Cancer Cell Detection and Segmentation

Problem Statement

The early stage cancer detection is required to provide proper treatment to the patient and reduce the risk of death due to cancer as detection of these cancer cells at later stages lead to more suffering and increases chances of death. Cancer cells have huge variations in shape and size. Their nucleus is darker and larger than a normal cell.Some blood tests used to test the presence of cancer cell are: Blood Protein Test, Complete Blood Count (CBC), and Tumor Marker Test. Detecting a cancer cell in a microscopic image requires segmenting the image into multiple regions. Then filtering out those regions that are representative of cancer cells. But cancer cellshavethe pro-survival characteristic that makes them difficult to differentiate. Also, due to loss of contact inhibition, they grow in uncontrolled manner while normal cells stop when they increase beyond the body requirement limit. So, at early stage detection of these cancer cells because of too less size is difficult.

Background

Researcher's efforts have made it possible to detect cancer cells not only by going through radioactive or magnetic test rather it can be detected by simple blood test. However, detecting a tumor cell among all normal cells is like looking for 1 moleculein 1000. The new blood-based technique **Strand LB**is a liquid biopsy test that is conducted by taking blood sample hence it lowers the patient's diagnosis discomfort. After taking blood samples tumor can be detected by sensitive digital technology.

The advantage of this techniqueis that it is a common test for detecting all kind of cancers.

Other researchers worked on image analysis of the cancer cell to accelerate diagnosis.Before analyzing the CT or MRI images for cancer cell detection some pre-processing is done and morphological operations are performed. Some has detected and segmented the cell using Sparse Reconstruction and Stacked Denoising Autoencoders. In that variation in shape is handled by sparse reconstruction and autoencoder was trained with discriminative losses and structured labels for segmentation.

Some researchers have used automatic counting of cell in microscopic images using CNN. Others used different resolution images to identify cancer cells. Some has segmented the cell using marker-basedwatershed.

Methodology

The architecture of cancer cell Detection and segmentation is shown in Fig1.

Step 1: Data collection and dataset preparation

In this step, several microscopic images containing cancer cell will be collected and annotated with expert help.

Step 2: Developing a CNN based cancer detection

Popular pretrainedInception and Resnetmodels will be explored on cancer cell images.

Step 3: Implementation and Experiment

In this step, the detected cancer cells will be segmented out and the model will experimentwith different images containing cancer cell.

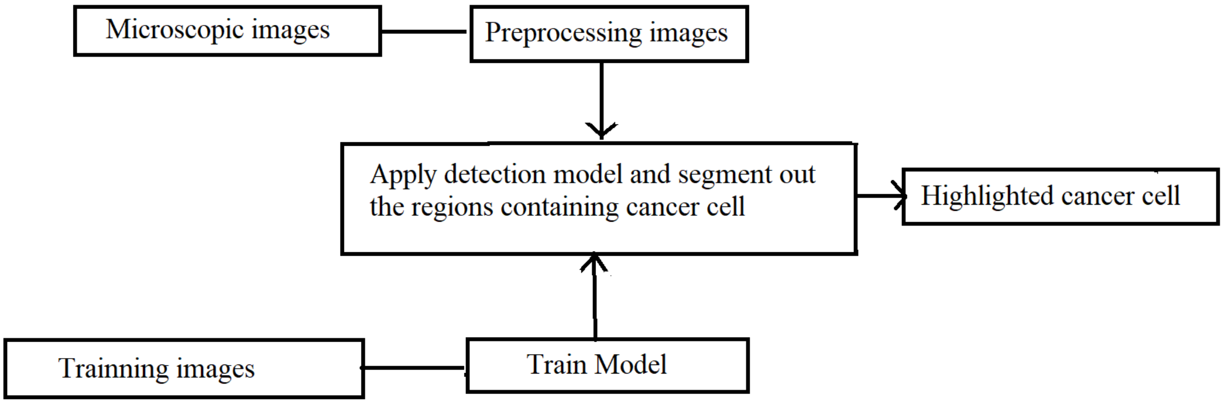

Fig 1. Cancer Cell Detection and Segmentation

Experimental Design

Dataset
UCSB Bio-Segmentation
Bio GPS dataset
NCBI dataset
NCI data catalog
NTU dataset
ALL-IDB image datasets
TCGA dataset
AMIDAI13 dataset
https://www.kaggle.com/paultimothymooney/blood-cells

Evaluation Measures
Measures such as accuracy and Mean Average Precision (MAP), the recall will be computed by comparingthe detected cancer cell and ground truth from the datasets.

Software and Hardware Requirements
Software:
Anaconda
Python
Keras
Tensor flow
OpenCV
Hardware:
NVIDIA GPU