AniLength
version 1.0

User Manual

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System requirements

- AniLength runs on Microsoft Windows OS with .NET 5 installed.

  - Users will have to install .NET 5 (x64) on their computer.

  - If users still fails to run AniLength, please install Visual Studio 2019 Community including the ".NET desktop development" component.

- AniLength supports both CPU and GPU processing.
- GPU processing greatly reduces processing time.
- To enable GPU processing,

  - Nvidia graphics card with CUDA cores must be installed in the computer.

  - Users must install both CUDA 10.0 and cuDNN 7.6 software.

  * Simply installing CUDA 10.0 and cuDNN 7.6 does not complete the settings for GPU CUDA processing. See other CUDA/cuDNN installation tutorials.

User interface

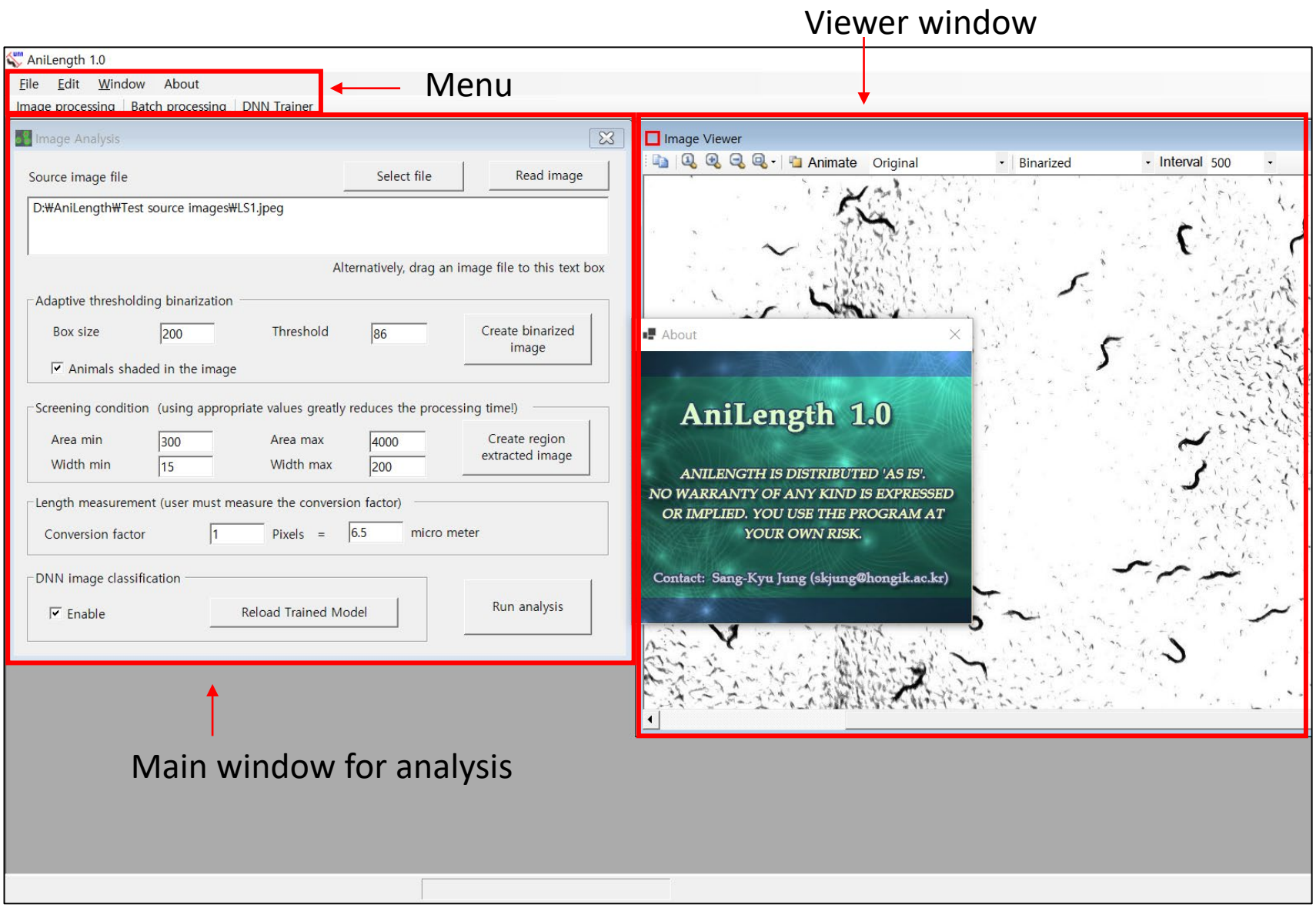
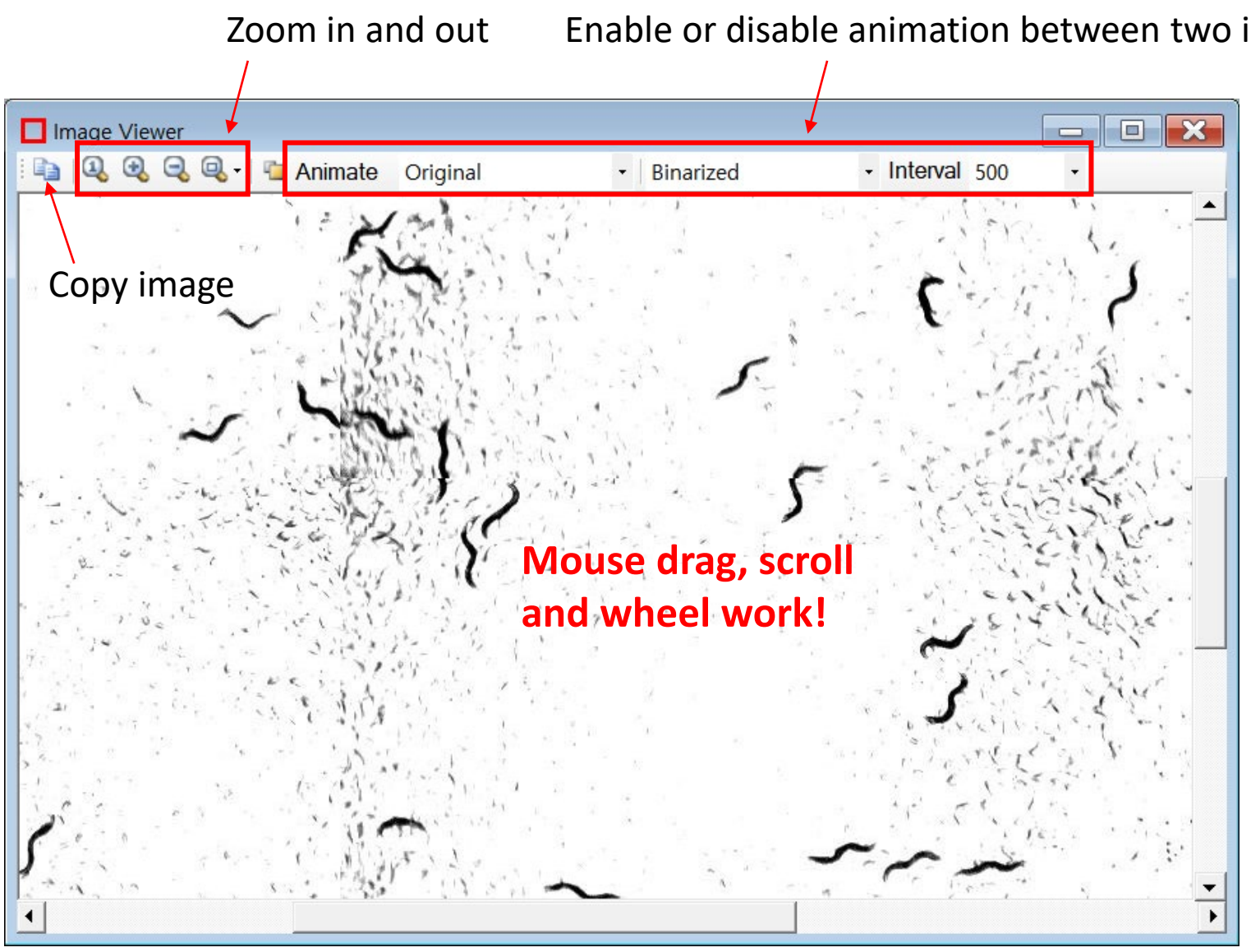
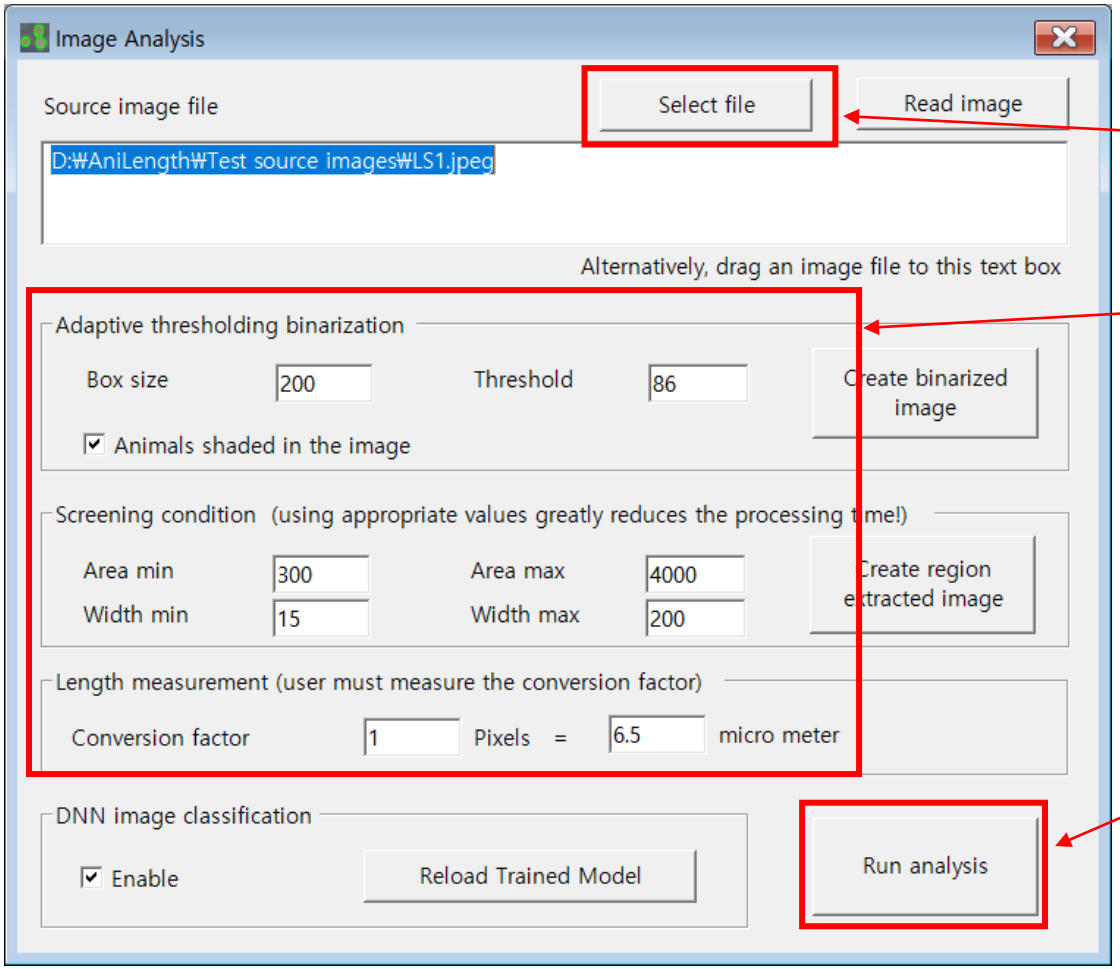


