

## Advanced Video Tracking and Behavior Recognition

Date: Thursday, August 26  
Time: 14:00 – 14:30  
Location: Zernike  
Presenters: Elsbeth van Dam, Rob Ottenhoff and Nico van der Aa (Noldus Information Technology, The Netherlands)

### Abstract

Members of the Image Research Group will be present to show prototypes, inform on activities and results of the current state of affairs. We welcome you to discuss with us on what our work (once integrated in Noldus products) can mean for you in your day-to-day research. We are also very interested to discuss with you how our work might be validated in your environment, should such an opportunity exist. Summarizing, we can show you *what's just over the horizon*.

**Author Keywords:** Computer Vision, Video Tracking, Behavior Recognition

In 2005 Noldus Information Technology created the Image Research Group as a separate entity within its R&D organization. As part of Noldus, the Image Research Group has as task to continuously improve existing and upcoming Noldus products using the latest technology. Rather than just copying-in academic advances in image recognition technology, we quickly discovered that image research in the rodent domain was rather barren ground and in fact we were leading the world. Among its successes, this group can count the unrivalled Rodent Nose/Tail tracker and the Multi-Rodent Nose/Tail tracker that have both been integrated into EthoVision XT.

Ongoing research focuses on:

- **Multi-target tracking.** Today, tracking a single subject is routine and tracking features of a subject (such as nose point or tail base) have become commonplace. After the successes of the Multi-Rodent tracker, research now focuses on tracking many subjects at the same time (flocks, crowds) and/or many subject features at the same time (hands, feet, eyes, ears)
- **Animal identification.** The holy grail of multiple animal tracking is to track unmarked animals. Noldus research has developed algorithms to recognize the identity of animals based on how they appear to the camera. Thus, the animal's identity in experiments, and therefore its role, may be automatically detected based on things like fur-color, fur-appearance, and potentially also overall body features, body shape and/or body proportions. The algorithms are now undergoing beta-testing and first results are very promising. Since this will not work when animals are identical, there is no escape from using markings to differentiate between animals. Noldus research therefore performs studies to evaluate the success of various ways of marking rodents for use in red light and near-infrared light circumstances.
- **3D tracking.** When you observe a home cage using multiple cameras, you can build up a 3D model of the subject(s) being observed. The ultimate research goal is to determine what (new and new quality of) tracking and behavior detection becomes possible that cannot be achieved with a single camera.
- **Behavior recognition for rodents.** At this time, the state of the art can automatically classify rodent behaviors such as grooming, walking, urinating with a human-like accuracy. Unfortunately, this claim can only be substantiated when the experimental setup very closely resembles the setup on which the original detection algorithms were developed. This is seldom

possible. Our group has spent years developing algorithms which are designed to work on subjects in their home cage environment *with the explicit goal* to be independent of the setup or animals with which the original algorithms were made. This turned out to be extremely difficult but we made a groundbreaking advance last year and we are now starting validation studies in experimental setups in several labs, using various rodent species in a range of home cage environments.

- **Pose and gesture recognition.** Whereas automating the recognition of behavior of rodents has been the classic application of image research within Noldus, we have now ventured into the domain of image recognition of human behaviors. Many academic groups are researching this subject and Noldus is closely tied up with the work at Utrecht University, creating algorithms for detection of human postures and gestures. When combined with the Noldus involvement in the Restaurant of the Future, this offers great potential for supplementing The Observer XT with algorithms to automate recognition of human behavior. We would be very interested to find out your needs in this area.