Feature Extraction from Images

App Physics 157

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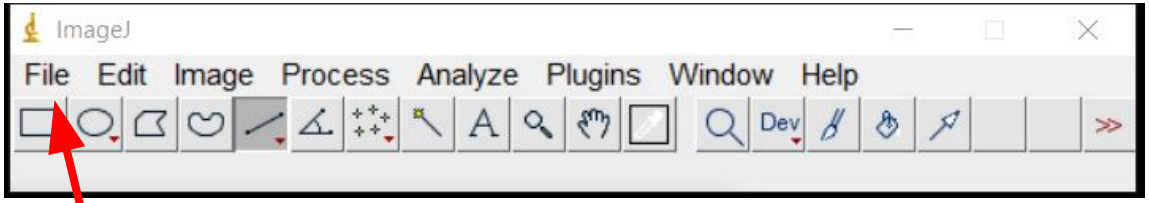
ImageJ

In this module we use ImageJ for measuring properties of an image automatically. ImageJ is a free Java-based scientific image processing software developed by the National Institutes of Health US. Install the ImageJ suited for your operating system (Windows, Linux, or macOS) from their website

https://imagej.nih.gov/ij/download.html

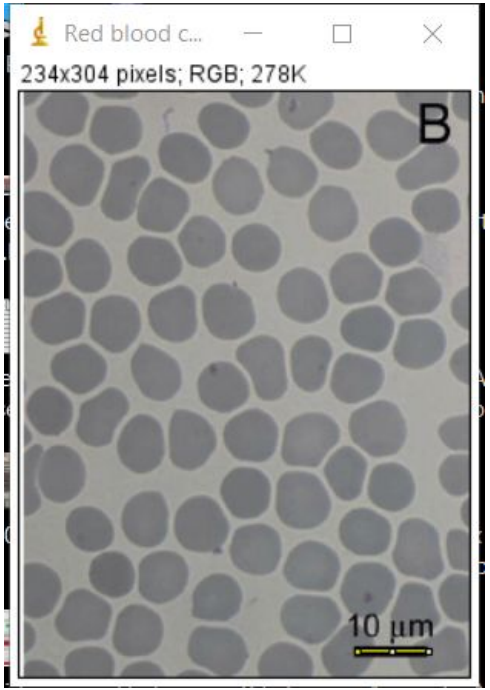
Use Case: Measuring Cell Sizes

The ImageJ toolbar looks like this:

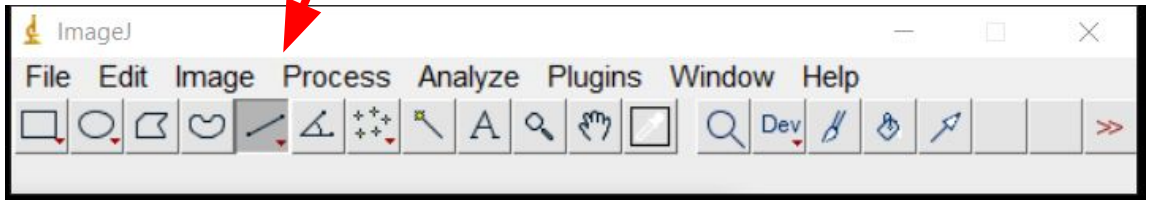


Click File -> Open… and select the test image

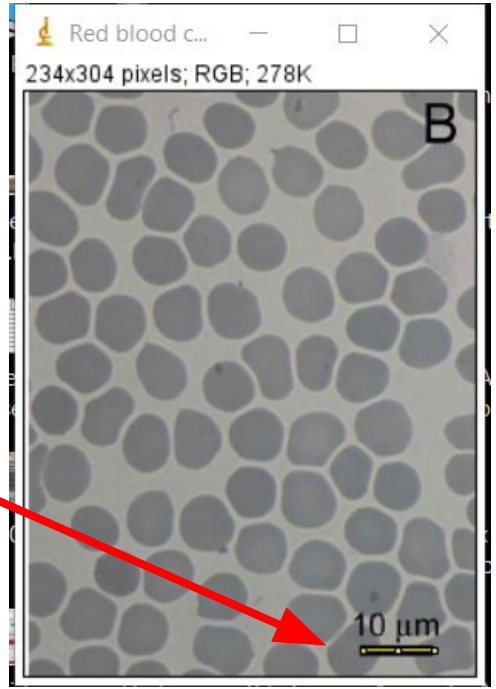
“Red blood cells PUrban.png”



Select the Line tool and use your mouse or track pad to trace the scale bar in the image...