Image Viewer window



Length measurement in Image Analysis window

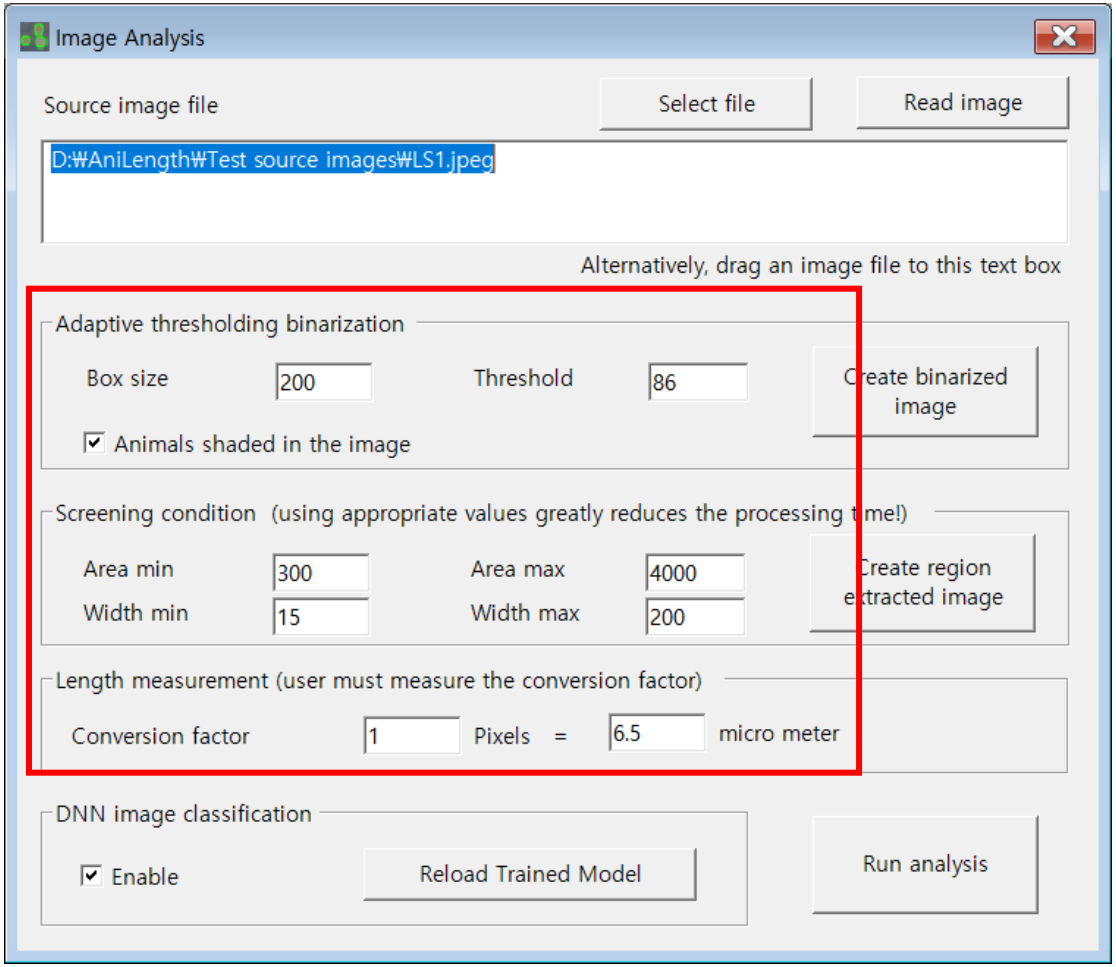


1. Select an image file.

2. Adjust parameters (default values should work for normal use).

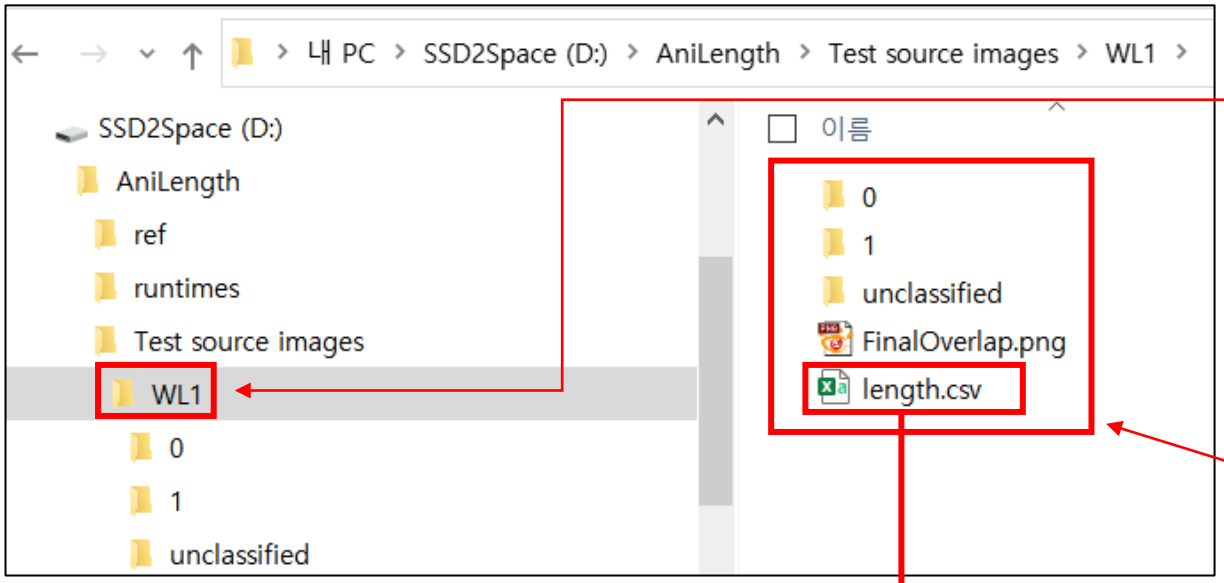
3. Click on the 'Run analysis' button to start the analysis.

Length measurement in Image Analysis window



- Box size: Set a number larger than the worm thickness at least.
- Threshold: Detect blurry worms by adjusting sensitivity.
- Area min, Area max, width(height) min, width(height) max: Objects outside the range are excluded from analysis.
- Conversion factor: Users must measure the conversion factor before analysis.

