FKGrain Software Manual

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1 Installation

1.1 Dependency

1.1.1 Matlab Runtime

1.1.1.1 Download Matlab Runtime Installer from the link below
Matlab Runtime Installer : https://drive.google.com/file/d/1AM-gQMwe66ClW6BzuNx_CHVNxmIi1Gte/view?usp=sharing

1.1.1.2 Unzip MatlabRuntime.zip, and start the installer in ./MatlabRuntime/for_redistribution/MyAppInstaller_web.exe

1.1.1.3 Follow the step from the installer and accept the terms of agreement.

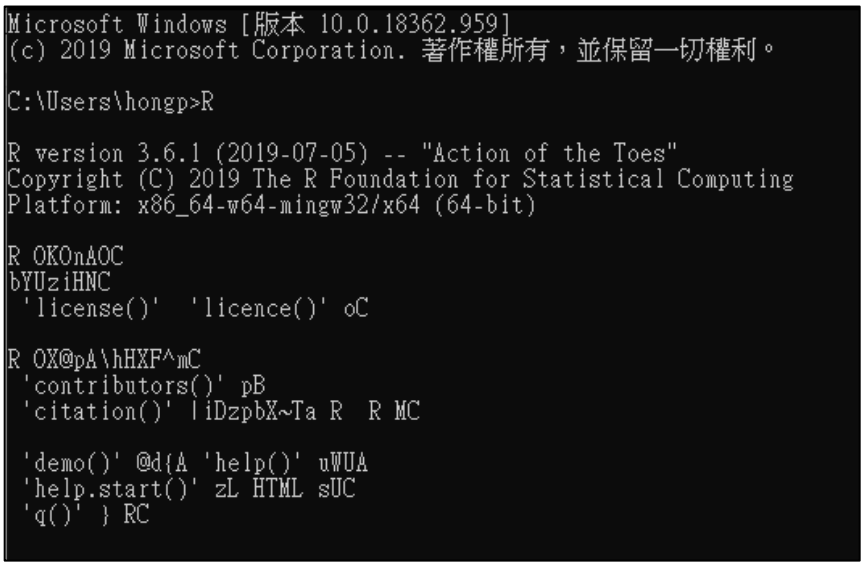
1.1.2 R

1.1.2.1 Download R 3.6.3 installer from the link below
R 3.6.3 installer: https://cran.r-project.org/bin/windows/base/old/3.6.3/R-3.6.3-win.exe
Different version of R may not have the require library. Only R 3.6.1 and R 3.6.3 has been tested

1.1.2.2 Follow the step from the installer to install R

1.1.2.3 Add C:\Program Files\R\R-3.6.6\bin to PATH system enviroment

1.1.2.4 Open a terminal and run R Console by typing R and press enter.



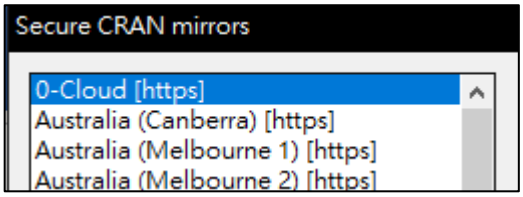
1.1.2.5 Install gstat and sp packages by running the following command in R console.

install.packages("gstat")

install.packages("sp")

1.1.2.6 Type in yes if personal library is required

1.1.2.7 Select the mirror server for where to download the packages. The Default server to use is 0-Cloud.



1.1.2.8 Check the library is correctly install by running the following command in R console:

library("gstat")

library("sp")

If no error is shown means the library has successfully install.

1.1.2.9 If the library did not correctly install, try to run it by using a Windows PowerShell or run the terminal using administrator. And retry step 1.1.2.4 to 1.1.2.8.

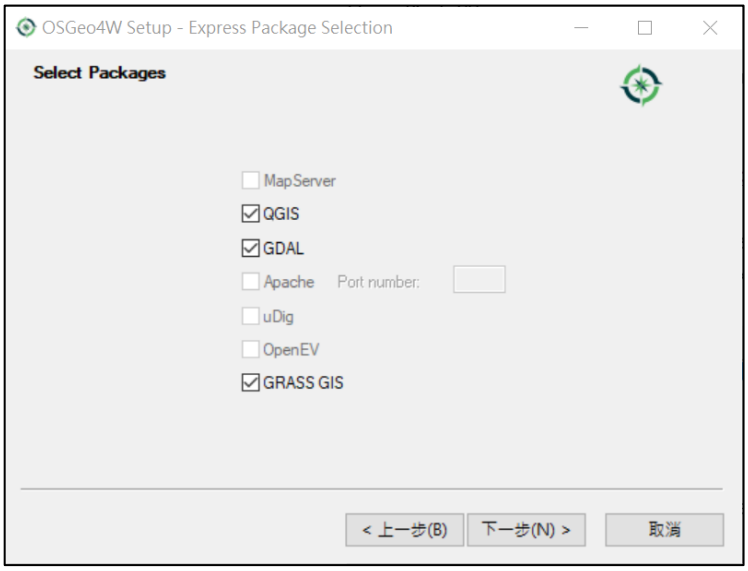
1.1.3 GDAL

1.1.3.1 Download OSGeo4W from the link below

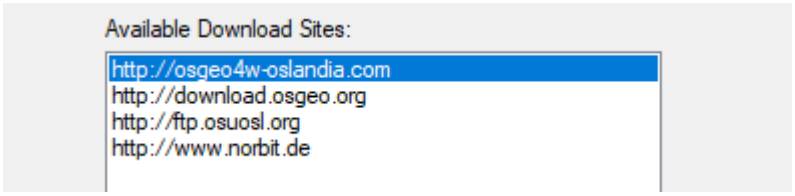
OSGeo4W: http://download.osgeo.org/osgeo4w/osgeo4w-setup-x86_64.exe