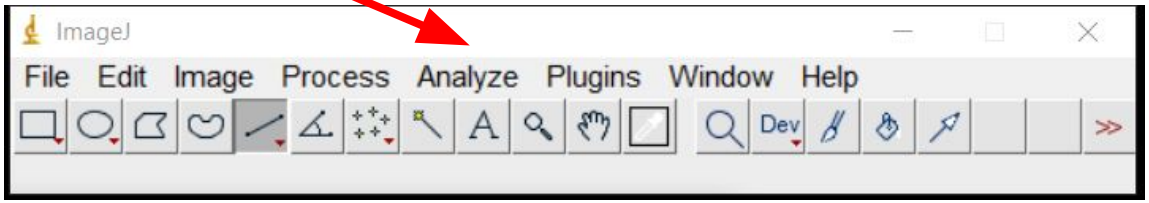


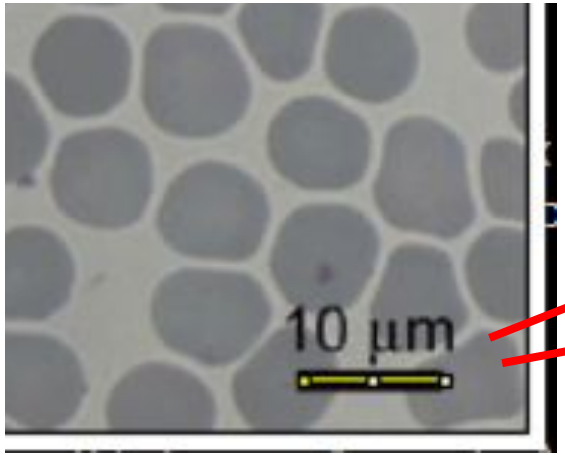
...like so.

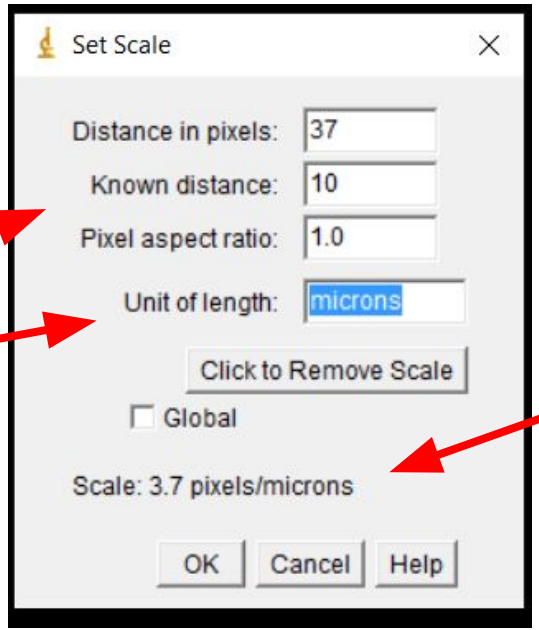


NOTE: To make physical measurements from images there must be a scale bar in the scene. In the absence of a scale bar, objects with known lengths can be used as reference.

Click Analyze -> Set Scale and set the parameters. Click OK when done.