Length measurement in Image Analysis window

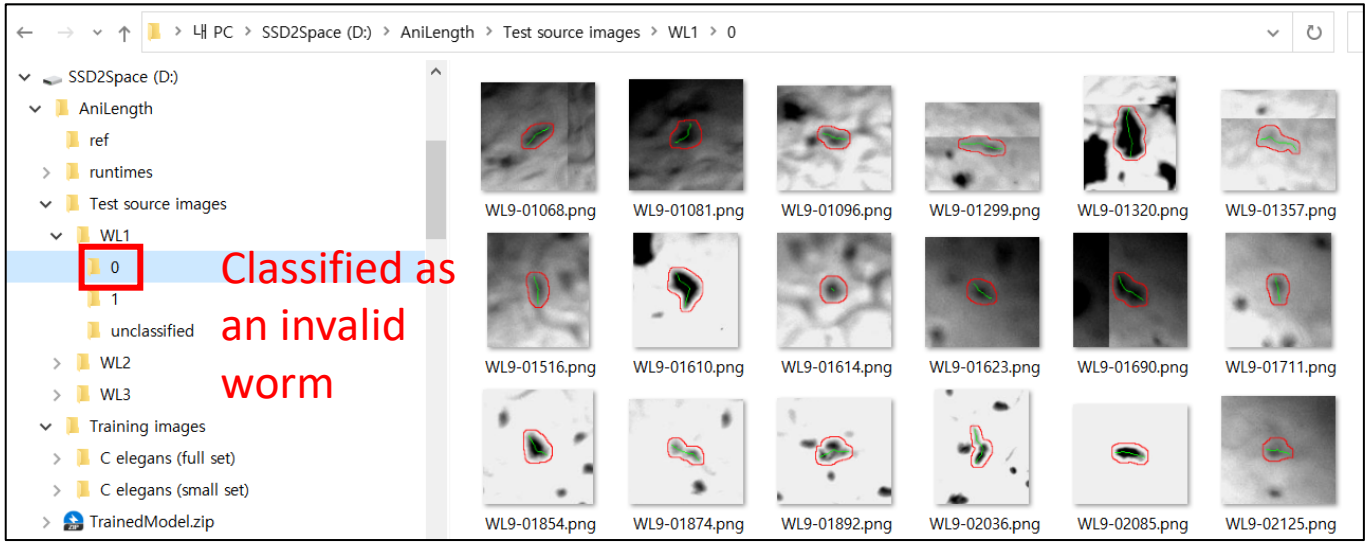


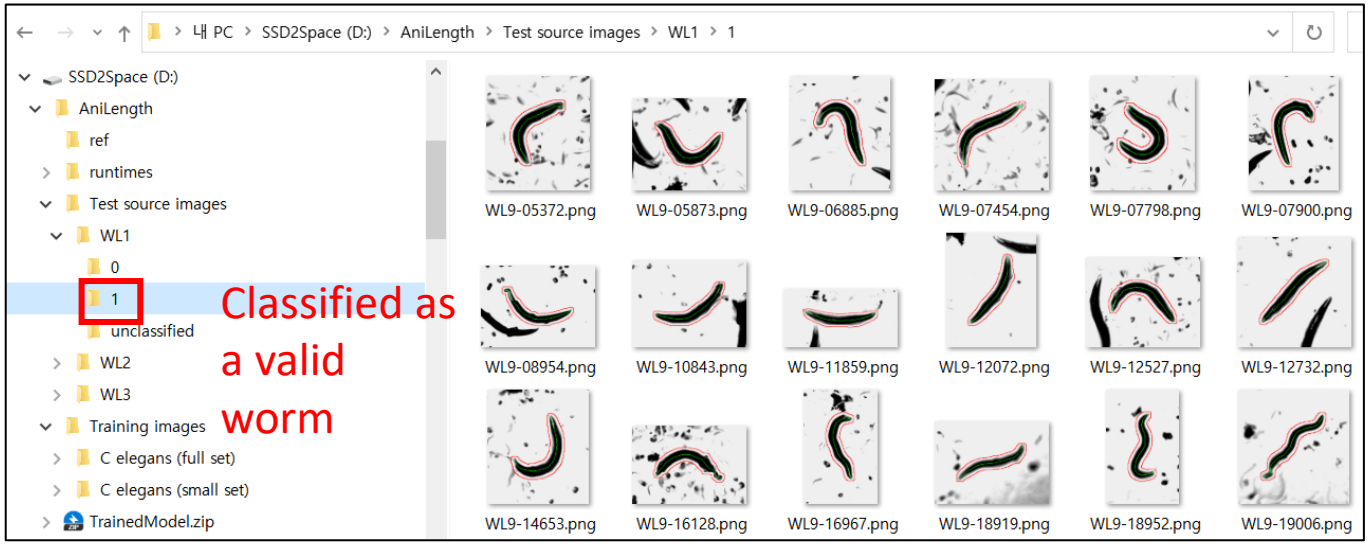
AniLength creates a new subfolder after image analysis.

The subfolder contained the output files.

	A	B	C	D	E	F
1	AnimalID	length(um)	Area(pixels)	ROI_Width	ROI_Height	ROI_ID
2	97	1076.03	3465	99	120	5372
3	111	1123.25	3575	128	84	5873
4	123	1138.09	3364	92	118	6885
5	136	1220.88	3581	132	127	7454
6	139	1070.88	3222	81	97	7798
7	144	1190.63	3164	81	130	7900
8	145	998.38	2663	153	34	7972
9	152	1134.82	3181	125	72	8357
10	164	1151.97	2815	149	79	8954

