15th International Congress for Stereology and Image Analysis
Aarhus University, 27–30 May, 2019

Abstract

Vedrana A. Dahl (Technical University of Denmark)

Detecting and tracking myelinated axons in volumetric data

From a work with Lars Dahlin, Martin Bech, Martin Kjer and Anders Dahl

Advances in tomography allow us to visualize the 3D fibre micro-structure of a tissue. We are often interested in whether a disease affects the tissue and changes its micro-structure. Such hypothesized correlation is exemplified in following questions: Does diabetes influence the radius, trajectory and organization of myelinated axons in human peripheral nerves? Does cerabral palsy influence the size and the muscle fibres and the micro-architecture of the muscle tissue?

In these questions, the hypothesized change in the fibre micro-structure is subtle and can not be revealed by visual inspection, or by conducting measurements in only a few places. Therefore, automated methods leading to quantification of fibre radius, trajectory and organization are required for establishing the correlation between the fibre micro-structure and the disease.

The focus of this talk is an automated method developed for segmenting, tracking and measuring myelinated axons in human peripheral nerves, see Fig. 1. This method employs a geometric representation of the segmentated axon, making the method robust to noise often present in 3D tomography. Geometric representation is also favorable for a subsequent quantification of the fibre micro-structure. With small modifications, the method has also been used for tracking muscle cells, and for tracking myelinated axons in brain tissue.

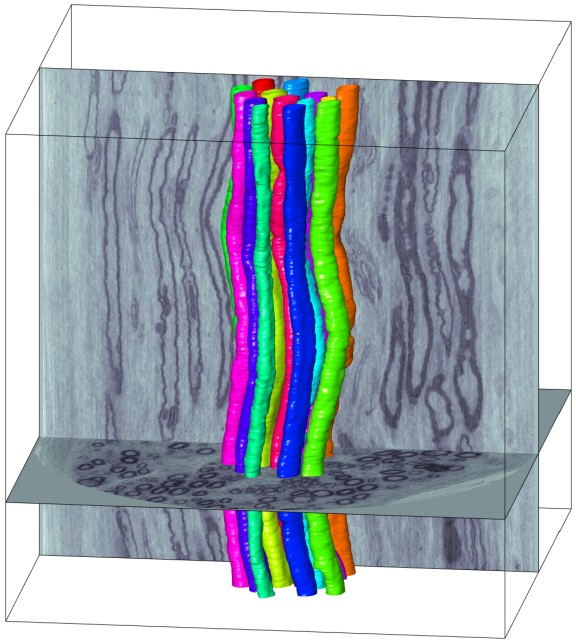

Figure 1: A cluster of tracked axons is shown together with two orthogonal slices trough the volumetric data of a human peripheral nerve.