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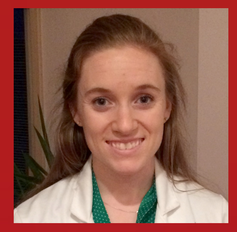

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A Self Organizing Maps Approach to Segmenting Tumors in Computed Tomography (CAT) and Magnetic Resonance Imaging (MRI) Scans

Introduction

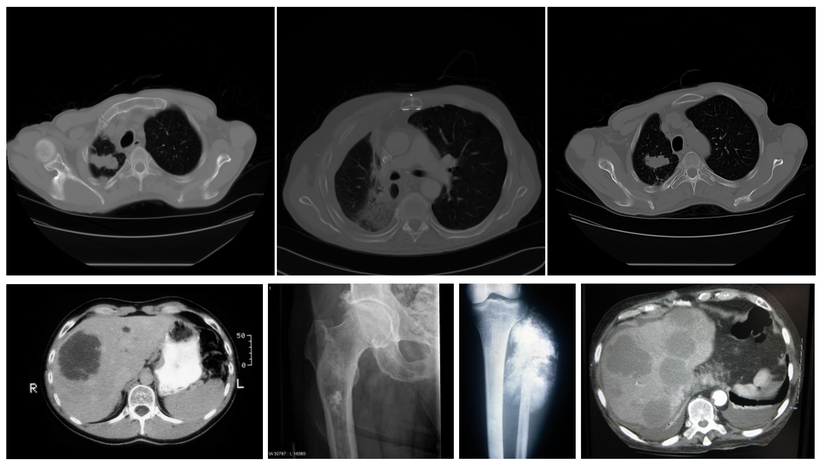
Human visual perception is based on the neural coding of fundamental features, such as object boundaries, color, orientation, shape, etc. Thus, finding the contours and boundaries of objects provides the first step for object recognition and interpretation. Form here, the idea of this research inspired to introduce an automatic boundary detection technique based on active contours that is designed to detect the contours of abnormalities in X-ray and MRI imagery. Our research is aimed to aid healthcare professionals to sort and analyze large amount of imagery more effectively.

Motivation

An automated segmentation algorithm would allow for efficient computation of tumor statistics, such as, area, volume, growth, remission, etc. The result could be used for assessment or triage, prioritization of critical and treatable prognoses. Potential application include accurate determination of local invasion, staging, and progression. Additionally, the algorithm can perform on a variety for data types including: plain film X-ray, Computed Tomography (CT) scans, and Magnetic Resonance Imaging (MRI)

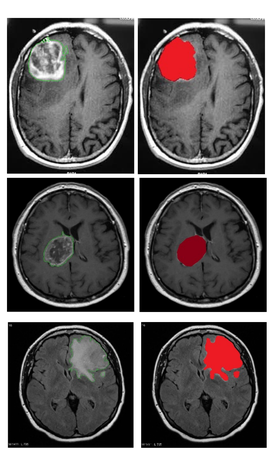
Objectives:

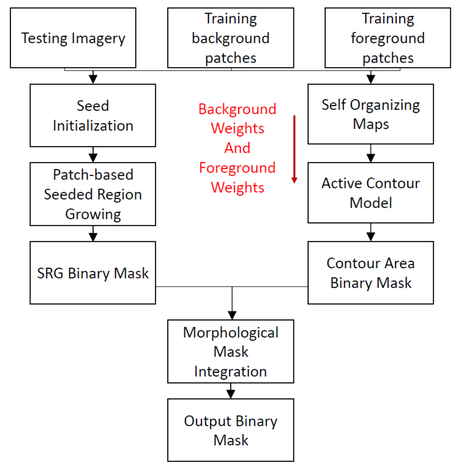
- A generalized method for:
  - Detection of potential carcinoma
  - Segmentation of regions of interest
- Automatic computation of area statistics



Segmentation Methodology

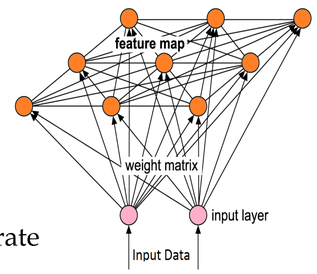
The segmentation process is achieved by the construction of a level set cost function, in which, the dynamic variables are the Best Matching Units (BMU)s coming from the SOM maps.