Length measurement in Image Analysis window



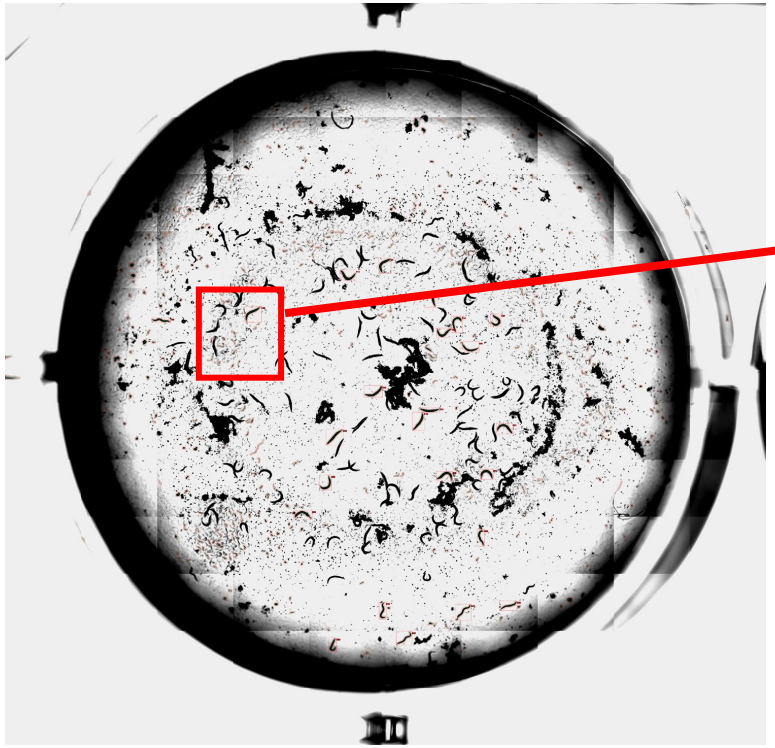


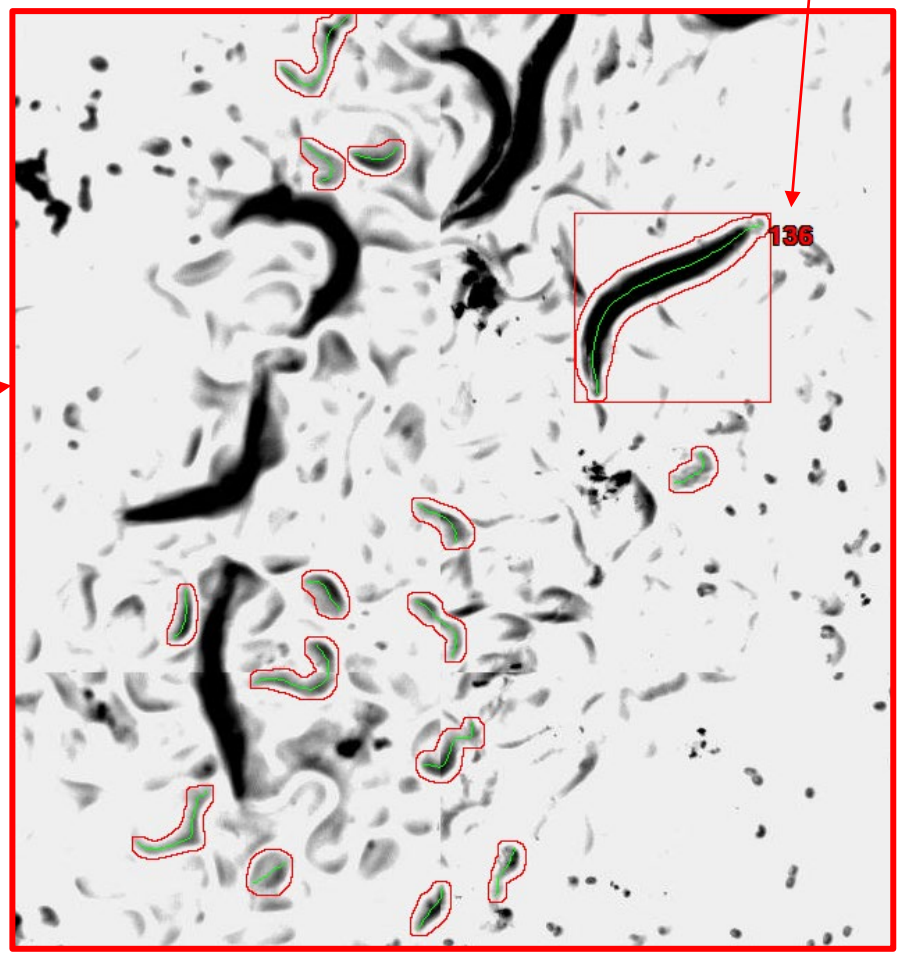
Sample contents of output folders marked "0" and "1"

Length measurement in Image Analysis window

Only valid worms are marked with numbers.

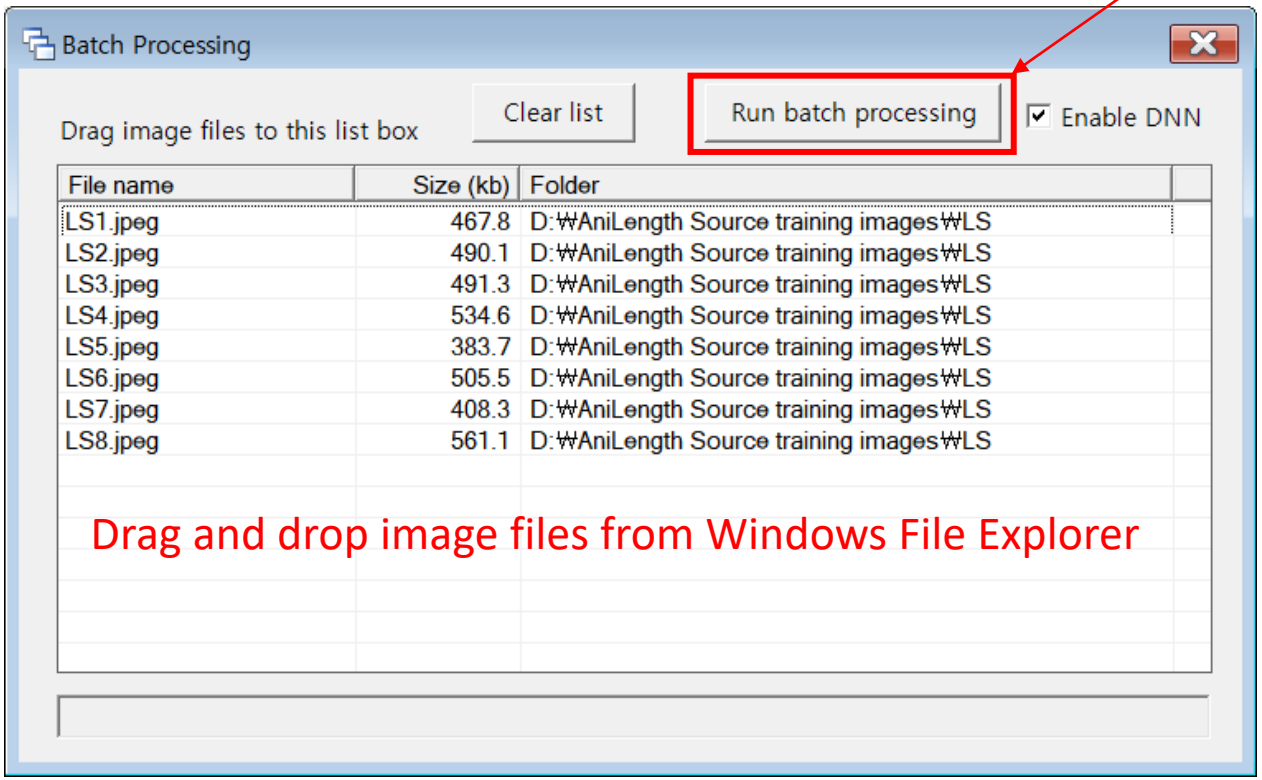
Sample "FinalOverlap.png"