1.1.3.2 Choose Express Desktop Install and press Next

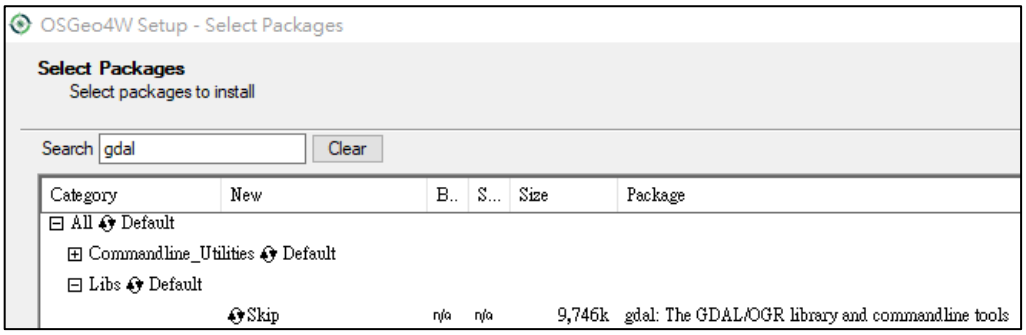
1.1.3.3 Make Sure GDAL is selected when prompt what to install.

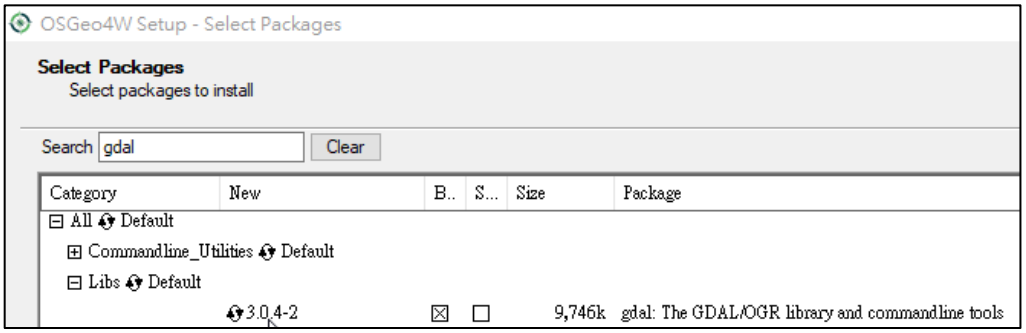


1.1.3.4 Choose a Download Sites, and press Next. The default site is http://osgeo4w-oslandia.com



1.1.3.5 Search for "gdal: The GDAL/ORG library and command line tools" and Click on "Skip" if it is not selected to install gdal.





1.1.3.6 Press Next and agree to all license term to start the install process.

1.1.3.7 Add <Install path>/bin to PATH system environment.

1.2 Main Program

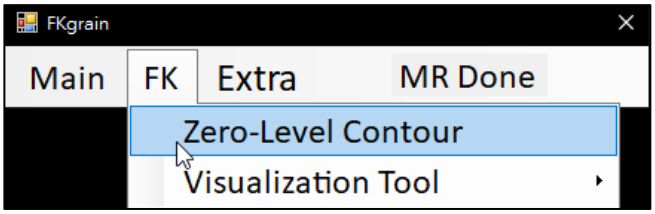
1.2.1 Download the program from the link below: https://github.com/hongping1224/Dummy-Project/releases/download/v2.0-alpha/Release.zip

