Image Segmentation of Mandible to find the extent of Mandibular Invasion through CT imaging

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Abstract

- Oral cancer or Oropharyngeal cancer is the third most prevalent type of cancer in India. It comprises 30 percent of all cases of cancer and also it comprises 9 out of 10 cases of oral cancer.
- Doctors use CT scan images to find the extent of mandibular invasion which help them to remove the infected bone during the surgery.
- In the current scenario, there are specific segmentation algorithms for lung, abdominal, spine cancer but none for oral cavity. Because of absence of specific algorithm doctors remove 2cm more bone as detected in the images. Bones in the oral cavity are small therefore in many cases, all of the healthy bone is removed and if complete bone is removed then there is no chance it will grow again.
- Therefore an algorithm specific for oral cavity is devised that will accurately find the extent of mandibular invasion and hence help in proper treatment of squamous cell carcinoma.

INTRODUCTION

- The head and neck is one of the most complex structures in human anatomy including the throat, tongue, teeth, mouth, nose, glands, brain, nerves, blood vessels and muscles. The head and neck is also one of the most functionally important structures since it contains both vital organs and major pathways of the vascular, lymphatic, nervous, respiratory, digestive and endocrine systems. Tumors originating in salivary glands are rare and differ from squamous cell carcinomas in histopathology, clinical presentation, treatment and management.
- Cancer cells can grow into other tissues or cells, and that is something that normal cells cannot do. Instead of dying, cancer cells continue to grow and form new, abnormal cells. This property of growing out of control and attacking different tissues makes a cell as cancerous.
- The easiest strategy for segmentation is amplitude segmentation in light of histogram features. This strategy depends on thresholding of histogram features and gray level thresholding.
- To beat this constraint, band thresholding based multiple thresholding operation is used. Instead of dying, cancer cells continue to grow and form new, abnormal cells. This property of growing out of control and attacking different tissues makes a cell as cancerous.
- Active contour models have been shown to be very useful in medical image processing [20]. It has been suggested that a more accurate size criterion is the minimal (shortest) axial nodal diameter. Examination of clinical presentation, treatment and management.
- CT criteria for assessing nodal metastases are based on nodal size and shape, the presence of central necrosis, and the presence of a localized group of nodes in an expected nodal draining area for a specific primary tumor. If this dimension exceeds 11 mm, metastasis is probably present.
- Diagnosis based on imaging evaluation of nodal size is more accurate than diagnosis based on palpation alone. This is because CT can show lymph nodes that are not accessible to palpation. If nodal shape is added as a criterion to nodal size, the sensitivity of CT diagnosis is improved only slightly. This criterion is based on the pathologic observation that the average hyperplastic node is lima-bean shaped, whereas most metastatic nodes are spherical.
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METHOD

- Bones in CT images have different sizes, and the intensity values of bone pixels are not uniform and noisy. This algorithm must improve the segmentation quality by decreasing the number of false edges and it should also connect the gaps in edges of real contours.
- Reading DICOM files reads the dicom file and make a matrix which contains CT data. In our data each file contains a 512 X 512 matrix of 16-bit signed integer.
- Conversion to Hounsfield Values CT numbers correlate to gray levels, or gray shades. The Hounsfield unit (HU) scale is a linear transformation of the original linear attenuation coefficient measurement into one in which the radiodensity of distilled water at standard pressure and temperature (at STP) is defined as zero Hounsfield units (HU), while the radiodensity of air at STP is defined as -1000 HU.
- In Noise Removal an anisotropic diffusion Gaussian filter is used here to improve and smoothen the original CT images of the mandible bone.
- Mask formation- Now for process of segmentation seed points are selected. It can be selected manually. Here I have automated the process by using the fact that the hounsfield values of healthy bone are very high.

CONCLUSION AND FUTURE WORK

- In this research work, an algorithm for finding the invasion in the lower mandible due to a malignant nodule is proposed. It was tested on 40 images of 4 patients. The results are compared with the global thresholding method because of its widespread use in segmenting mandible bone.
- The proposed algorithm can be modified to make the 3-D model of human mandible. 3-D modelling can be used in better assessment.
- In future can also assist in automatic mandibullectomy. CT images with their geometric accuracy in defining anatomy and tissue density differences can be combined with PET images to provide physiologic imaging, thereby differentiating malignant tumors from the normal tissue on the basis of their metabolic differences.