Whole Cell Segmentation for the Quantification of Molecular Biomarkers in Histopathology Samples from Multiplex Immunostaining and Multi-Spectral Imaging

by

Kedar Balaji Grama

An Abstract of a Thesis Submitted to the Graduate
Faculty of Rensselaer Polytechnic Institute
in Partial Fulfillment of the
Requirements for the degree of
MASTER OF SCIENCE
Major Subject: BIOMEDICAL ENGINEERING
The original of the complete thesis is on file
in the Rensselaer Polytechnic Institute Library

Approved:

_____
Dr.Badrinath Roysam, Thesis Adviser

Rensselaer Polytechnic Institute
Troy, New York

May, 2010

Abstract

The procedure of histopathologic analysis of cancerous tissue samples largely depends on a trained human observer classifying the tissue specimen. Computer-automated methods to quantify biomarkers and classify tissue samples have been making inroads into this field because of their objectivity and low error rates.

A method for quantifying molecular biomarkers in histopathology specimens on a cell-by-cell basis, a manner that is compatible with current clinical practice are presented here. The nuclei and cytoplasmic domains of the cells in the field are delineated and then based on a cell type marker each cell in a field is segmented and identified by type. The intra-cellular distribution of molecular biomarkers is quantified for each cell and cell classification is done on the basis of the levels of the markers. The method is validated on a set of samples prepared with specific ratios of cells either positive or negative for PKH67. Also, a set of carcinoma tissue samples immunolabeled using a combination of chromogenic and/or fluorescent stains to highlight cellular structures and molecular biomarkers of interest are used to demonstrate the efficacy of the method.