Medical Imaging Device that Locates and Sizes Blood Vessels and Airway Passages

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Technology description

Enhances Visualization of the Circulatory and Respiratory Systems, Increasing Diagnostic Accuracy and Facilitating Treatment

This medical imaging device, which distinguishes and characterizes vascular and pulmonary anatomy from surrounding tissue, will aid in the detection and diagnosis of diseases, such as chronic pulmonary arterial hypertension, pulmonary emboli and birth defects (including under developed lungs). Chronic respiratory diseases affect hundreds of millions of people across the globe, according to World Health Organization. More than 500 million people suffer from asthma or chronic obstructive pulmonary diseases (COPD) alone. Available methods for quantitatively characterizing and sizing vessels to identify vascular and pulmonary diseases involve either voxel-based images or thresholding techniques that have poor sizing accuracy. Researchers at University of Florida have developed a medical imaging device that improves the accuracy of blood vessel and airways passage localization and sizing, while also better characterizing the vascular tree structure. The tool uses three-dimensional images of the chest to measure vessel radius, length and location.

Technology

This medical imaging device, called Gatortail, is composed of a curvilinear line segment with cylindrical extensions that generate 3D models of blood vessels and airway passages. Location, axial length and radius are matched to the patient’ s vessels or airways through the calculation of a similarity metric such as normalized cross-correlation coefficients (NCCCs) between the 3D appearance models and the 3D images featured in the patient’ s scans. Gatortail employs a similar optimization approach to determine the best-fit vessel centerline and radius, which is driven by grayscale features of 3D CT or MRI images that can be used to detect disease. The technology also applies a schema for delineating individual tree structures from amongst a complex intermingling of trees that, because of limitation in the image resultion and patient motion during the scan, often erroneously appear connected.

Application area

Device that uses three-dimensional X-ray computed tomography (CT) of magnetic resonance (MR) images of the chest to identify best-fit centerlines and radiuses of blood vessels and airway passages, and accurate characterization of the vascular tree structure, facilitating vascular and pulmonary disease diagnoses

Advantages

Computes a vessel or airway passage’ s centerline and radius with greater accuracy than available technology, making the diagnostic process easier
Characterizes the vascular tree structure with greater accuracy than available technology, improving the delineation of individual vascular trees within the lung versus bronchial circulation
Provides quantifiable metrics of vessel size to allow calculation of vascular changes that result from disease or intervention, enabling healthcare providers to measure a patient’ s response to treatment
Allows pharmaceutical researchers to better assess drug efficacy, shortening the time from laboratory to market
Provides new insights into pulmonary diseases, resulting in better clinical decision making

Institution

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