

Image Processing and Pattern Recognition Using Complex Valued Images

Project Leader

KURIHARA Toru, Ph.D.

Associate Professor, Information Systems Engineering (Image Processing and Informatics Laboratory)

1. Objective

This project is aimed at the development of effective image processing algorithms for images with complex values, such as those captured by a correlation image sensor [1]. In such images, each pixel has a complex value, not a real value like a conventional image sensor, so that the new methodology is required. It is expected that more information about the objects can be retrieved using the increased Degree-Of-Freedom available at each pixel. A complex-valued image processing library will be developed during this project.

2. Project Outline

To that end, the project will consist of the following phases:

- (a) Development of a signal processing algorithm for complex-valued images
- (b) Development of a wide range of applications using the algorithm
- (c) Development of a programming library

3. Expected Performance

In this project, the successful candidate would be expected to:

- (a) Work independently on a research topic and develop a program for experiments.
- (b) Read related international journal papers independently and discuss with senior researchers.
- (c) Understand the theory of image processing, computer vision, and machine-learning algorithms.
- (d) Publish research results in international journal papers, and present them at international conferences.

4. Required Skills and Knowledge

The successful candidate for this project will have the following knowledge and skills:

- (a) Mathematics, especially algebra and statistics.
- (b) Image Processing, Machine Vision, Signal Processing.
- (c) Programming skill (C/C++/Cuda)
- (d) Ability to communicate and discuss in English

References

- [1] S. Ando and A. Kimachi, "Correlation image sensor: Two-dimensional matched detection of amplitude modulated light," *IEEE Trans. Electron Devices*, Vol. 50, no.10, pp.2059—2066, 2003.
- [2] S. Ando, T. Nara, and T. Kurihara, "Spatial filtering velocimetry revisited: Exact short-time detecting schemes from arbitrarily small-size reticles," *Measurement Science and Technology*, vol.25, no.8, 085001, 2014.
- [3] T. Kurihara, S. Ando and Y. Michihiko, "Temporal modulated deflectometry for painted surface inspection," *Proc. SPIE(Optical Metrology 2015)*, Vol.9525, pp.952518, Munich, Germany, June.22-25, 2015.

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Contact

E-mail: kurihara.toru@kochi-tech.ac.jp