1.2.2 Unzip the downloaded package.

1.2.3 Run the program by launching StoneCount.exe

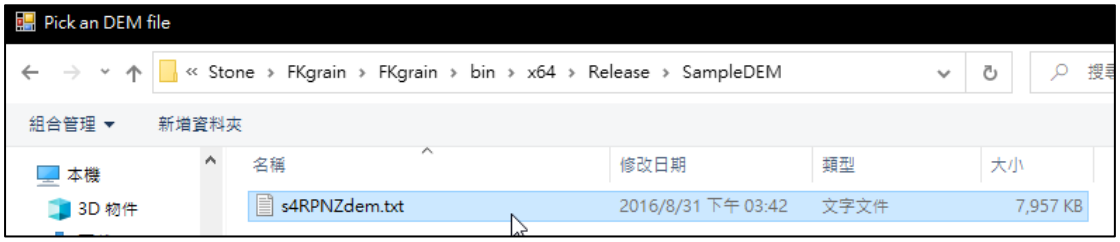
2 Generate zero contour Images from DSM

2.1 Generate zero contour Image by go to FK -> Zero-Level-Contour

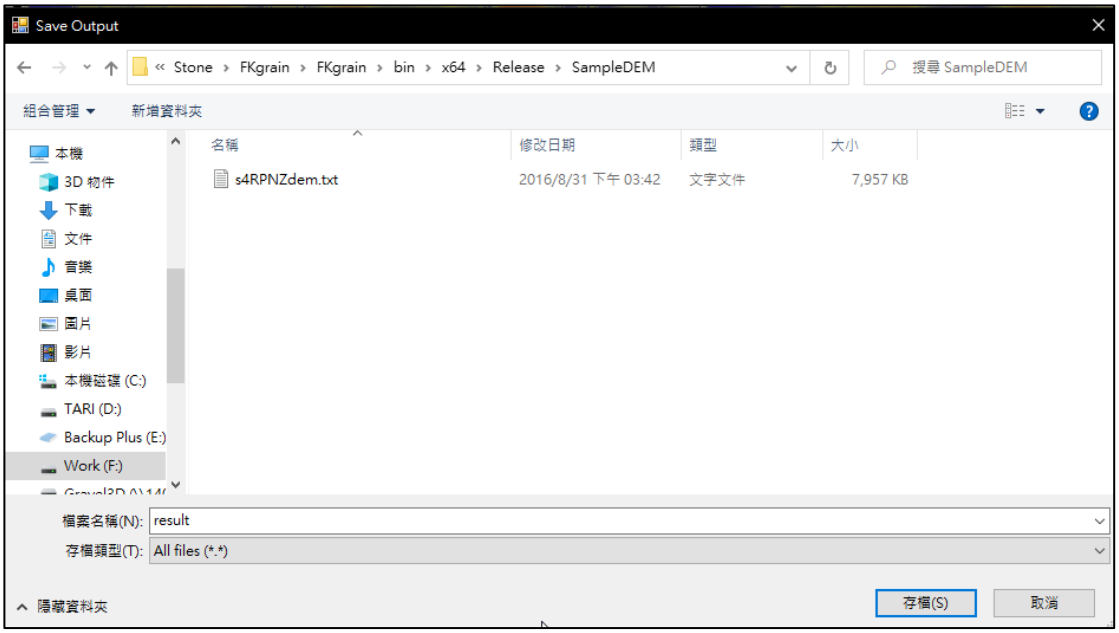


2.2 Select a DEM File

**Beware: space within the full path will result in error

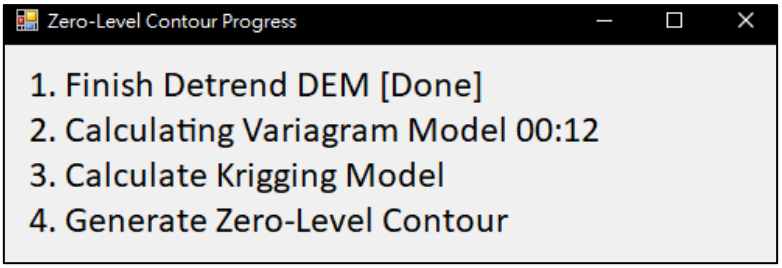


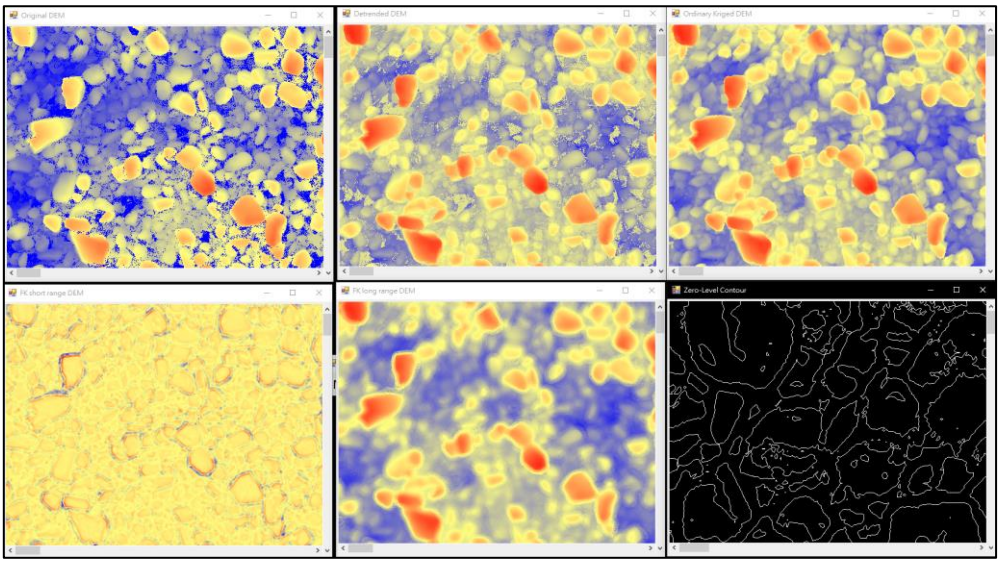
2.3 Select a location and input a filename to save result's images.



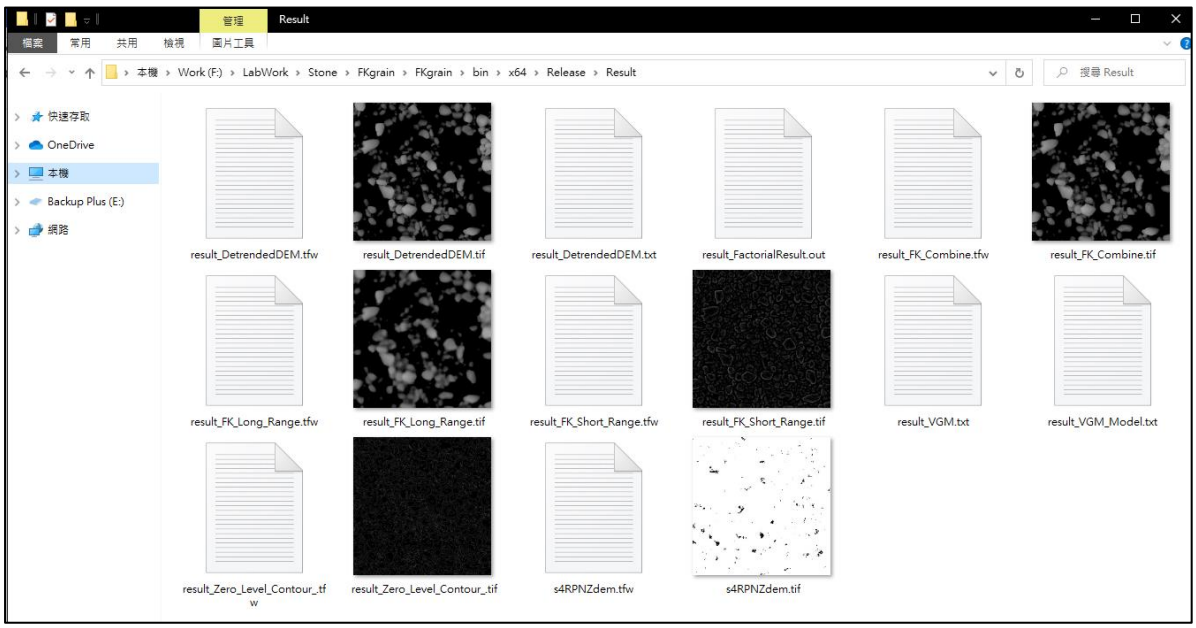
2.4 Wait until all process finished and showed the , the whole process can takes up to 35minutes. When Detrend DEM is done, a original DEM and a Detrended DEM image window will appear, and when Krigging Model is finish calculate, the ordinary kriged DEM, FK short range DEM, and FK long range DEM image window will appear. When all process is done, a