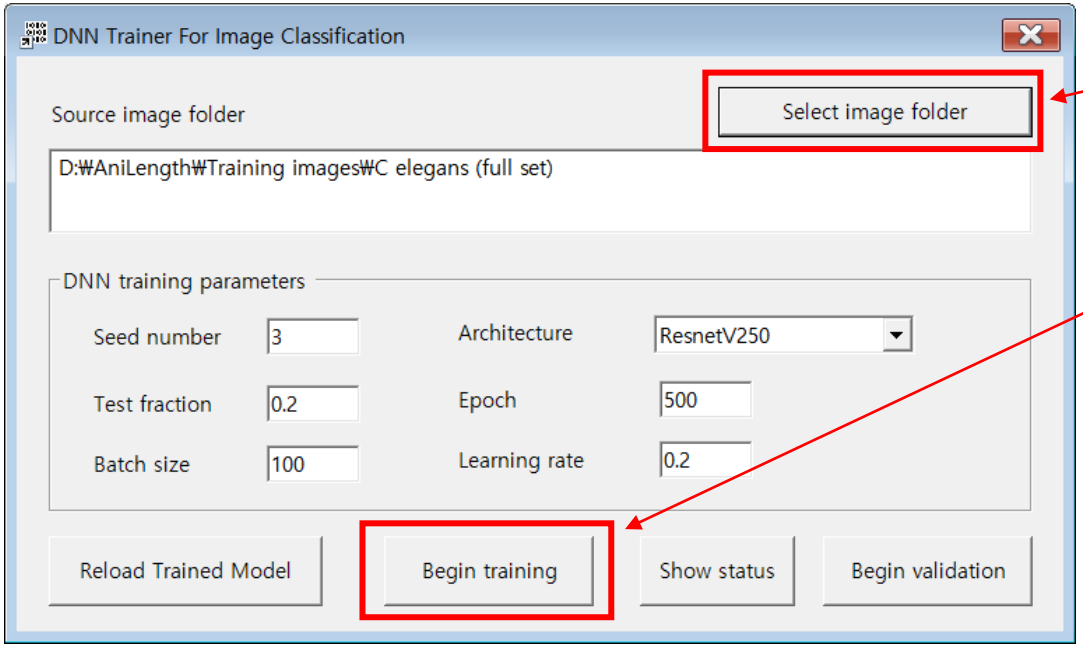


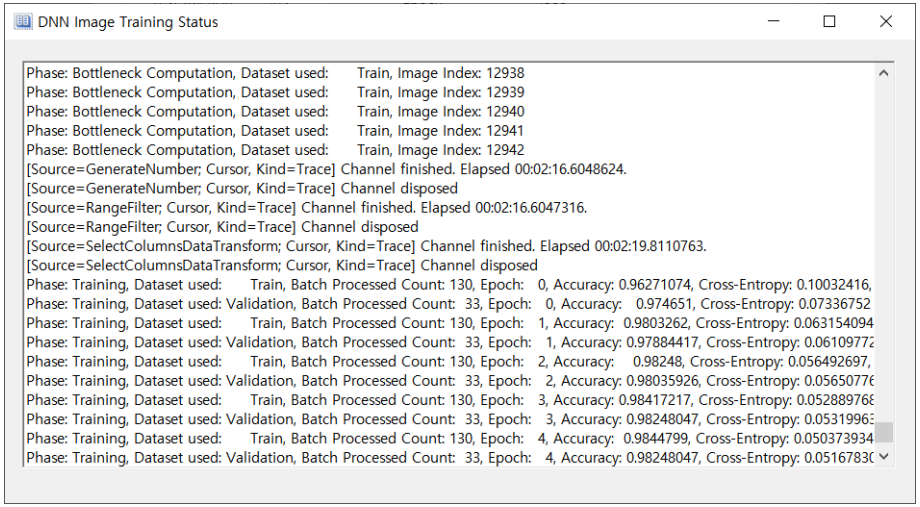
Batch processing

Click the button to start the batch processing.



DNN image classification training





This training status window pops up

1. Select source image folder containing training images.

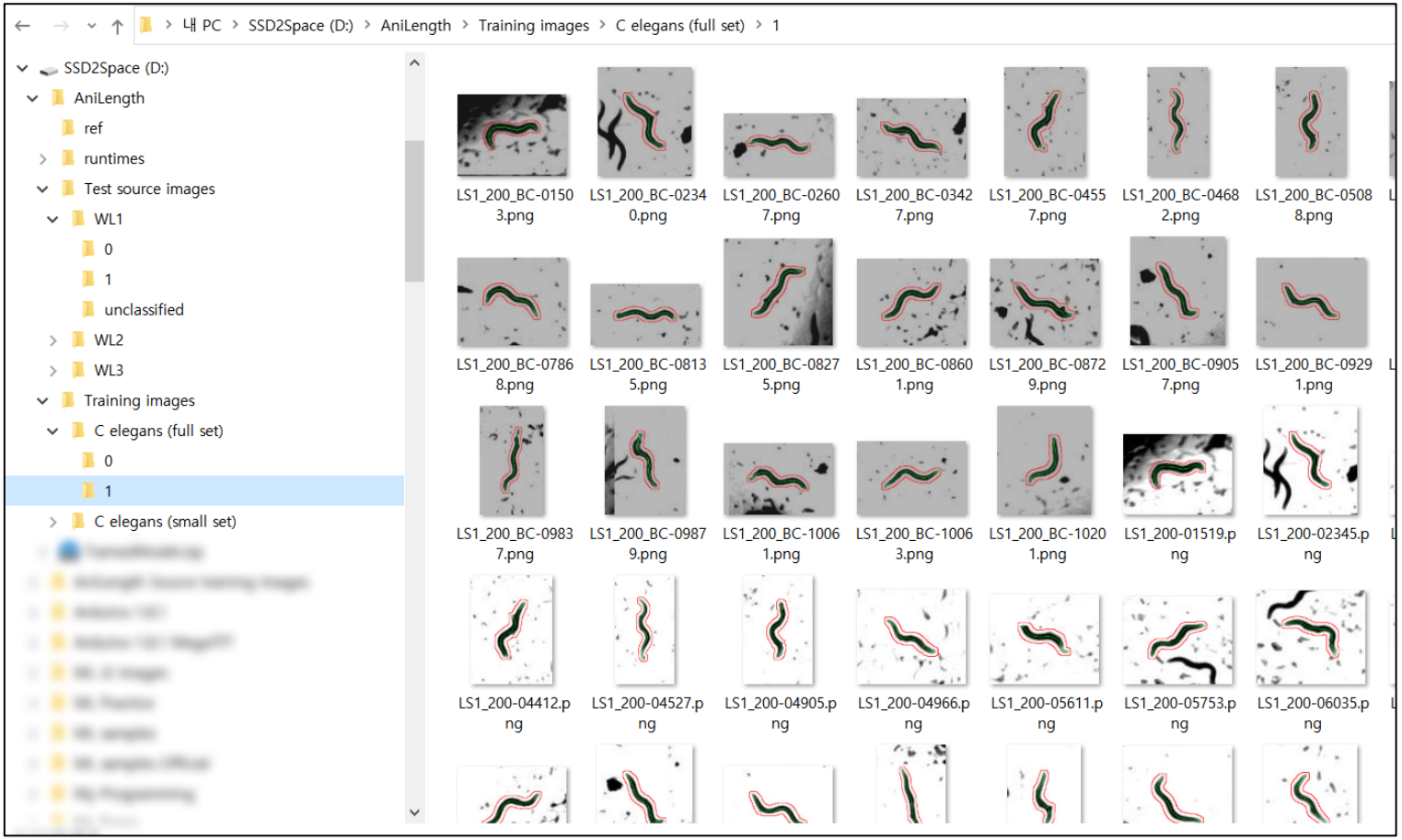
2. Click on the 'Begin training' button to start the training.

3. When the training is completed, "TrainedModel.zip" is created in the source image folder.

4. Users can replace the original "TrainedModel.zip" with a new one. Find the original zip file in the folder where "AniLenth.exe" is located.

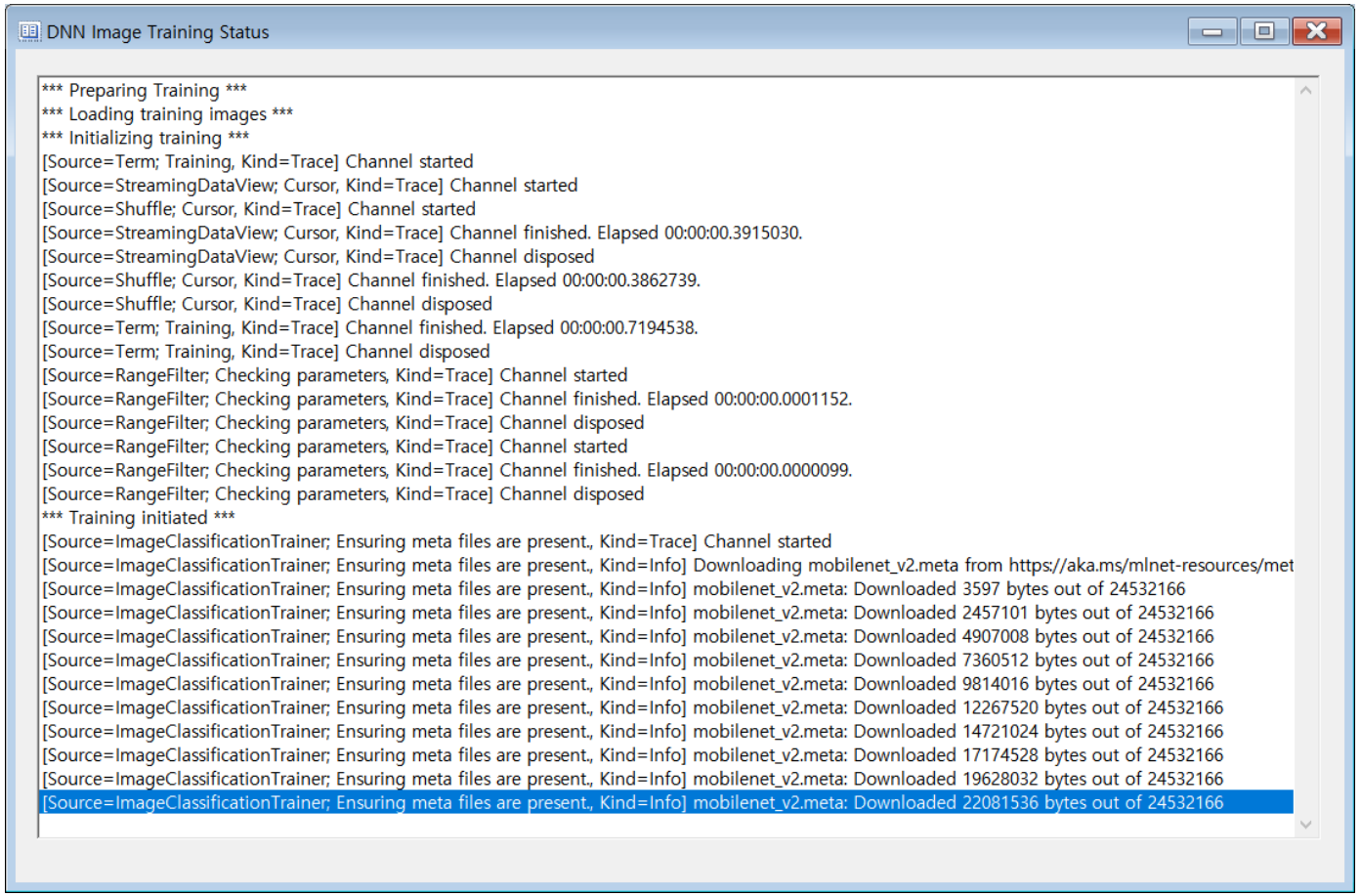
DNN image classification training

Sample training images are included in the "C elegans (full set)" and "C elegans (small set)" folders. Training images are easily created by analyzing source image in the "Image Analysis" window (See slide 8)



