

Chapter 15

Improved Automatic Anatomic Location Identification Approach and CBR–Based Treatment Management System for Pediatric Foreign Body Aspiration

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ABSTRACT

In general, the diagnosis and treatment planning of pediatric foreign body aspiration is done by medical experts with experience and uncertain clinical data of the patients, which makes the diagnosis a more approximate and time-consuming process. Foreign body diagnostic information requires the evidence such as size, shape, and location classification of the aspired foreign body. This evidence identification process requires the knowledge of human expertise to achieve accuracy in classification. The aim of the proposed work is to improve the performance of automatic anatomic location identification approach (AALIA) and to develop a reasoning-based systematic approach for pediatric foreign body aspiration treatment management. A CBR-based treatment management system is proposed for standardizing the pediatric foreign body aspiration treatment management process. The proposed approach considered a sample set of foreign body-aspired pediatric radiography images for experimental evaluation, and the performance is evaluated with respect to receiver operator characteristics (ROC) measure.

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INTRODUCTION

Medical image analysis is a difficult task in which a medical expert makes extensive use of the knowledge of medical anatomy structure and imaging techniques such as X-ray, computer tomography (CT), and magnetic resonance imaging (MRI) and etc., In foreign body aspiration diagnosis process, the physicians and radiologists are ground their diagnosis based on their expertise for determining the anatomic location based on clinical cases. The manual diagnosis is often complex and involves many steps such as taking an appropriate history of symptoms and collecting relevant data, generating a provisional and differential diagnosis, physical examination, reviewing, referral to other experts to seek clarification if needed, reaching a final diagnosis, providing instructions and follow up, and documenting decisions made which are time consuming and cost effective steps in medical diagnosis process. vasumathy et al.,(2016) presented a framework for automatic intrude object identification in paediatric foreign body aspired radiography images. The developed framework of automatic intrude object identification approach adopted combination of image processing techniques such as median filtering, iterative thresholding, sobel edge detection and k-means clustering for segmenting the images and edge, shape and texture based features are extracted. The j48 decision tree is used for classification and achieves 80% of classification accuracy but the work has some limitations in mapping the anatomic region that is the pixel position and intensity value alone is used to distinguish similar region of interest and mapping is done by predefined template of anatomic location based on pixel coordinates. Hence a simple change in template pixel positions can largely affect the classification accuracy and which leads to misclassification. Motivated by this challenge, this work developed an improved automatic anatomic location identification approach to distinguish anatomic location by considering pixel, edge, shape and texture features on foreign body aspired pediatric radiography images and case based reasoning approach is used to improve classification accuracy. The CBR approach is usually used where the experts find it very difficult to expressive their thought processes while solving problems.

Related Work

In general, for foreign body aspiration diagnosis and treatment planning, assessing the radiological and clinical evidence such as size, type, shape and aspired location determines the accuracy of diagnosis process. Some of the existing work has been surveyed for assessing the significant usage of imaging features on identifying the anatomic location on radiography images are described in Table 1. Knowledge base systems and intelligent computing systems are used widely in areas that require heuristic and logic in reasoning where knowledge is predominant than data. A review is made to assess the benefits of knowledge based decision making in the field of medical diagnosis and treatment planning and the observation is presented in Table 2.

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