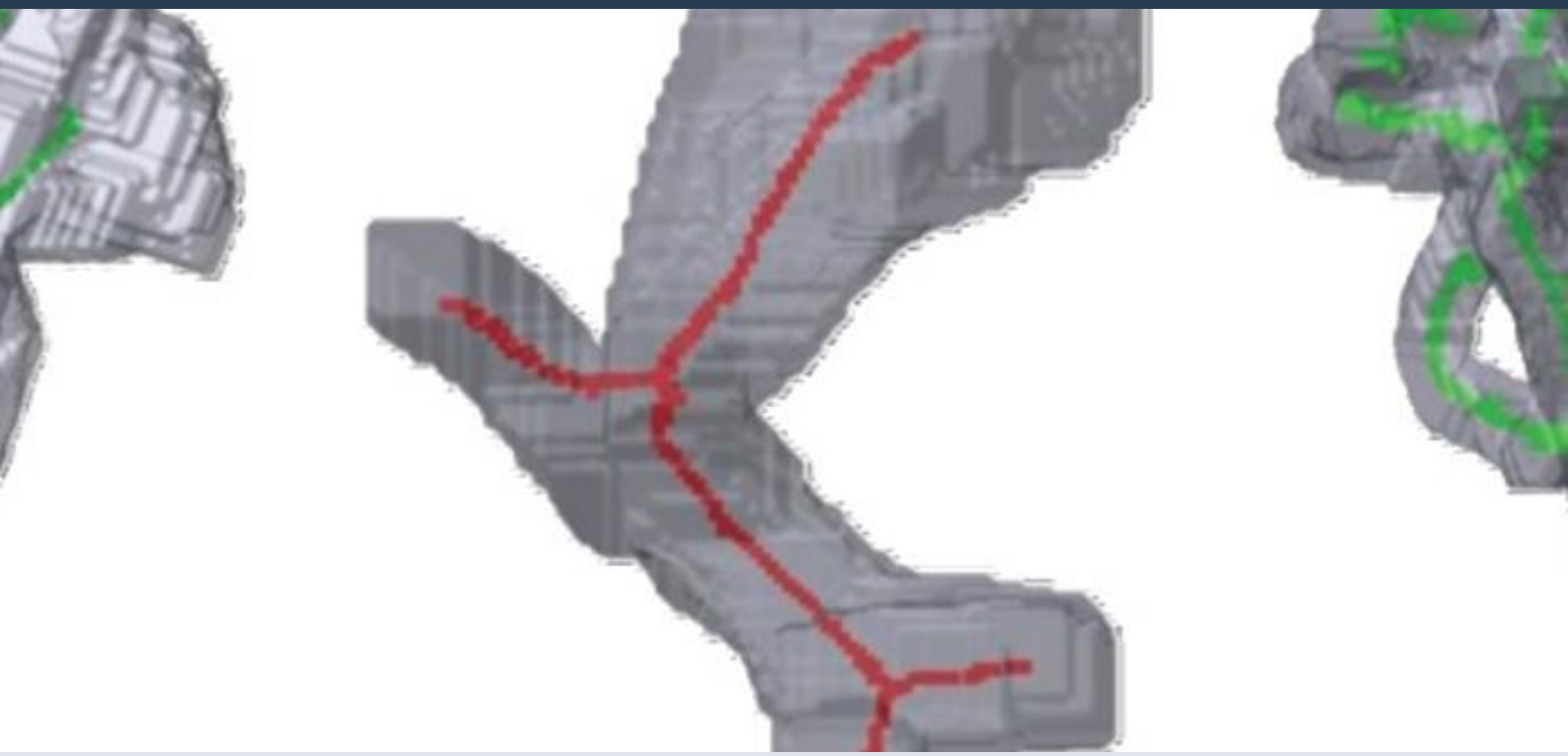
University of Manitoba

Powered by: IN-PART

Automatic Centreline Extraction Algorithm for Complex 3D Objects

A method to accurately and efficiently extract centerlines from complex anatomical structures segmented from medical imaging data.

Reference: Centreline Extraction Algorithm



S Younas and CR Figley (2019). Journal of Medical and Biological Engineering, 39(2):184-204.

IP Status

Patented

Seeking

Licensing, Commercial partner, Development partner

About **University of Manitoba**

Since 1877, the University of Manitoba has been driving discovery and inspiring minds through innovative teaching and research excellence. Proudly located in the heart of Canada, the university has a strong and engaged community of students, faculty, staff, alumni, donors and community partners.

Background

Centerlines (aka, skeletons) are an extremely efficient way to represent the size, shape and topology items in a digital image. They are widely used in computer vision, image processing, pattern recognition, data compression and are becoming commonly used in life and biological sciences. However, although extracting the centerline from a 2D shape is relatively straight forward, the problem is substantially more complex for 3D objects (especially ones that are not smooth and/or uniform).

Tech Overview

University of Manitoba researchers have developed and validated a novel, fully automated, centerline extraction method that produces one-pixel thin, continuous, and spatially accurate skeletons from complex 3D shapes in a computationally efficient manner.

The method uses a 'divide and conquer' algorithm, in which any 3D object is first sliced into a series of 2D images in X, Y and Z directions. A geometric (Voronoi) algorithm is then applied to each planar image in order to extract the 2D centerlines before recombining the information using an intersection technique that is able to reconstruct the centerline of the original 3D object.

Further Details

S Younas and CR Figley (2019). "Development, Implementation and Validation of an Automatic Centerline Extraction Algorithm for Complex 3D Objects." Journal of Medical and Biological Engineering, 39(2):184-204.

Benefits

This approach has been validated using both standard 3D benchmark objects, as well as more complex anatomical structures segmented from medical images, demonstrating that the method is able to extract accurate centerlines.

Unlike other centerline extraction methods, our algorithm is computationally efficient, requiring relatively short processing times for both the 3D benchmark objects as well as complex medical images and can be run on standard desktop computers.

Applications

This method has wide-ranging utility in the field of 3D medical imaging, including data reduction for large microscopy datasets, automated quantification of MRI and other medical imaging techniques. It is currently being

developed for automated quantification of anatomical features from medical imaging data (e.g., MRI values along brain axons, vessel diameters along coronary arteries, etc.), but could be broadly applied to other medical and non-medical applications.

Opportunity

The method has already been validated and benchmarked using various 3D objects (including anatomical structures segmented from medical imaging data), and is now being developed for quantifying MRI characteristics along-structures (e.g., axons, blood vessels, etc.). However, the University is interested in discussing licensing opportunities with respect to how our automated 3D centerline approach could be integrated into commercial products in these and other fields.

Patents

- US15845205 / Issued