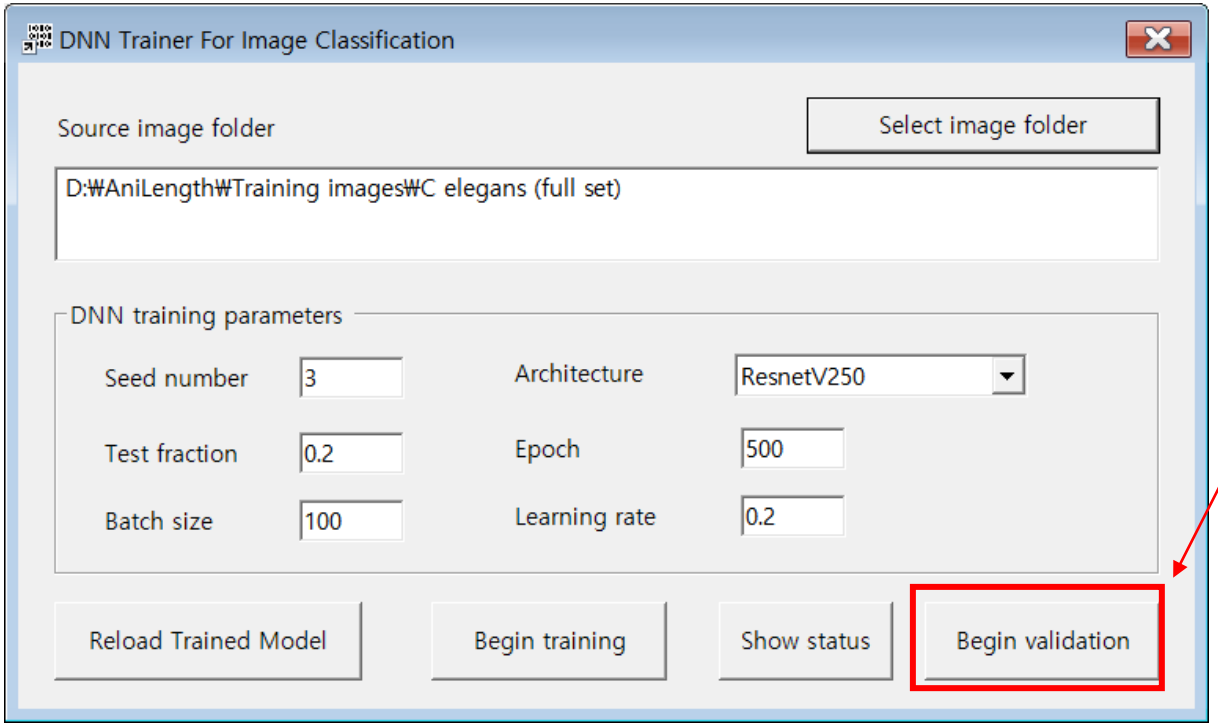
DNN image classification training

Pretrained DNN models (ResnetV250, ResnetV2101, InceptionV3, and MobilenetV2) must be downloaded from the Internet when used for the first time, so the computer must be connected to the Internet, and it takes time to download.



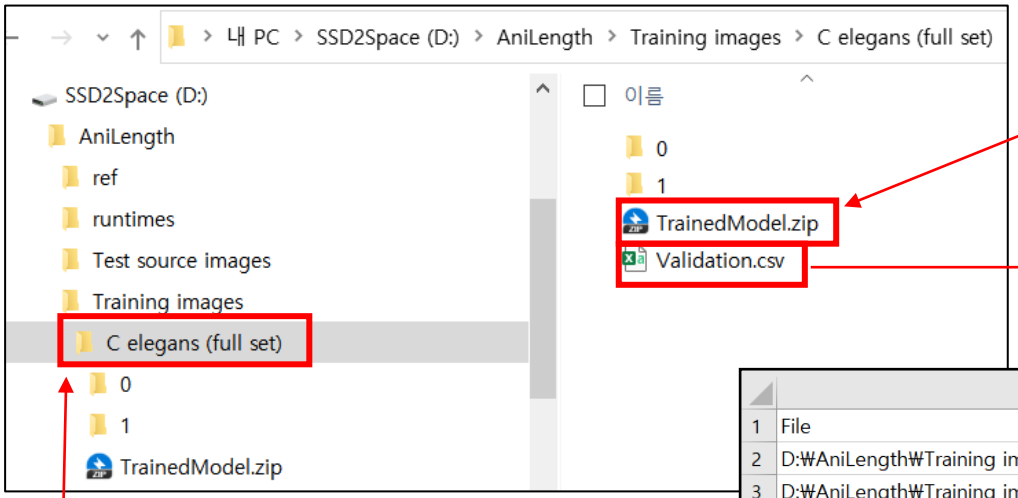
DNN image classification training

Optionally, the user can generate a training analysis report



Click on the 'Begin validation' button to generate a validation report named "Validation.csv" for the current loaded trained model.

DNN image classification training



Newly created trained model file

Sample "Validation.csv"

	A	B	C	D
1	File	real	predicted	correct
2	D:₩AniLength₩Training images₩C elegans (full set)₩0₩LS1-00303.png	0	0	1
3	D:₩AniLength₩Training images₩C elegans (full set)₩0₩LS1-00388.png	0	0	1
4	D:₩AniLength₩Training images₩C elegans (full set)₩0₩LS1-00474.png	0	1	0
5	D:₩AniLength₩Training images₩C elegans (full set)₩0₩LS1-00502.png	0	0	1
6	D:₩AniLength₩Training images₩C elegans (full set)₩0₩LS1-00567.png	0	0	1
7	D:₩AniLength₩Training images₩C elegans (full set)₩0₩LS1-00632.png	0	0	1
8	D:₩AniLength₩Training images₩C elegans (full set)₩0₩LS1-00638.png	0	0	1
9	D:₩AniLength₩Training images₩C elegans (full set)₩0₩LS1-00870.png	0	0	1
10	D:₩AniLength₩Training images₩C elegans (full set)₩0₩LS1-00910.png	0	0	1
16225	D:₩AniLength₩Training images₩C elegans (full set)₩1₩WLs12-06069.png	0	1	1
16226	D:₩AniLength₩Training images₩C elegans (full set)₩1₩WLs12-06085.png	0	1	1
16227	D:₩AniLength₩Training images₩C elegans (full set)₩1₩WLs12-06106.png	0	1	1
16228	D:₩AniLength₩Training images₩C elegans (full set)₩1₩WLs12-06147.png	0	1	1
16229	D:₩AniLength₩Training images₩C elegans (full set)₩1₩WLs12-06175.png	0	1	1
16230	----------			
16231	True negative : 8611 of 8763Accuracy of 98.265%			
16232	False negative : 152 of 8763Accuracy of 1.735%			
16233	True positive : 7416 of 7465Accuracy of 99.344%			
16234	False positive : 49 of 7465Accuracy of 0.656%			
16235	----------			
16236	Correct: 16027 of 16228Accuracy of 98.761%			
16237	Wrong : 201 of 16228Accuracy of 1.239%			

Source training image folder

License info

LGPL v3.0

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AniLength uses the following compiled libraries:

- Microsoft.ML (MIT license)
- Microsoft.ML.Vision (MIT license)
- Microsoft.ML.ImageAnalytics (MIT license)
- SharpZipLib (MIT license)
- SciSharp.TensorFlow.Redist-Windows-GPU (Apache License)
- Queens_ImageControl ("you are free to redistribute it and/or modify it")

Alternative license terms are available upon request.