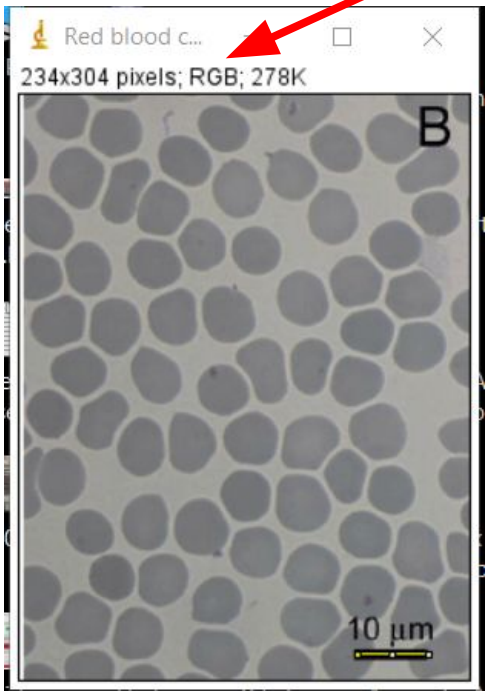




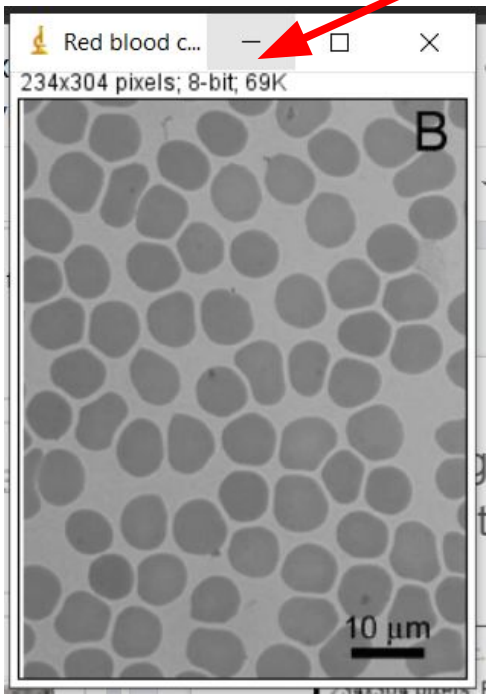


You see here the pixel to micron conversion

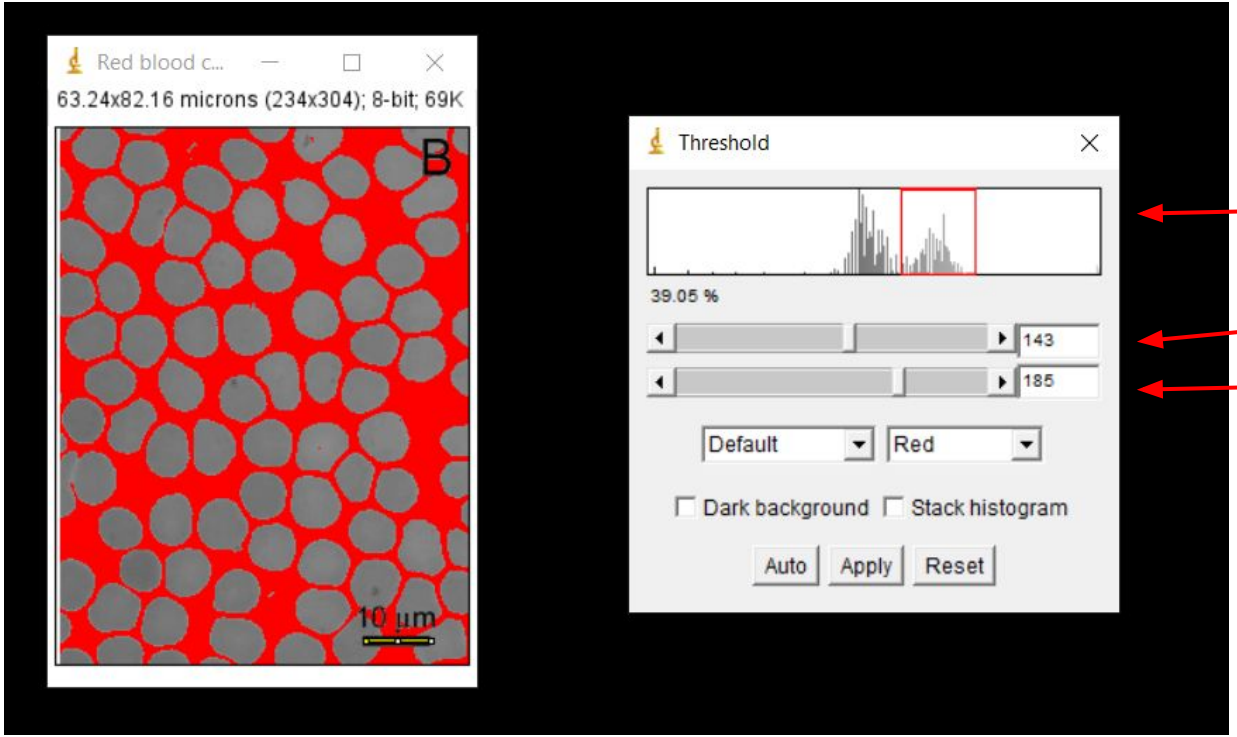
Even though the image is grayscale it is loaded as RGB