zero contour image will appear.





The image below shows all the results, including all the intermediate results. DetrendedDEM is the Detrended DEM, FK_Combine is the Ordinary Kriged DEM, FK_Short_Range is the FK short range DEM, FK_Long_Range is the FK long range DEM, and Zero_Level_Contour is the zero contour image.



3 Process the Gravel

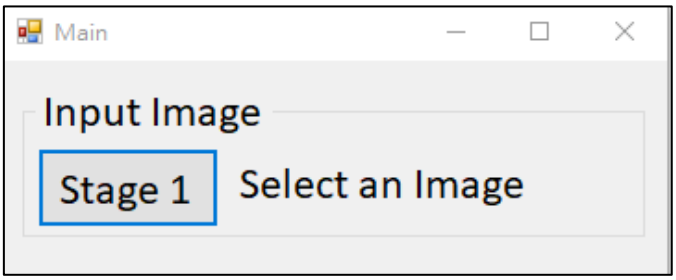
3.1 Click Main to open the Main Menu.

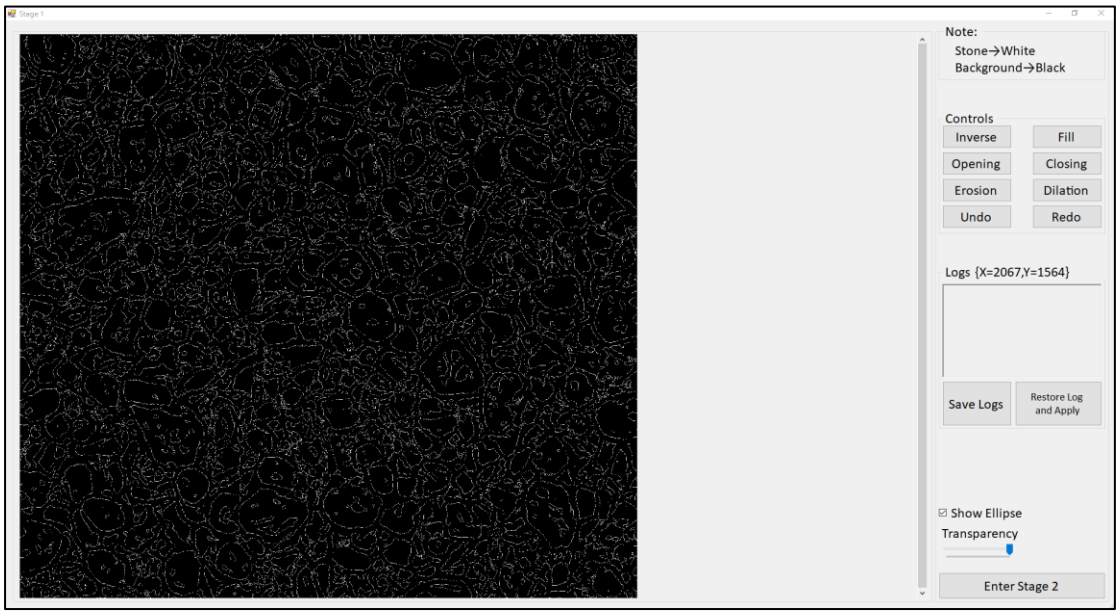
3.2 Stage1 - Preprocessing

Click Stage1 and Select a zero contour image. The Stage1 Window is shown below. The Controls include Inverse, Fill, Opening, Closing, Erosion and Dilation. All controls are working with a binary image. Where white is to 1 and black is zero.

Each step will be show in the Logs panel. The logs can be save as a log file and can later be reapply to the images.

For comparison purpose, left clicking on the image will show the original image. Or by setting the Transparency of the result image is useful.





