Paper Fiber Identification

Knowledge about the mechanical behaviour of paper is important for the paperboard packaging industry. This knowledge can help with reducing material waste, and improving the durability of packages. Paper consists of wood fiber networks, and as the mechanical behaviour of the material largely depends on the properties of these networks, it is of interest to study them.

A widely used tool for analysing materials such as paper is X-ray tomography, which can provide 3D-images of the internal structure. This master thesis project has been about exploring the possibility of using artificial neural networks to identify the different individual fibers in such an image, i.e. 'segmenting' it. Segmenting the image would mean to identify which voxels (3D pixels) belong to each fiber. This would be a useful tool for the analysis of tomography images, as it would give researches access to many properties of the fiber networks, such as fiber lengths and thicknesses.

In the last decade, artificial neural networks have become widely used in the fields of image analysis and computer vision. To be able to perform tasks such as image classification or segmentation, an artificial neural network is trained on a set of training data. In the case of segmentation, this essentially means that the neural network is shown a number of examples of how different images should be segmented. By the use of advanced algorithms, the network should learn from these examples, so that it is able to segment other images by itself.

In this project, different methods and models for segmenting images of paper fiber networks have been tested. The conclusion is that more future work is needed to reach any satisfying results. Much of the challenge lies in the difficulty of obtaining good enough training data, which is due to the fact that the fibers in the images often are very difficult to distinguish from one another, even for a human observer.