, then use the following function:

<code>/cl_nr_extract</code>	Component Labeling Extract Number
<code>-input</code>	Input AIM
<code>-output</code>	Output AIM
<code>-min_number</code>	Min nr of voxels in extracted components
<code>-max_number</code>	Max nr of voxels (0: no limit)
<code>-value_in_range</code>	Value for in range voxels

The input `-min_number` specifies the minimum number of voxels that each object has to contain in order to be kept in the image. This number depends on many factors, such as for instance the resolution, and is mostly empirically determined.

In our example we have use `/cl_rank_extract` and only kept the largest object (both `-first_rank` and `-last_rank` to 1) which yielded the result below.



It is important to be aware on how the noise influences other parameters such as the measurement of the pore diameter. In the two images below a visualization of the pores has been made after it has been computed for the segmented image with and without noise removal. You can clearly see in the left image how the pores where noise was present several smaller spheres were fitted inside of the pore instead of one large sphere as in the image to the right.

