Master 2 Internship

Agricultural image stitching resulting from a compact spatio-spectral camera

1 Lab/Institution

This internship will be achieved at Laboratoire d'Informatique Signal Image de la Côte d'opale (LISIC), Université du Littoral Côte d'Opale (ULCO), France. It will take place in the campus of St Omer (Maps Campus).

2 Supervisors

- Gilles Delmaire, Associate Professor
- Pierre Chatelain, third year PHD student
- Gilles Roussel, Full professor

3 Salary and Duration

- Salary : 550 € net per month
- 6 months (from March to September)

4 Context

Hyperspectral Imaging for precision agriculture is a fast-growing field with the advent of compact hyperspectral imagers that provide multiple wavelengths.

In this context, an ongoing Phd thesis, funded by the PMCO and the ULCO university, aims at extracting potato leaf spectra along a field by scanning it with a portable hyperspectral imager. Through these experimentation, it is expected to detect and locate the affected plants by late blight. To this end, extracting a consistent datacube representing part of the field is needed.

To this goal, the alignment of datacube layers obtained from a spatio-spectral compact hyperspectral imager (funded by the FEDER and Hauts-de-France Region) appears as a challenging task. Indeed, this kind of imager is designed to scan the scene through a thin lens, causing parallax effects from oblique vision. This effect directly impacts the datacube design with some indesirable spatial gaps while browsing the spectral layers.

In [1], we proposed a method based on multiple independent homographies [5] that allow us to align spectral layers with respect to one reference layer. However, geometrical results should still be improved, and joint multiple homgraphies should be implemented based on the work from Chojnacki [3, 4, 2, 6, 7]

5 Objective

The main goal of the internship is to stitch images together into a big datacube with a negligible geometric reconstruction error along the layers regarding the potato leaf scale.

6 Required skills

The applicant should conduct Master or engineering studies in relevant fields (artificial intelligence, data science, applied mathematics). Some knowledge on optics and hyperspectral imagery may be useful.

Good programming skills in Python, Matlab and Shell programming are expected.

Good oral and written communication skills are needed.

7 Application

The applicant should send an email to `gilles.delmaire@univ-littoral.fr` including at least:

1. a detailed CV
2. a motivation letter
3. University transcripts

Application deadline : February 27^{th}, 2022.

References

[1] Pierre Chatelain et al. "Semi-Automatic Spectral Image Stitching for a Compact Hybrid Linescan Hyperspectral Camera towards Near Field Remote Monitoring of Potato Crop Leaves". In: *Sensors* 21.22 (2021). ISSN: 1424-8220. DOI: 10.3390/s21227616. URL: https://www.mdpi.com/1424-8220/21/22/7616.

[2] Wojciech Chojnacki et al. "Enforcing consistency constraints in uncalibrated multiple homography estimation using latent variables". In: *Machine Vision and Applications* 26.2 (2015), pp. 401–422.

[3] Wojciech Chojnacki et al. "Multi-projective parameter estimation for sets of homogeneous matrices". In: *2009 Digital Image Computing: Techniques and Applications*. IEEE. 2009, pp. 119–124.

[4] Wojciech Chojnacki et al. "Multiple homography estimation with full consistency constraints". In: *2010 International Conference on Digital Image Computing: Techniques and Applications*. IEEE. 2010, pp. 480–485.

[5] Richard I. Hartley. "In Defense of the Eight-Point Algorithm." In: *IEEE Trans. Pattern Anal. Mach. Intell.* 19.6 (1997), pp. 580–593.

[6] Zygmunt L Szpak, Wojciech Chojnacki, and Anton van den Hengel. "Robust multiple homography estimation: An ill-solved problem". In: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*. 2015, pp. 2132–2141.

[7] Zygmunt L Szpak et al. "Sampson distance based joint estimation of multiple homographies with uncalibrated cameras". In: *Computer Vision and Image Understanding* 125 (2014), pp. 200–213.