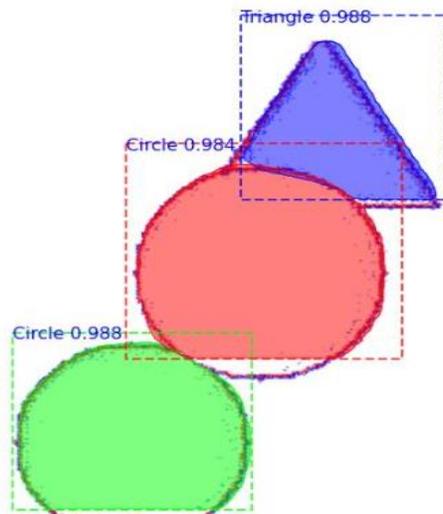# COMPUTER VISION & INTELLIGENT SYSTEMS RESEARCH GROUP

Research Topics:

- **Event-based object detection**

Event-based object detection aims to detect objects using event data. Unlike traditional camera-based object detection methods, event-based detection only considers events in changing pixels rather than a continuous image stream.

- **Event-based object tracking**

Event-based object tracking is an object tracking method using event-based cameras. Unlike traditional camera-based object tracking techniques, event-based tracking uses event data that focuses only on significant changes in the scene.
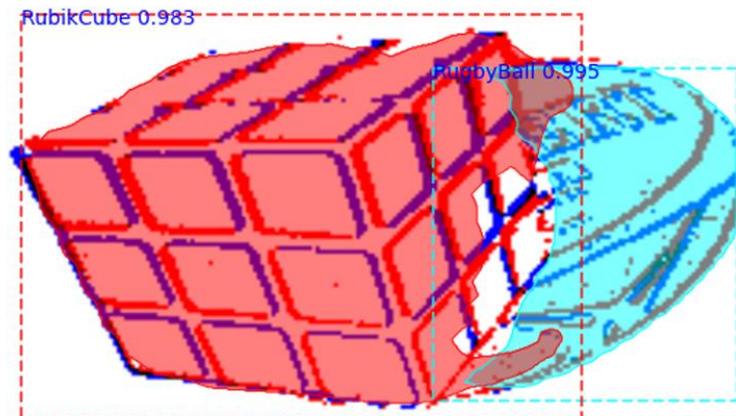
- **New techniques in event camera calibration**

Event Based Camera Calibration is a process to determine the internal and external parameters of event-based cameras. Event-based cameras, unlike traditional cameras, measure brightness changes that occur over any period of time. Therefore, traditional camera calibration techniques cannot be directly applied to calibrate such cameras. Event-based camera calibration involves special algorithms designed considering the dynamic nature of such cameras and special sensor characteristics.


- **Mosaicing of Non-Overlapping Images**

Image Mosaicing is the process of combining two or more images of the same scene into one image and generate panorama of high-resolution image. Blue points are corners of the reference image and green points are corners of the target image.

- **Smart Camera Image Signal Processor**

Camera Image Signal Processors (ISP) are responsible for proper adjustment of camera parameters such as exposure time, gain, focus and white balance during the image acquisition process. The classical camera ISPs are unaware of the scene content. Our smart camera ISP detects the faces in the scene and optimize the ISP parameters in order to increase the recognizability of the faces. This project is carried out together with OGAM (ODTÜ Görüntü Analiz Merkezi).
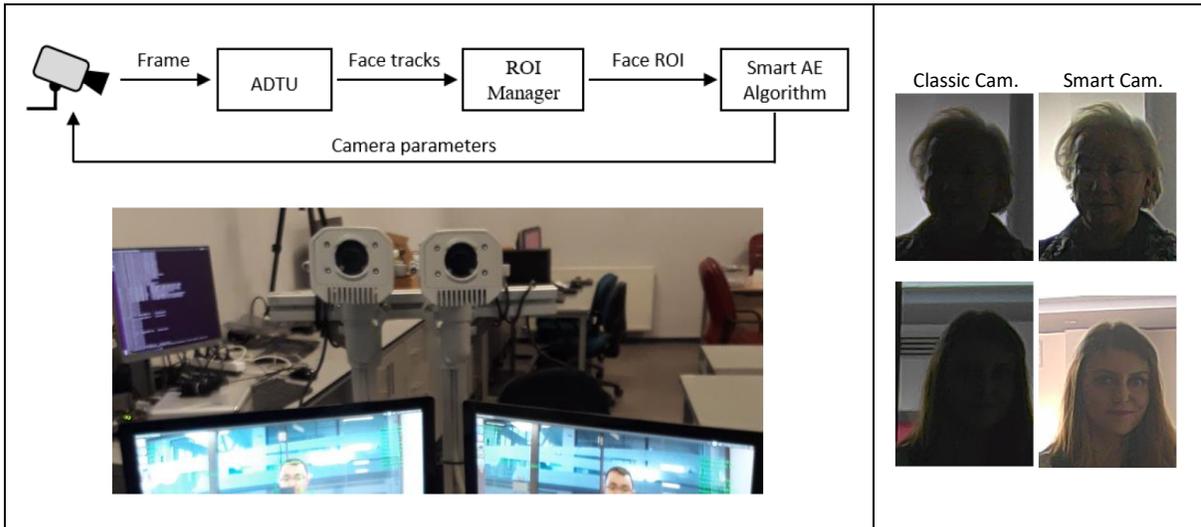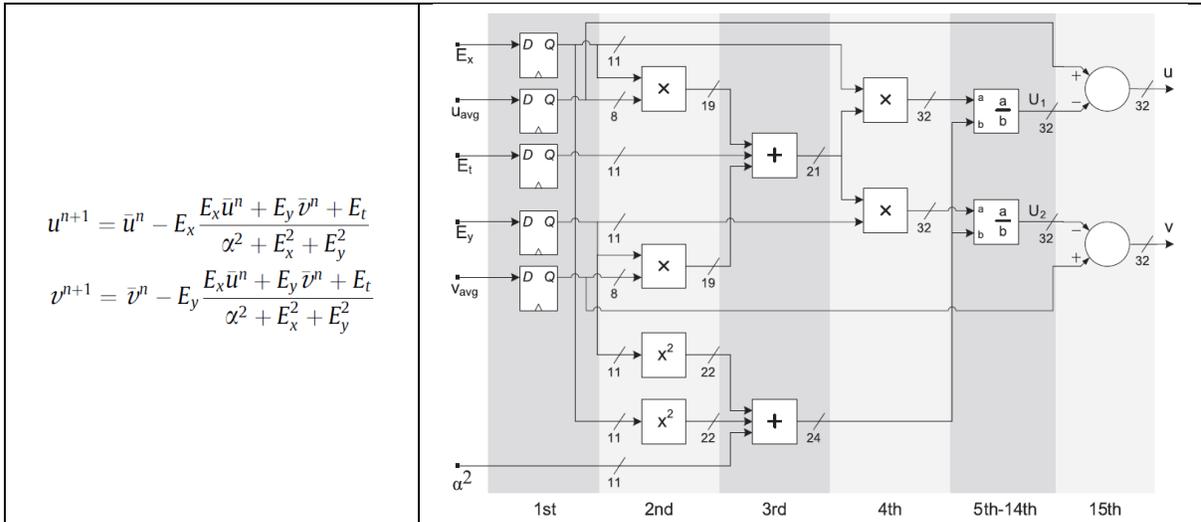