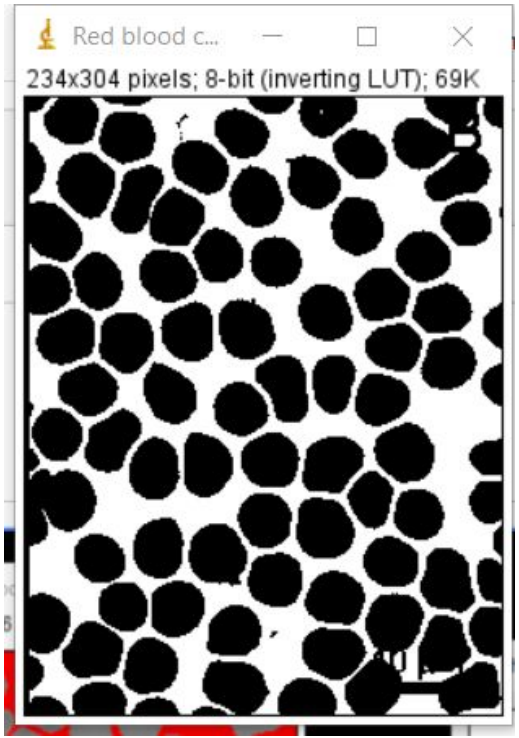
Click Image -> Type -> 8-bit to convert the image to grayscale.



The reason why we need to convert the image to grayscale is so that we can use thresholding to segment our cells. Click Image -> Adjust -> Threshold and adjust the gliders until the cells are separated from the background. Click Apply when done.

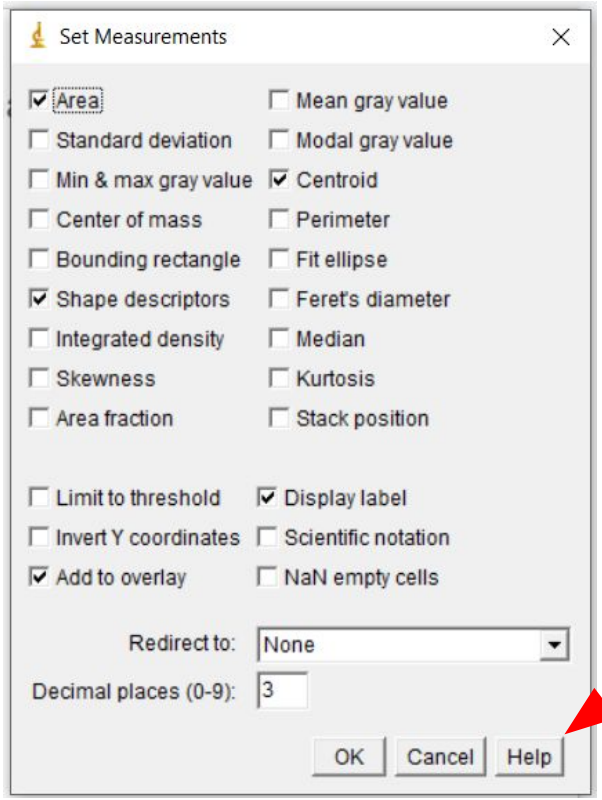


We next convert the thresholded image to binary and invert it. Click Process -> Binary -> Make Binary. Then click Edit -> Invert.



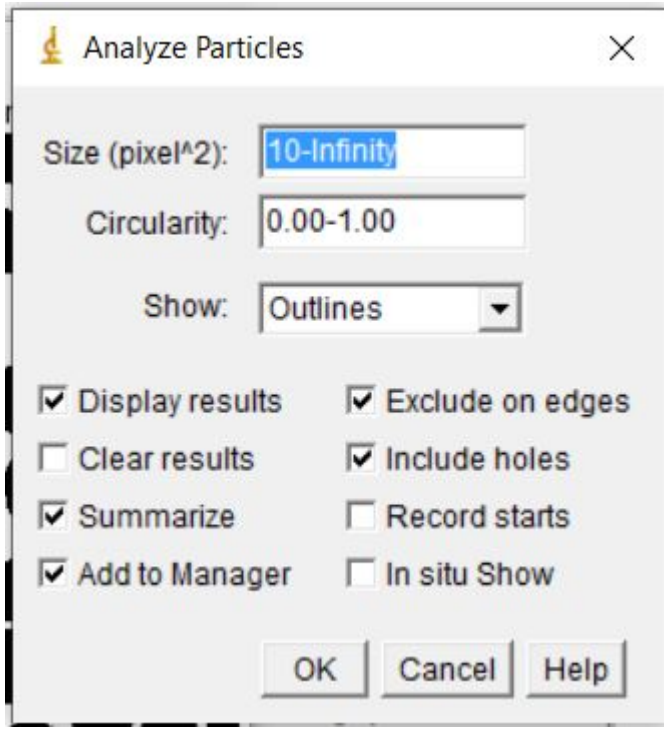
The region of interest will be the black parts (cells).

