Characterization of Complex Fibre Structures Based on Fibre Tracking

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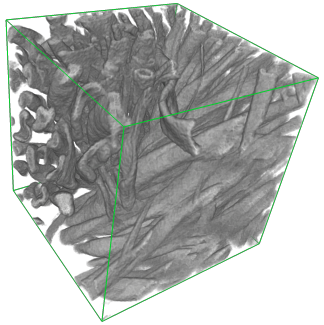
INTRODUCTION

With tomography imaging it is possible to look inside three-dimensional structures instead of just viewing the surface. In this project tomography images of cotton fibres was analyzed using fiber tracking methods to track each individual fibre in the sample. In this way each individual strand of cotton can be mapped and the shape and structure of each fibre can be analyzed. The goal is to quantify the effects of enzymes on cotton fibres on the microscopic level since there is a huge interest in developing effective enzymes for use on textiles.

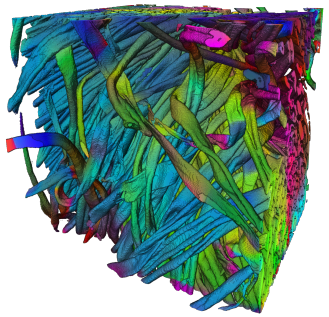
This image shows a cotton sample viewed from above. The woven strands form a complex fibre structure. The cotton fibres are flat, hollow and twisting. When cotton grows it has a round shape but when processed it becomes hollow and collapse into a biconcave shape.

ANALYSIS OF COTTON FIBRES

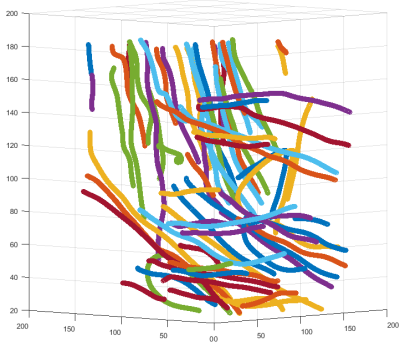
1. A smaller subvolume is extracted from the sample.



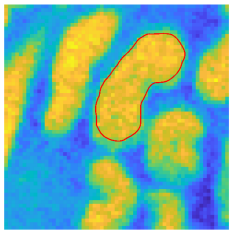
2. The local orientations are derived from structure tensor analysis



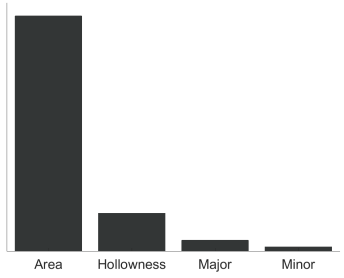
3. Each individual fibre is mapped by the fibre tracking algorithm.



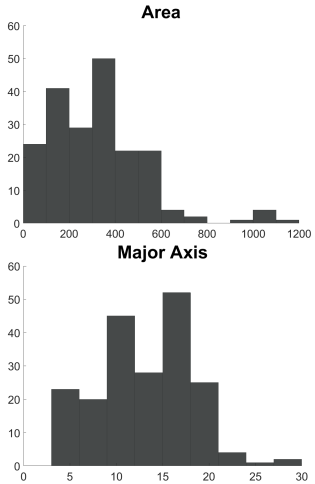
5. From cross-sections of the fibres the local shape is determined by using snakes; an active contour model. Note the characteristic biconcave shape of cotton fibres.



6. The shape are then characterized by various properties like area, length of the major and minor axes and hollowness of the fibre.



7. The local properties are sampled repeatedly to produce a statistical distribution of the properties of the sample.



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