Multivariate image analysis for quality inspection in fish feed production

Aquaculture is today one of the fastest growing food producing sectors in the world. Access to good and effective fish feed is a condition for optimised and sustainable aquaculture activity. In the aquaculture industry it is of utmost importance that the fish get feed of proper size and nutrition. The colour appearance of fish products is important for customers. Salmonid fish get their red colour from a natural pigment called astaxanthin. To ensure a similar red colour of fish in aquaculture astaxanthin is used as an additive coated on the feed pellets. Astaxanthin can either be of natural origin, or synthesised chemically. Common for both types is that they are relatively expensive in comparison to the other feed ingredients.

This thesis investigates multi-variate data collection for visual inspection and optimisation of industrial production in the fish feed industry. Quality parameters focused on here are: pellet size, type and concentration level of astaxanthin in pellet coating, as well as astaxanthin type detected in salmonid fish. Methods used are three different devices for multi- and hyper-spectral imaging, together with shape analysis and multi-variate statistical analysis.

The results of the work demonstrate a high potential of image analysis and spectral imaging for assessing the product quality of fish feed pellets, astaxanthin and fish meat. We show how image analysis can be used to inspect the pellet size, and how spectral imaging can be used to inspect the surface quality of biological materials. This technology and method can be a useful tool for optimising the industrial process, e.g. the utilisation of the expensive astaxanthin. The development of automatic quality inspection methods by machine vision can improve the industry's position in the competition for high quality products and efficient processes.