Lucerne University of
Applied Sciences and Arts
HOCHSCHULE
LUZERN
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Swisens

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Themengebiet Signal- und Datenanalyse, Feature Extraction, Statistik, Holography, Image Analysis

Projektpartner Swisens AG

Size estimation of particles from a trigger signal

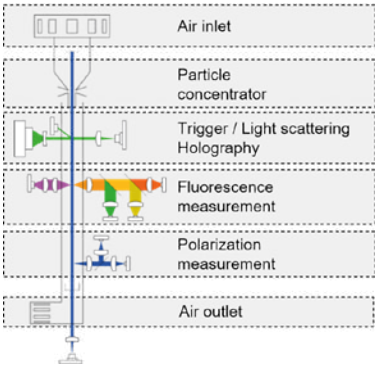

Abb. 1 Swisens Poleno

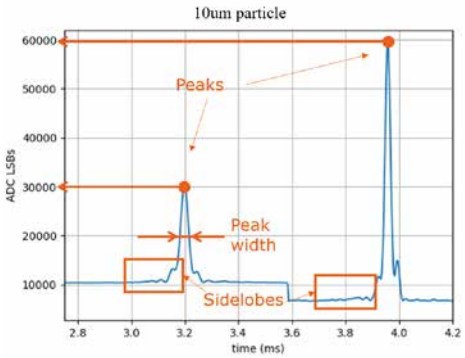

Abb. 2 Triggersignal with measured light scattering and concept descriptions

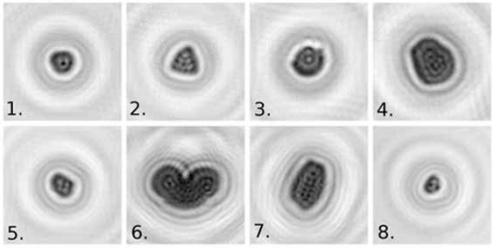

Abb. 3 Different Pollen taxa: Ragweed, 2. Hazel, 3. Grasses, 4. Beech, 5. Ash, 6. Pine, 7. Oak, 8. Nettle

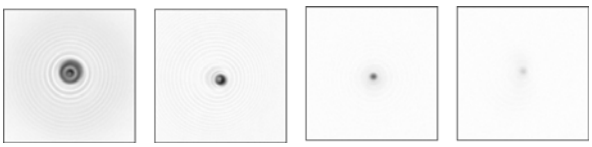

Abb. 4 Polystyrene Latex Beads (PSL) 20, 10, 5, 2 µm

Task description

This bachelor thesis deals with the size estimation of particles from a trigger signal. The start-up Swisens of the Lucerne University of Applied Sciences and Arts developed a real-time measurement device to identify airborne particles in the air. The measurement unit “Trigger / Light scattering, Holography” measures the scattered light and makes holographic images of the pollen. Swisens can estimate most sizes of pollen. But for particles below 5um, the resolution of the holographic images is not good enough. Therefore, should now be investigated if with the measurement of scattered light, the size of particles can be estimated.

Concepts

Three concepts have been developed during the project. One concept investigates the relationship between the peak width of the trigger signal with the particle size (PSL). The second is to examine the relationship between the trigger signal peak height and the PSL size. Lastly, the third concept looks at whether the frequency of the waves before each peak correlates with the particle size.

Realisation

Different light scattering theories needed to be researched to be able to understand the matter. With this understanding, the algorithms were developed. The code was mainly written in python because the industry partner also uses this language in its own projects. Few calculations (FFT and Image processing) were done in MATLAB.

Results

One concept which results showed a very strong correlation relationship is calculating the peak height. Especially the first of the two peaks of the trigger signal. Another concept which shows promising results is the trigger width at a certain threshold. The third concept, the spectral analysis of the sidelobes so far showed the least strong correlation with the particle size. During the project, few troubles came up because of the available Data sets but a solution was found to be able to verify the measurements.

Outlook

Since the concepts showed promising results, it is now to investigate how the algorithms can be applied to estimate particles below 5um. Swisens so far was possible to estimate sizes of pollen. But because the resolutions of the holographic images of particles below 5 µm are not clear enough, with this proof-of-concept further investigation can now be made.