



**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS**

Name of the Student : Abhishek Vahadane

Roll Number : 11610215

Programme of Study : Ph.D.

Thesis Title : A Few Algorithms for Histopathological Images in Computational Pathology

Name of Thesis Supervisor(s) : Dr. Amit Sethi

Thesis Submitted to the Department/ Center : EEE

Date of completion of Thesis Viva-Voce Exam : 21/04/2017

Key words for description of Thesis Work : Digital Pathology, Histological Images, Staining, Stain Separation, Non-Negative Matrix Factorization, Sparse Coding, Color Normalization, Nuclei Segmentation, Deep Convolutional Neural Network, HER2 Score Prediction

SHORT ABSTRACT

In computational pathology, huge stacks of histological data are made available through advances in the microscopic image acquisition. Clinicians cannot learn easily from this big data due to obvious human limitations. However, machine learning systems can learn important patterns from these huge histological data to improve the diagnosis and prognosis. Such automated prediction can act as a second opinion for the experts to help make their decisions. In this thesis, we address four different problems, some of which are widely applicable to computational pathology pipelines such as stain separation, color normalization, nuclei segmentation, and HER2 score prediction. In the stain separation, we included biologically plausible sparsity constraint on the stained structures at each pixel. Color normalization proposal was dependent on the accurate stain separation representation. Color normalization method standardizes color appearance of a source image to that of a standard (target) image, which effectively preserves the biological structure of the source image. A deep learning based robust nuclear segmentation algorithm was proposed which performs out of box on any tissue type H&E stained image. While participating in HER2 score prediction competition, we developed a deep CNN to predict the HER2 score of the patches and novel criteria to score the WSI based on the patches HER2 scores. We were successfully able to detect the HER2 score of the difficult WSI in which experts gave wrong HER2 score.