Improved Cancer Detection and Diagnosis through a Novel Combination of Cell Segmentation and Artificial Intelligence Techniques

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This project explores whether a quantitative and computational approach to differentiate cancerous liver tissues from normal liver tissues can be developed, utilizing cellular and nuclear descriptors derived from their images. This task has two primary objectives: 1) Find underlying trends within cancer tissue images and normal tissue images that can help differentiate between the two and 2) Train a machine learning program to diagnose cancer tissues based on complex patterns and algorithms without the necessity of a human operator. First, normal and cancerous liver tissue images from the Human Protein Atlas were segmented using selective image processing functions in the FIJI and ImageJ applications. Next, the data was processed by a data handler and written to an Excel spreadsheet. The resulting empirical and statistical distributions showed that cancer nuclei were smaller than normal nuclei. When this hypothesis was tested on 8 new images, 7 out of the 8 images exhibited this identical pattern. Finally, neural network and decision tree classifiers were trained to differentiate between normal and cancerous tissues. Each classifier correctly diagnosed 100% of the images in the test set. This research primarily applies to the field of oncology, and could assist in early diagnosis, saving lives. Furthermore, one could investigate whether a drug is working or not based on cellular and nuclear descriptors. Finally, this research can be extended to all types of cancer. The descriptors that indicate different types of cancerous tissue may change, but the fundamental concepts of image processing and statistical analysis will remain constant.

Awards Won: