# Biological Image Processing and Informatics

**Spring 2023**

**Project Assignment #1**

Assigned on MAR-16-2023

***Due on APR-06-2023 by 10pm @Education Cloud***

# Overview

本作业回顾了图像分析和计算机视觉中的一些基本操作，如图像的读/写、图像的显示、图像的强度直方图的计算、感兴趣区域的定义以及图像分割

NOTE: Each student is required to complete this assignment individually.

Please install a copy of ImageJ for viewing images for this project. You may also find it useful to install a copy of IrfanView or comparable image viewer software that can handle 16-bit images.

For this assignment, we ask you to use MATLAB or Python. The total score for this assignment is 60 points + 10 points extra credit.

# Questions

## Question 1 (20 points): Basic concepts of image analysis and computer vision

**Part I:** If you choose MATLAB, we ask you to use the MATLAB Image Processing Toolbox. If you choose to use Python, we suggest the Pillow package (<https://pillow.readthedocs.io/en/stable/>), Scitkit-image (<https://scikit-image.org/>) or OpenCV (<https://opencv.org/>).

We ask you to familiarize yourself with either the Image processing Toolbox or the Pillow package and answer the following questions

* What are the image formats supported? # 支持哪些图像格式？
* How to read, display, and write an image? # 如何读取、显示和写入图像？
* Please give a summary of the image processing functions provided.

# 请简要介绍所提供的图像处理功能

## Question 2 (20 points): Input/output of a static greyscale image

* 1. Download the image named “axon01.tif” from Education Cloud.
  2. 使用MATLAB或Python读取图像并显示。编写程序绘制其强度直方图。请不要使用内置的图像强度直方图功能。相反，请通过调用MATLAB或Python中的直方图函数来编写自己的图像强度直方图代码。（10分
  3. 编写一个程序来定义矩形感兴趣区域（ROI），在ROI内裁剪图像，并以非压缩TIF格式保存裁剪后的图像（请随时为保存的图像指定名称）。（10分）

## Question 3 (20 points): Image segmentation using ICY-Spot Detector

**3.0** Download and install a copy of ICY-Spot Detector (<http://icy.bioimageanalysis.org> )

**3.1** Use the program to segment the image named “axon01.tif”. Show your result.

## Question 4 (EXTRA CREDIT: 10 points): Retrieving image from

**4.0** Retrieve an image of mitochondria from Protein Atlas, specifically the Cell Atlas (5 points）.

<https://www.proteinatlas.org/>

**4.1** Use the ICY(select a segmentation toolbox) or CellProfiler (<https://cellprofiler.org/>) to segment the retrieved image as well as “axon02.tif” and “cell\_nucleus.tif” (5 points).

# Instructions on report writing

* 1. Write a project report in either Chinese or English following the format listed below. Submit the report in hard copy.

The report should include the following sections:

* + - *Project number and title, student name, date of submission*
    - *Introduction: write a general and brief summary of the project.*
    - *Code execution instruction: provide clear instructions on how to run your code.*
    - *Result section: present key results by showing the images. This part should be organized largely following the sequence of questions. Concisely explain/comment on your results.*
    - *Summary/discussion section: summarize and discuss what you have learned from this project.*
    - *References: list references you want to cite.*
  1. As a requirement for best practice in programming, your code should be properly formatted and commented.
  2. Submit relevant images generated for this assignment. See instructions below.

# Instructions on report submission

* For this assignment, report submission will be handled by Education Cloud.
* Package all programs and results files (e.g. videos) into one file using any of the commonly used compression software (WinZip, WinRAR, etc). **Be sure to include your name in the file name.**

# Report format

There is no page limit for the project report.

Page size: letter Line space: single

Page margins: 0.5 inch on each side (top, bottom, left, right)

Font size: 11 or 12 points font for the main text; 10 points for listed references