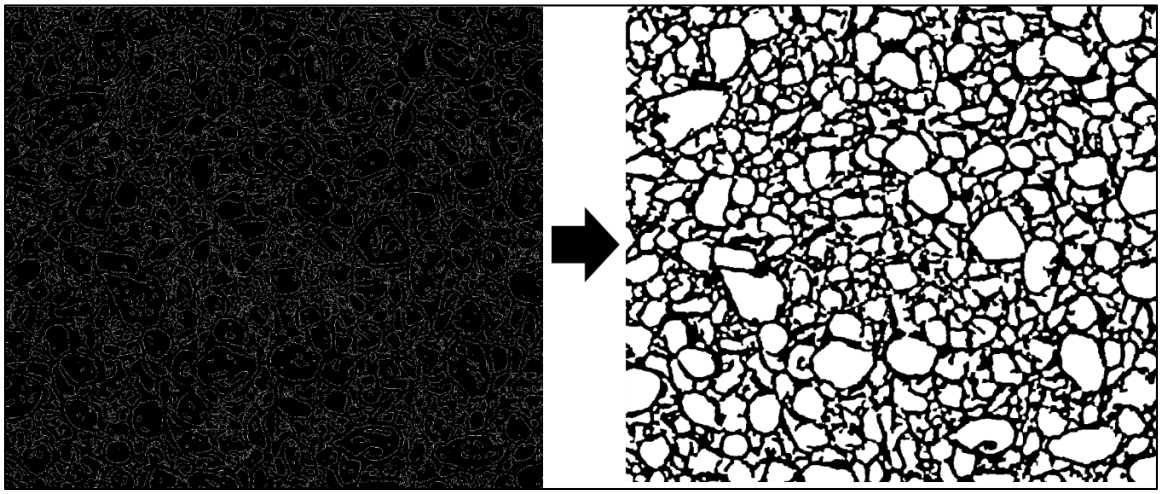
3.3 Preprocess the zero contour image.

This step is use to first fill in the gravel to get a solid gravel from its contour. Then end result of preprocessing background should be black and the gravel contour should be white. Press done after getting a satisfied result.

The example below shows the sample contour image and the result of preprocessing by going through these 5 steps.

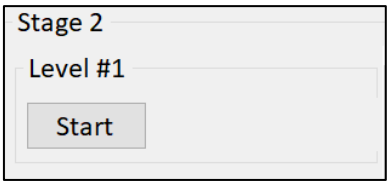
1. Fill → Fill Coordinate at x=1,y=1
   - (x,y) should indicate a location of background.
2. Inverse
3. Fill → Fill Holes
   - After executing Step 2, some contour lines may exist inside larger contour lines, which should be treated as noise. Step 3 eliminates this kind of noise.
4. Closing with a square filter with filter size equal to 7
5. Opening with a square filter with filter size equal to 7

Note that Step 4 and Step 5 are used to remove other kinds of noise and the parameters are only suitable in our example. When using other image, users should design their own morphological operations to eliminate the noise. The morphological operations implemented in StoneCount are based on Matlab. Reference of these morphological operations can be found in Matlab's document.

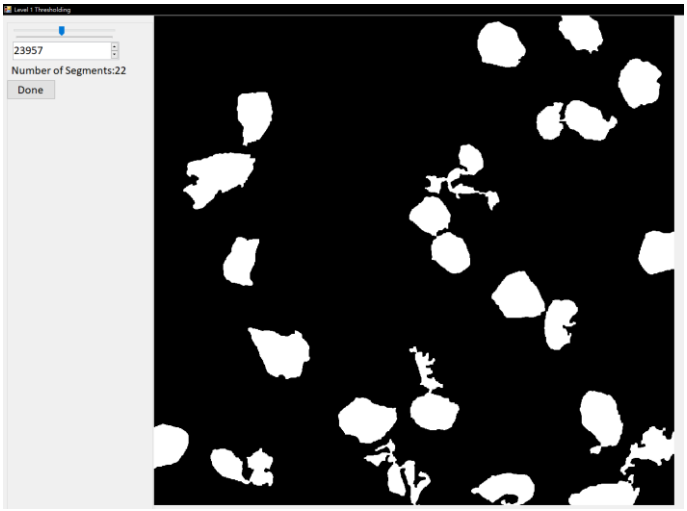


3.4 Stage2 – Gravel Processing

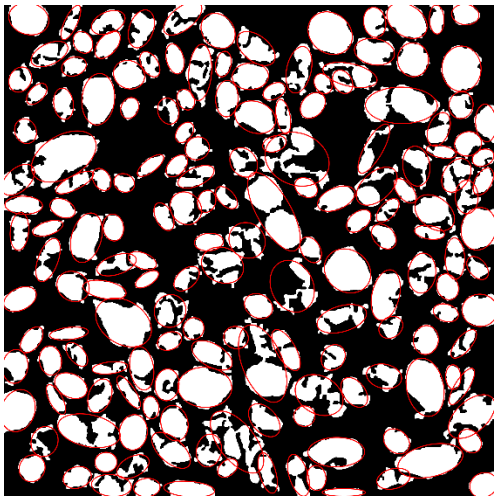
Stage 2 contain multiple Level. The first level of gravel processing will be available after the preprocessing process.

