INFSCI 2160: Data Mining – Project Abstract

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Cell Nuclei Detection and Segmentation of Different Cell Types

Abstract

Background

Convolutional neural networks (CNN) have become a prevalent tool for the detection of nuclei in "histopathology images". Many implementations share a basic approach that includes generation of an intermediate map indicating the presence of a nucleus center. Nevertheless, these implementations often still differ in several parameters, resulting in different detection qualities. In this project, we would be detecting cell nuclei and exploring segmentation of various types of cell based on convolutional neural network.

Method

The data involved in this project mainly deals with microscopic images and it has been sourced from Case Western Reserved University's publicly available dataset for Nuclei Detection (More info can be found here: https://engineering.case.edu/centers/ccipd/data). We will incorporate a deep learning method to extract features in images and focus on segmentation of different cell types. As we are not predicting anything, the problem does not follow any hypothesis rule.

The nuclei detection accuracy would be measured by the miss rate, and the segmentation accuracy would be evaluated by two types of 'error metrics'. Overall, the nuclei detection efficiency of the proposed method is similar to the supervised template matching method. We will calculate Precision, Recall and F-Score to determine the accuracy of our model.

Technologies Used

The technologies used for solving this problem include Keras + TensorFlow (for Convolutional Neural Network, based on U-Net model), OpenCV (for Image Processing), Scikit-image (for Image functions), Numpy (Python library for numerical calculations) and matplotlib (for plotting graphs).

Step Forward

As a known fact, cell nuclei are important indicators of cellular processes and diseases. Segmentation has been proved as an essential and crucial stage in systems for quantitative analysis

of nuclei extracted from microscopic images. This deep learning method of segmenting cells could assist the pathologists in determining various patterns in different organs. In someway this model will help pathologist to detect cell segmentation quickly, thus reducing the diagnosis time, which will ultimately help mankind.

References:

https://arxiv.org/pdf/1505.04597.pdf
https://ieeexplore.ieee.org/document/8732905