

# Title

Nuclei Segmentation Using Deep Learning and Hyperspectral Imaging for High Accuracy

## Abstract

Computerized microscopy image analysis plays a crucial role in computer aided segmentation/diagnosis. Machine learning methods have emerged as a powerful aspect in medical investigation and clinical practice. Deep learning methods for segmentation have been recently utilizing RGB images to train neural networks which has attracted considerable attention in the biomedical informatics industry. This study provides an in-depth analysis of the differences in probability segmentation of human tissue using RGB images and Hyperspectral images using the UNET Convolutional Neural network architecture. We introduce the popular neural network specifically designed for biomedical segmentation problems and we summarize current deep learning achievements in tasks such as detection and segmentation. The results of this research qualify the potential usage of hyperspectral imaging to improve the quality of neural network segmentations. In particular, we explain the architecture and the principles of the convolutional neural network and describe how we were able to improve the efficiency and accuracy of the UNET architecture segmentation by utilizing hyperspectral imaging to train the network with a larger volume of data. In addition, we discuss the challenges and the potential trends of future research in biomedical image analysis using machine learning methods.

## Authors

hridaanshu@gmail.com  
Hridaanshu Gusain Shaker High School, USA

lkmestha@gmail.com  
Lalit Mestha  
Rensselaer Polytechnic Institute, USA

## Domain Conflicts

N/A

## Subject Areas

Primary : Machine learning

Secondary : Biomedical Applications, Computational Imaging, Multi- and Hyper-spectral imaging, Medical image analysis, prostate

## Statement of novelty/impact

Please provide a statement of novelty/impact of the contribution made by the manuscript as the main argument for its presentation at the conference.(300 characters)

In the histopathological field of biology, current computational methods of biological nuclei segmentation are done using large datasets of 3-color-channel images to train neural networks. The accuracy of these models are not up-to-par with experienced pathologists, so this study presents an alternative method to segment and analyze human tissue. Hyperspectral imaging was proven to drastically increase the accuracy of neural networks with limited data compared to RGB images.

## Review conflicts

N/A

## Declaration of Other Conflicts

N/A

## Student Survey

High School student

# ISBI best Paper award

Don't know

## Agreement \*

You must agree to all of the following or your submission will be rejected.

- I have read and understood the author's guidelines as outlined in [https://2024.biomedicalimaging.org/en/AUTHOR-\(4-PAGE-PAPER\).html](https://2024.biomedicalimaging.org/en/AUTHOR-(4-PAGE-PAPER).html)
- I understood that my submission will be rejected if it does not comply with the author's guidelines, including paper length and formatting violations.
- I have accurately entered all domain conflict information of all co-authors. (See author guidelines)
- I understood that any inaccurate and incomplete author information and domain conflicts will result in desk rejection of my submission.
- I confirm that this work is not under review or has not been accepted by another conference/journal and will not be submitted to a conference/journal during the ISBI review process.
- I consent that all information submitted in this form is accurate.
- I have listed all co-authors of the paper.

I agree

## Human and/or Animal Subjects \*

IEEE-ISBI supports the standard requirements on the use of animal and human subjects for scientific and biomedical research. For all IEEE ISBI 2024 papers reporting data from studies involving human and/or animal subjects, formal review and approval, or formal review and waiver, by an appropriate institutional review board or ethics committee is required and should be stated in the papers. For those investigators whose Institutions do not have formal ethics review committees, the principles outlined in the Helsinki Declaration of 1975, as revised in 2000, should be followed.

This paper reports data from studies involving human and/or animal subjects.

No

## Compliance with Ethical Standards \*

Reporting on compliance with ethical standards is required (irrespective of whether ethical approval was needed for the study) in the paper. Authors are responsible for correctness of the statements provided in the manuscript.

Examples of appropriate statements include:

- (a) "This is a numerical simulation study for which \*no\* ethical approval was required."
- (b) "This research study was conducted retrospectively using human subject data made available in open access. Ethical approval was \*not\* required as confirmed by the license attached with the open access data."
- (c) "This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of my institution."
- (d) This paper includes a section titled "Compliance with Ethical Standards" (note that this can be on the fifth page).

I agree

## Conflicts of Interest Disclosure \*

- IEEE-ISBI supports the disclosure of financial support for the project as well as any financial and personal relationships of the author that could create even the appearance of bias in the published work.
- If the paper is accepted, the authors must disclose any agency or individual that provided financial support for the work as well as any personal or financial or employment relationship between any author and the sources of financial support for the work.
- If accepted, this paper will report on real or potential conflicts of interests, or the absence thereof, in the "Acknowledgments" section.

I agree