生物图像处理与信息学
Biological Image Processing and Informatics

Spring 2023

Reading Assignment #1

Assigned on MARCH-02-2023

Due on MAR-19-2023 by 10PM in Education Cloud

A. Overview

The goal of this reading assignment is to provide a general overview of biological image processing and informatics, referred to as bioimage informatics, with an emphasis on introducing related basic concepts.

NOTE: There is no need to be concerned if you cannot fully understand all the biological or technical details in the articles at this time. We will gradually build the background knowledge to understand these details.

Reports should be submitted in Adobe PDF format through the submission links in Education Cloud of UCAS. The full score for this assignment, which includes two reports, is 40.

B. Instructions

B.1 Bioimage informatics

Please read the following article. You can download the PDF from the **Education Cloud** portal for this class. Write a report to summarize and discuss your understanding of bioimage informatics. Detailed instructions on report formatting are provided in Section C.

1. H. Peng, Bioimage informatics: a new area of engineering biology, *Bioinformatics*, vol. 24, pp. 1827-1836, 2008.
    Comments: This article provides a general overview of bioimage informatics, including a summary of some core techniques.

Additional references are provided at the end of this handout. Reading of these additional references is optional and NOT required.

B.2 Deep learning for cellular image analysis

Please read the following article. You can download the PDF from the **Education Cloud** portal for this class. Write a report to summarize and discuss your understanding of bioimage informatics. Detailed instructions on report formatting are provided in Section C.

2. E. Moen et al, Deep learning for cellular image analysis, *Nature Methods*, vol. 16, pp. 1233-1246, 2019.
    Comments: This article provides a general overview of deep learning techniques in analyzing cellular images.

Additional references are provided at the end of this handout. Reading of these additional references is optional and NOT required.

C. <u>Report format</u>

C.1 General formatting

Each report, including references, must not be more than 2 pages. <u>This page limit is set to ensure reasonable workload and conciseness in writing.</u>

Page size: letter
Line space: single
Page margins: 0.5 inch on each side (top, bottom, left, right)
Font size: 11 or 12 point font for the main text; 10 points for listed references

C.2 Detailed requirements

Please write your report following the following structure of organization.

<u>Title</u>
       Choose a title for your report. Remember to number the assignment.

<u>Author information</u>
       Please list your name here.

<u>Section 1:   Short abstract</u>
       Use this section to give a concise summary of key messages/ideas in the reference articles.

<u>Section 2:   Introduction/background</u>
       Use this section to provide relevant background information.

<u>Section 3:   Detailed summary</u>
       Use this section to provide a more detailed summary of important information in the references.

<u>Section 4: Discussions</u>
       Use this section to provide your opinions and critical comments on the subject.

<u>Section 5: References</u>
       List all references here. Be sure to format properly.

D. <u>Some general guidelines on report writing</u>

1. Organize your report into sections and use section titles. This substantially improves readability.

3. Avoid long paragraphs. Instead, try to break them up into logically coherent short paragraphs.

4. Pay attention to details. Be sure to cite your references properly. If you are not sure how to make citations, follow the format of a research journal.

E. <u>References for further reading (optional, NOT required)</u>

1. Nature Methods, Focus on Bioimage Informatics https://www.nature.com/collections/ljnrytmmwc
2. J. Swedlow and K. Eliceiri, Open source bioimage informatics for cell biology, *Trends in Cell Biology*, vol. 19, pp. 656-660, 2009.
3. J. Swedlow, et al, Bioimage informatics for experimental biology, *Annual Review of Biophysics*, vol. 38, pp. 327-34, 2009.
4. G. Danuser, Computer vision in cell biology, *Cell*, vol. 147, pp. 973-978, 2011.
5. R. Pepperkok and J. Ellenberg, High-throughput fluorescence microscopy for systems biology, *Nature Review of Molecular Cell Biology*, vol. 7, pp. 690-696, 2006.
6. G. Myers, Why bioimage informatics matters, *Nature Methods*, vol. 9, pp. 659-660, 2012. *Comments: This article discusses briefly some rationales for development of bioimage informatics.*
7. G. Danuser, Computer vision for systems biology, *Proc. IEEE 2006 Int. Symp. Biomedical Imaging (ISBI)*, 241-244. *Comments: This article is written for a general audience. It explains the necessity of using computational techniques to analyze biological images for systems-level understanding of biological processes.*