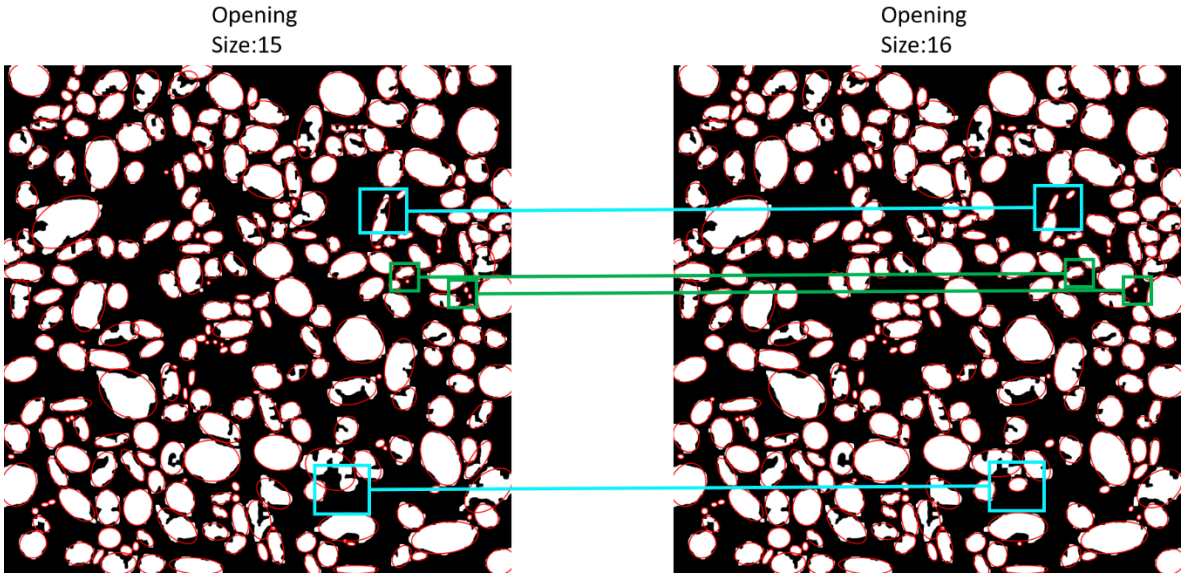


Each level is divided in 2 steps. The first step is to separate out the gravel segment size larger than the threshold. The threshold can be changed by adjusting the scroll bar or by typing in to the input box and press enter. Only the gravel segments of size larger than the threshold will remain. Press done to go to the next step when getting a satisfied result. The remaining segments will be processed in the next level.



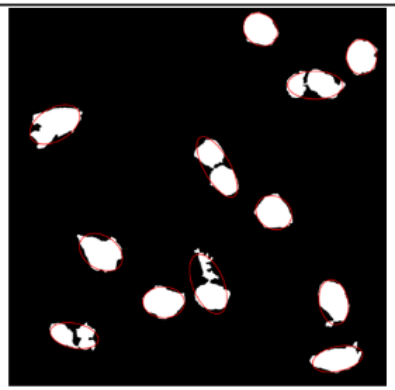
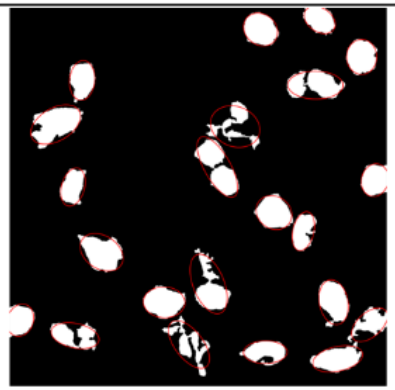
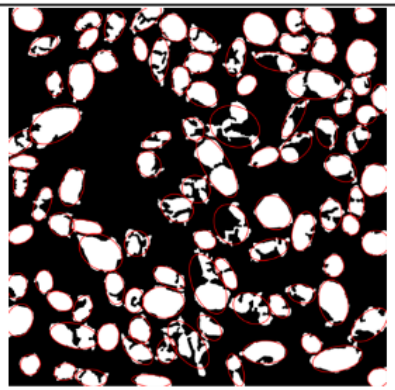
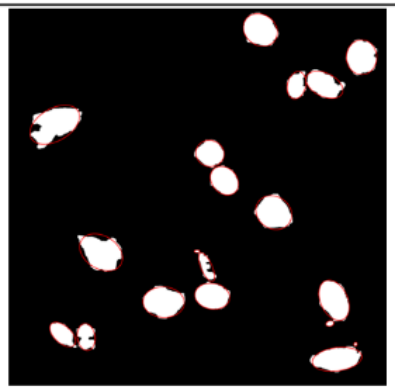
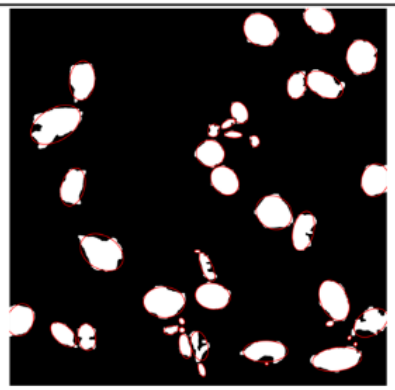
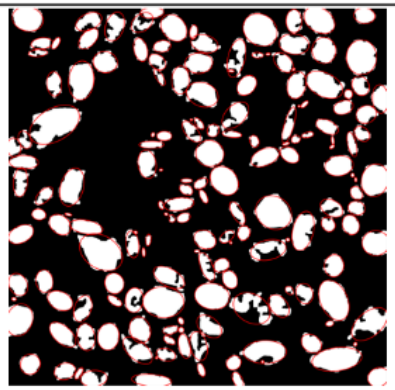
The purpose of separating the gravel segments of different size in to different level is because in second step of each level is to separate gravel which are merged together in one segment. However, all the operation works on a global scale, there are some situation where no operations can reach satisfy result. The example below is using a threshold of 6000 in the first level, and 172 gravel segments remaining. While a larger filter size was used, some small gravel is lost (mark in green). And while a smaller filter size was used, some gravel is not well segmented (mark in cyan). The solution is to separate these gravel into different level and process separately.





By separating different size gravel segments into different level, it is easier to get to a satisfy result in each level. However, more levels are required to complete Stage 2.

The Table below shows the results of different threshold used in Level 1.

