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Bachelor/Master thesis on unsupervised spectral unmixing

Zeiss Research Microscopy (RMS) is offering Bachelor and Master theses on the topic of blind spectral fluorescence unmixing. When imaging multiple markers in a fluorescence microscope, the resulting images often exhibit spectral crosstalk. This is due to most fluorescence markers having broad emission spectra. As a specimen is labeled with an increasing number of spectral markers, spectral bleed through is inevitable. However, the cross talk can be computationally undone by so called *spectral unmixing* techniques. In recent years, an increasing number of new techniques for blind spectral unmixing have been proposed [1,2,3,4]. The candidate will implement algorithms for blind spectral unmixing in a high-level programming language (Python/Matlab/Julia) and benchmark their performance.

We encourage applicants from Physics, Mathematics, or Computer Science with a strong mathematical background to apply for the position.

References

[1] Seo, Junyoung, et al. "PICASSO allows ultra-multiplexed fluorescence imaging of spatially overlapping proteins without reference spectra measurements." Nature Communications 13.1 (2022): 2475.
[2] McRae, Tristan D., et al. "Robust blind spectral unmixing for fluorescence microscopy using unsupervised learning." Plos one 14.12 (2019): e0225410.
[3] Jiang, Yuan, et al. "AutoUnmix: an autoencoder-based spectral unmixing method for multi-color fluorescence microscopy imaging." *Biomedical Optics Express* 14.9 (2023): 4814-4827.
[4] Gillis, Nicolas, and François Glineur. "Accelerated multiplicative updates and hierarchical ALS algorithms for nonnegative matrix factorization." *Neural computation* 24.4 (2012): 1085-1105.