Self Organizing Maps

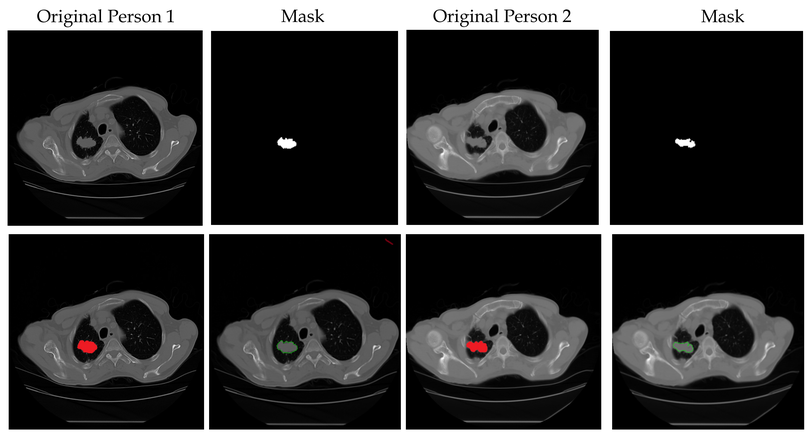
- A SOM is an unsupervised learning algorithm.
- This network is composed of two layers:
  - An input layer: receiving the input vectors,
  - An output layer: enclosing the neurons of the network.
- The SOM has a time decreasing learning rate
- SOMs have two phases:
  - Learning phase: a map is built, network organizes using a competitive process using training set.
  - Prediction phase: new vectors are quickly given a location on the converged map, easily classifying or categorizing the new data.

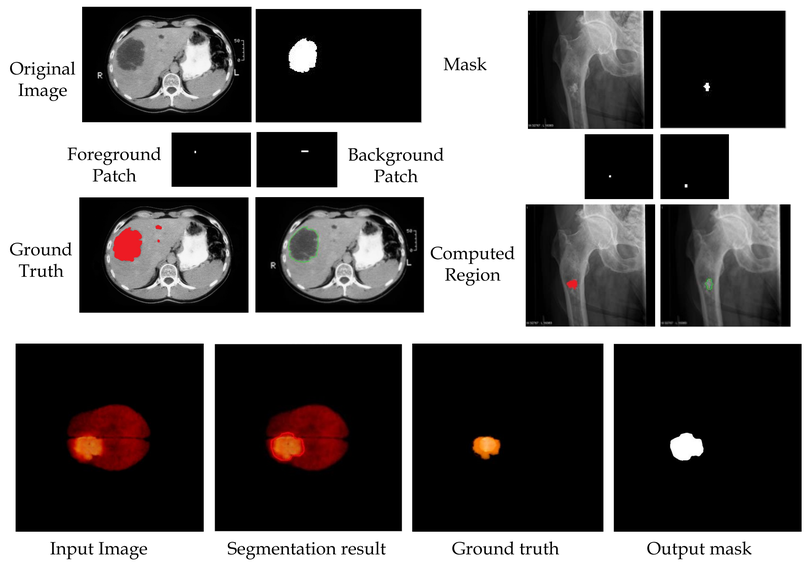


Level-Set Method

The level set method is a great tool for modeling time-varying objects, like inflation of an airbag, or a drop of oil floating in water. Energy-minimizing curves that deform to fit image features.

Results





	True Positive (%)	True Negative (%)
Lung	84.79%	97.16%
Liver	89.81%	95.42%
Brain	94.75%	99.25%
Bone	44.83%	98.46%

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