Threshold	35000	24000	10000
Number of Segments	9	22	98
Remaining gravel			
Processed Result			
Satisfactory	Yes	Yes	No
Efficiency	No	Yes	Yes

3.5 Rinse and Repeat

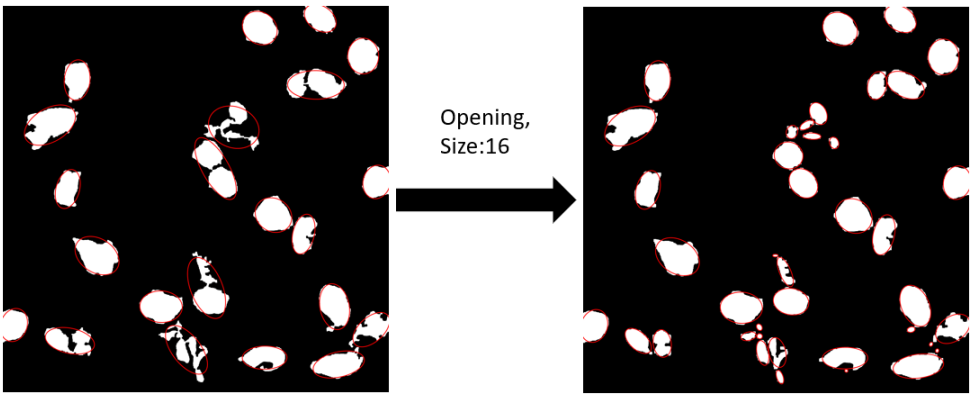
After a level of gravel processing is done, The Next level will be available. Repeat step 3.4 until reaching a satisfied result.

The table below shows the parameters used for the sample image.

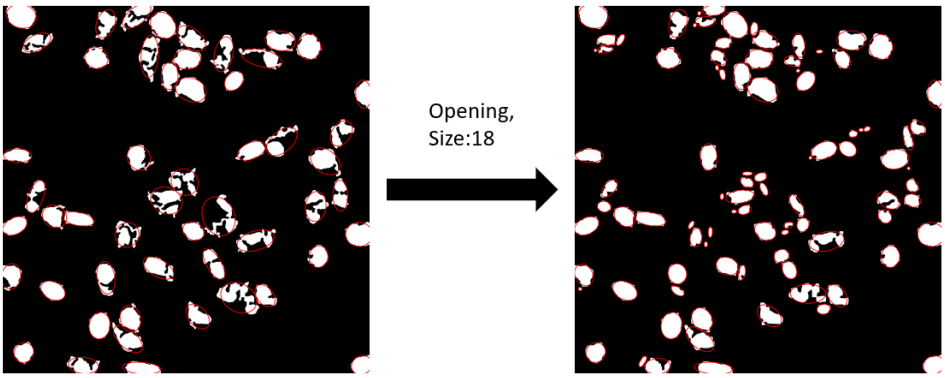
Level	Size Threshold	Operation(s)
1	24000	Opening, square,16
2	11898	Opening, square,18
3	5949	Opening, square,19
4	817	Opening, square,14

The result are as below:

