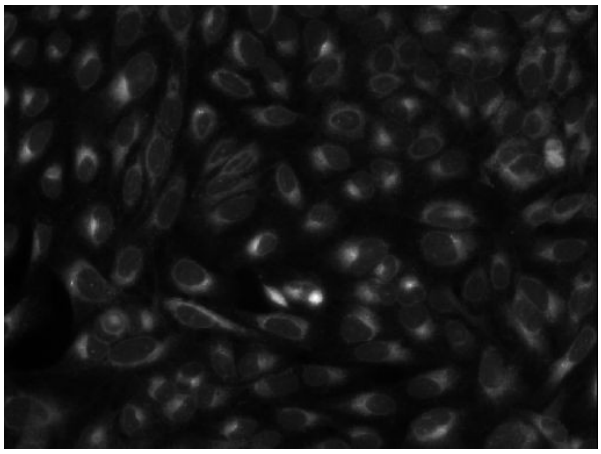
ASSIGNMENT 4: AUTOMATING CELL COUNTING

In this assignment you will write a program to perform cell counting. The images to be used are available in the Cell Image Library online. They are produced by a process called "multiplex cytological profiling assay" which "paints" biological cells with different fluorescent dyes depending on their cellular state (such as dead vs. alive). This is often done to determine the toxicity of drugs. The Cell Image Library (375 images) is located here:

http://www.cellimagelibrary.org/pages/project_20269

To download an image, please click on one of the "plate" links. A page with an image will then appear. Below the image, select "Image Data Download Options…" and "Download in JPEG Format". Don't download any of the other formats! A JPEG image should then download. An example of an image is this one:



As you can see, cells have irregular shapes, sometimes they overlap and sometimes they do not overlap. Sometimes they are bright (probably due to the fluorescing dye) and sometimes they are faint. Counting the cells in these images therefore will be a challenge, but it is not impossible. I am not sure how close to the exact number of cells it is possible to get with an automated system, but we could say +- 10% is acceptable.

The way to write a program performs an image processing task like this is to set your program up as an *image pipeline*. Each operation in the pipeline inputs an image and outputs an image. The format of the image may change along the way (e.g. thresholding will turn an 8bit greyscale image to binary). By the end of the pipeline you should have an image in which the cells can be counted (e.g. using the region counting algorithm described in lectures). Examples of steps in the pipeline: blurring, sharpening (for enhancement), median filtering (for noise removal), intensity scaling, thresholding, opening, closing …. etc. You may need to apply the same operation more than once and at different places. In general, there no single right way of building the pipeline for this problem.

Write a program that will count the live and dead cells in images like this. You can use as many of the images from the website about as you like for testing. We will pick five random images for marking. Your program should have the name Counter and be invoked in the usual way from the command line, i.e:

`javac Counter.java && java Counter` *`imagefile.jpg`*

The program should (i) display a selection or all of the intermediate images from your pipeline, to give an idea of what your program actually does (you will need to create a Java GUI for this), and (ii) output the cell count.

Please also provide a very short report (2 pages max) describing your pipeline so we can get an idea of the complexity of your method and what you did. You can use any basic image operation described in lectures, but are not permitted to use advanced operations (e.g. existing cell counting libraries are prohibited!).

Please submit on moodle a zip file containing (i) your source code and (ii) your report in PDF format. Marks will be allocated according to how accurate and how sophisticated your method is.