- **Motion Deblurring in Legged Robotic Platforms**

The locomotion of legged robotic platforms causes oscillations of the robot body which become more severe depending on the surface and locomotion speed. Camera sensors mounted on such platforms experience the same disturbances, hence resulting in motion blur. This is a corruption of the image and results in loss of information which in turn causes degradation or loss of important image features.
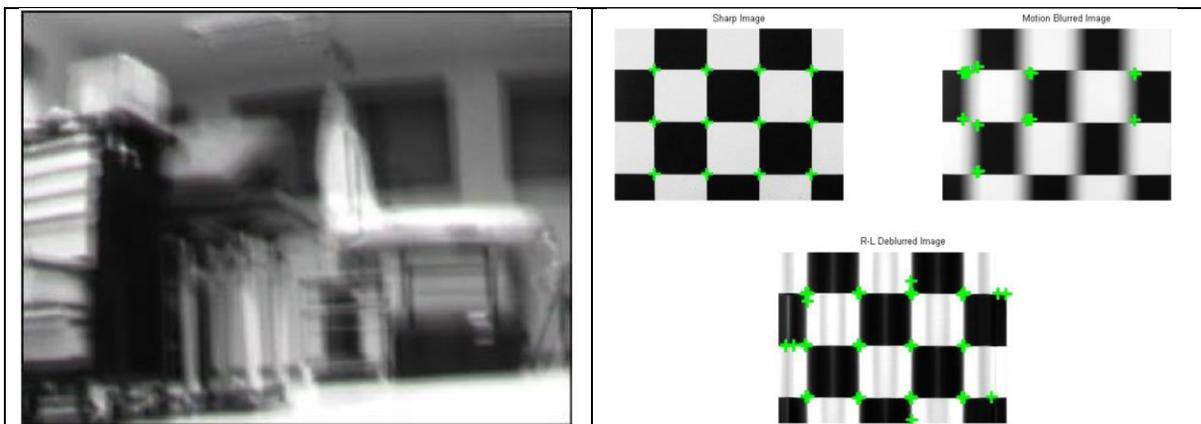
- **Real Time Image Processing Hardware and Applications**

The use of some digital image processing methods in real-time mobile robotic applications is limited because of the high computational complexity involved and the limited availability of computational resources on such platforms. Therefore, we focus on developing computational methods on parallel and pipelined architectures such as GPUs and FPGAs.

$$u^{n+1} = \bar{u}^n - E_x \frac{E_x \bar{u}^n + E_y \bar{v}^n + E_t}{\alpha^2 + E_x^2 + E_y^2}$$

$$v^{n+1} = \bar{v}^n - E_y \frac{E_x \bar{u}^n + E_y \bar{v}^n + E_t}{\alpha^2 + E_x^2 + E_y^2}$$

ACADEMIC STAFF

Asst. Prof. Gökhan Koray GÜLTEKİN

E-Mail: gkgultekin@aybu.edu.tr

Room: C303

Research interests:

- Event Based Neuromorphic Systems
- Visual Object Detection and Tracking
- Smart/Cognitive Cameras, Image Signal Processor
- Real-time Image Processing Hardware and Applications
- Robotics and Autonomous Systems

RESEARCH ASSISTANTS

Res. Asst. Sezgin DULKADİR

E-Mail: sezgindulkadir@aybu.edu.tr

Room: B305

Research interests:

- Digital Image Processing
- Event Cameras
- Object Detection and Tracking
- Camera Calibration

GRADUATE RESEARCH STUDENTS

Ali Batuhan YELLİ

E-Mail: batuhanyelli19@gmail.com

Research interests:

- Digital Image Processing
- Deep Learning
- Computer Vision
- Computer Software

UNDERGRADUATE RESEARCH STUDENTS

Ceren Nisa AVCU

E-Mail: cerennisa220@gmail.com

Research interests:

- Event Camera Calibration Methods
- Control Systems
- Digital Image Processing
- Computer Vision