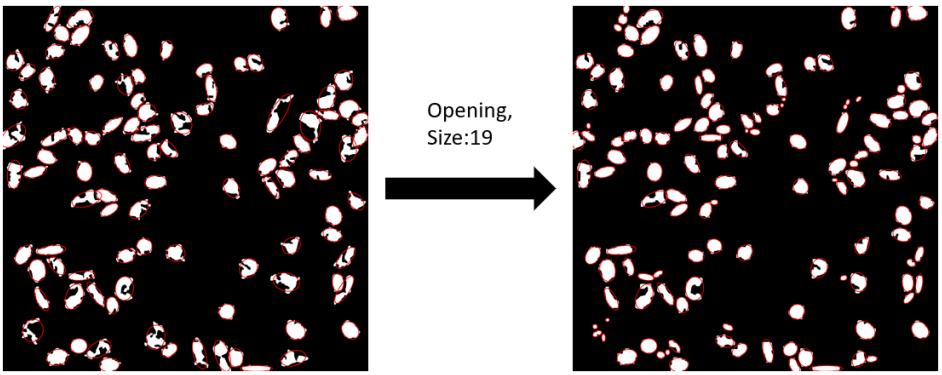
Level 1: 24000



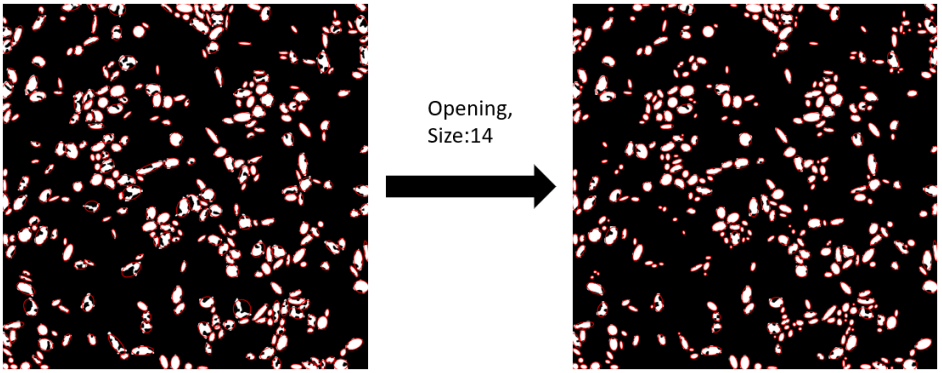
Level 2: 11898



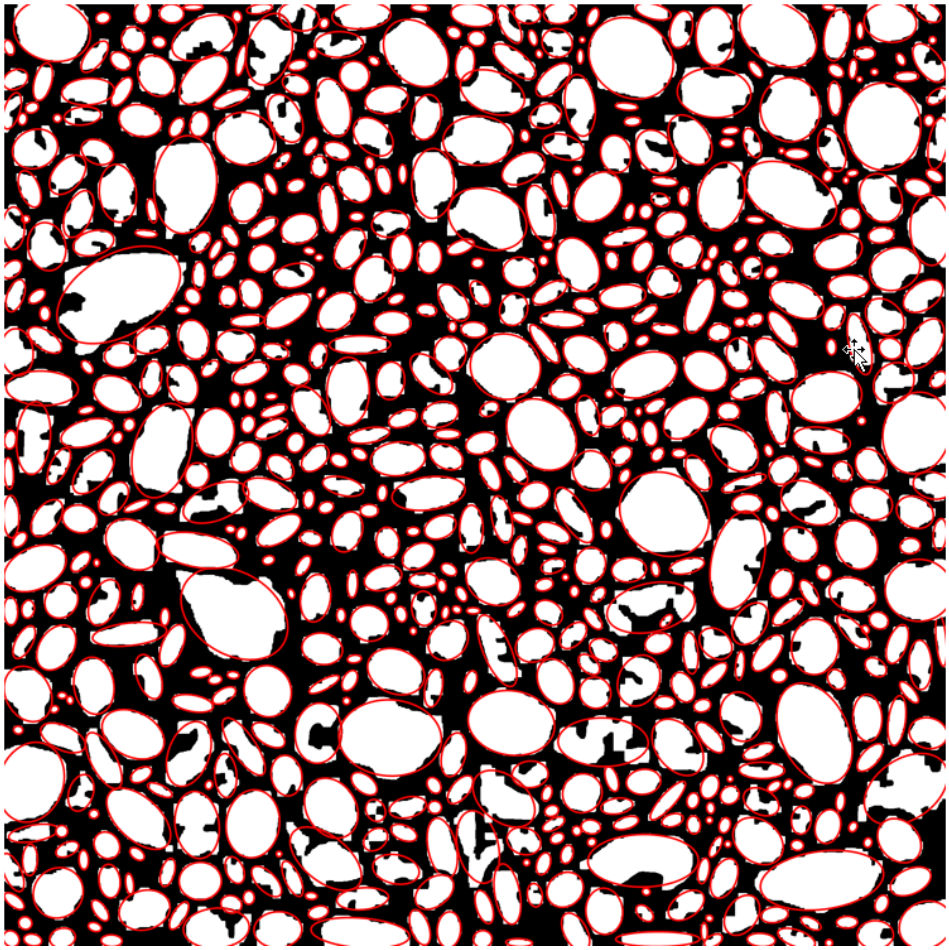
Level 3: 5949



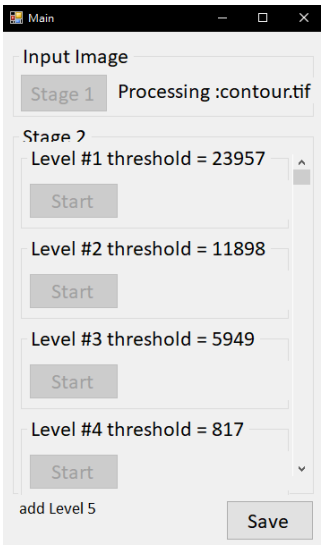
Level 4: 817



Combine Result:



Press Save to save the result. The result will include 2 shp file, result.shp is the boundary of each gravel and result_ellipse.shp is the fit ellipse of each gravel. In the table of both shp file are the x y coordinate of the ellipse center, the semi-major, semi-minor axis of the ellipse and the tilt of the ellipse.



名稱	修改日期	類型	大小
result.dbf	2020/9/3 下午 02:11	DBF 檔案	3 KB
result.shp	2020/9/3 下午 02:11	SHP 檔案	170 KB
result.shx	2020/9/3 下午 02:11	SHX 檔案	1 KB
result_ellipse.dbf	2020/9/3 下午 02:11	DBF 檔案	3 KB
result_ellipse.shp	2020/9/3 下午 02:11	SHP 檔案	97 KB
result_ellipse.shx	2020/9/3 下午 02:11	SHX 檔案	1 KB

	A	B	C	D	E	F
1	ID	x	y	a	b	tilt
2	1	0.7300	4.1524	0.4275	0.2575	-30.0135
3	2	0.8500	0.8225	0.2275	0.1375	43.1024
4	3	1.2300	0.7775	0.1400	0.2100	-7.1975
5	4	1.4700	2.1224	0.3600	0.2600	31.9382
6	5	2.4599	1.3300	0.3275	0.2425	3.1502
7	6	3.1949	3.6949	0.2250	0.2075	16.0230
8	7	3.2324	1.4250	0.2775	0.2050	9.1528
9	8	3.1399	1.8825	0.0850	0.2475	-22.9263
10	9	3.4249	3.2624	0.1975	0.2500	-42.2486
11	10	3.9949	5.6599	0.2850	0.2425	38.4809
12	11	4.2074	2.7549	0.2975	0.2550	34.4629
13	12	4.5699	4.7799	0.1450	0.2175	13.3277
14	13	5.0124	4.7874	0.3125	0.1850	26.7617
15	14	5.2099	0.4225	0.3925	0.1850	-7.4368
16	15	5.1649	1.3600	0.2150	0.3375	-24.4538
17	16	5.0999	0.9900	0.0625	0.0400	-15.5111
18	17	5.6024	5.2249	0.2400	0.2750	-0.7669