Click Analyze -> Set Measurements and select the image features you want to measure. Click OK when done.

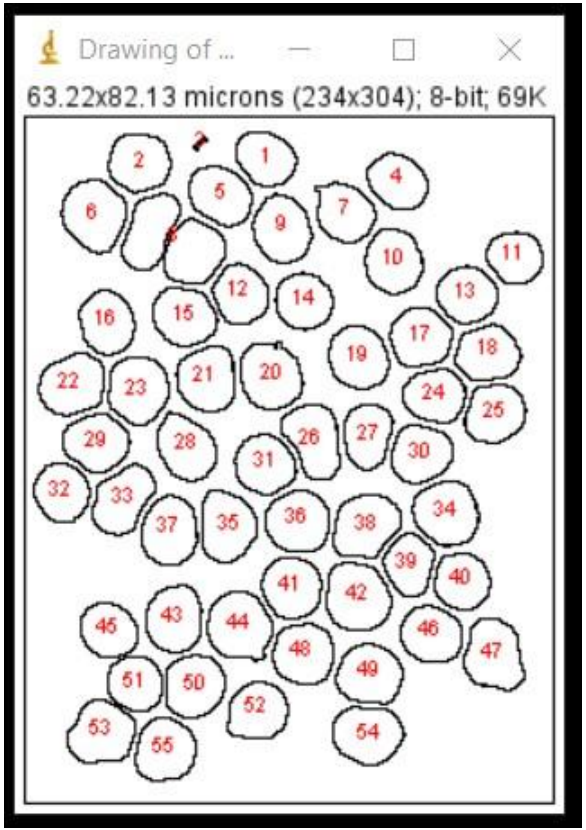


Learn more about these features. Click the Help button for more info or research about them.

Nearly there! Now Click Analyze -> Analyze Particles and click the choices below then press OK.



Et voila! Each of the cells will have been labeled and feature-measured!



Results

File Edit Font Results

	Label	Area	X	Y	Circ.	AR	Round	Solidity
1	Red blood cells PUrban.png	35.912	28.664	4.766	0.918	1.252	0.799	0.952
2	Red blood cells PUrban.png	41.022	13.489	5.235	0.887	1.078	0.928	0.947
3	Red blood cells PUrban.png	0.730	20.803	2.918	0.436	3.513	0.285	0.526
4	Red blood cells PUrban.png	36.277	44.506	7.539	0.921	1.264	0.791	0.952
5	Red blood cells PUrban.png	40.949	23.217	9.207	0.892	1.300	0.770	0.948
6	Red blood cells PUrban.png	50.219	8.076	11.543	0.885	1.165	0.858	0.947
7	Red blood cells PUrban.png	38.394	38.144	11.258	0.836	1.211	0.825	0.925
8	Red blood cells PUrban.png	85.109	17.415	14.776	0.418	1.448	0.691	0.867
9	Red blood cells PUrban.png	43.723	30.626	13.286	0.878	1.212	0.825	0.940
10	Red blood cells PUrban.png	41.971	44.007	17.127	0.886	1.151	0.869	0.948
11	Red blood cells PUrban.png	32.482	58.600	16.643	0.923	1.111	0.900	0.947
12	Red blood cells PUrban.png	36.423	25.656	21.087	0.899	1.124	0.889	0.944
13	Red blood cells PUrban.png	38.102	52.818	21.129	0.922	1.092	0.916	0.947

Now you try it!

Try it out on this sand image or use your own.

Note: the image on the left does not have a scale bar. Just use an arbitrary scale for now.

For more info, check out the Help button in the ImageJ menu.

Extra Challenge

1. Assemble different objects of different shapes, or texture.
2. Take a picture of them on a plain background.
3. Extract their properties using ImageJ.

Examples of objects for feature extraction:

- Coins
- Electronic components
- Candies
- Rice grains
- etc.