MTA SZTAKI

Computational Optical Sensing and Processing Laboratory

Head of department:
Dr. Ákos Zarándy

Phone:
+36 1 279 6131

E-mail:
akos.zarandy@sztaki.mta.hu

Address:
13-17. Kende Street. H-1111 Budapest, Hungary

Web:
analogic.sztaki.mta.hu/en

INTRODUCTION

Our laboratory derives precise abstract information from large, complex, noisy topological datasets captured by multiple optical sensors. We build special optical arrangements like holographic setups with fluorescent illuminations for microscopic imaging, large view angle multi-camera systems for monitoring and are involved in developing hyperspectral vision systems and endoscopes. Necessarily, we back the computations with both GPUs and FPGAs in desktop and embedded applications, respectively.

MAIN R&D TOPICS

- Design and application of Color or Monochrome Digital Holographic Microscopes
- Combining fluorescent and holographic microscope
- Automatic monitoring, classification, counting of microbiological organisms
- Visual remote aircraft detector sensor and collision avoidance for UAVs
- Visual navigation for UAVs
- Hyperspectral imaging and its application in medical, agricultural or food industry
- Design and programming of ultra-high speed focal-plane sensor-processor systems

The laboratory has three major topics. The first is the digital holographic microscopy. Here, an already established technology for automatic algae, protozoa, and worm detection is licensed to our industrial partner (Knot Ltd.), while further research activities are pursued to combine the holographic microscope with other technologies, like fluorescent imaging.

The second topic is the UAV collision avoidance and visual navigation system development. In this project, an embedded multi-camera vision system is being built for identifying and tracking remote aircrafts and deriving inertial data from ground objects for navigation. This work is done in cooperation with another laboratory of our institute, which develops the aircrafts and their navigation and control systems.

The third topic is hyperspectral imaging in smart agriculture, food industry and medical imaging applications.

We are also dealing with neuromorphic human vision models and simulations. We have significant experiments in ultra-high speed and/or low-power imaging and decision making using cellular processor arrays.

International scientific partnerships

- Norwegian Institute for Water Research (NIVA)
- University of Manchester
- University of Seville

INDUSTRIAL SOLUTIONS

The laboratory with its industrial partners, Knot Ltd. and WaterScope Ltd. delivers industrial microbiological measurement devices for automatic identification and counting algae, protozoa and worm species in either already processed drinking, industrial, or surface water. Our industrial customers are waterworks, sewage farms, food and beverage industry and environmental protection agencies.

Eutecus Inc. is another important industrial partner of us with whom we have long-term scientific relationship. Again, we work with Robert Bosch Ltd. in various ADAS and self-driving car projects.

MAIN INTERNATIONAL REFERENCES

- Drezden University of Technology
- Eutecus Ltd., Berkeley, California
- Instituto de Microelectrónica de Sevilla (IMSE-CNM)
- University of Seville
- Office of Naval Research (ONR)
- University of Manchester
- University of Turku

MAIN DOMESTIC REFERENCES

- Budapest University of Technology and Economics (BUTE)
- Eutecus Ltd.
- Knot Ltd.
- Pázmány Péter Catholic University, Faculty of Information Technology and Bionics (PPCU – FITB)
- Robert Bosch Ltd.
- WaterScope Ltd.

MAJOR PROJECTS

- Technology for ballast water treatment monitoring with the Norwegian Institute for Water Research
- SCOPIA: Development of narrow bandwidth imaging endoscope and performing extensive data analysis (VKSZ_14)
- Neuromorphic modeling of multi-focal lenses in eye cataract treatment (VKSZ_12)
- R&D for the automotive industry, vision problems of ADAS and self-driving car
- H2020-Japan: Vision: Validation of Integrated Safety-enhanced Intelligent flight control

We are working continuously on extending the limits of today sensing technology concerning primarily the biological inspection of aquatic animals and single-cell micro-organisms. These efforts include both novel physical methods (e.g. new kind of implementation of 3D photoactivated localization microscopy) and new algorithmic approaches (e.g. neuronal model for deblurring).

Teaching activities

- Faculty of Information Technology and Bionics, Pázmány Péter Catholic University
- Roska Tamás Doctoral School of Sciences and Technology, Pázmány Péter Catholic University