AI IN OPTRONICS

ABSTRACT

Artificial intelligence is an emerging technology with a large potential in various applications. Our goal is to improve information extraction from these images for specific applications. In this talk, I will provide an overview of the added value and challenges for applying AI for EO for data driven approaches such as Deep Learning.

Deep learning (DL) is a fast emerging technique for automating a large variety of tasks with promising results. In the field of optronics, so-called convolutional neural networks are used to automatically extract information from images and videos for classification and object detection. Many models are trained on publicly available datasets and ready to be used by anybody. These datasets consists images and their corresponding label: the class or the location of the object in the image. The advantage of these models is that the important features to distinguish different classes or to find the relevant object are already learned. However, this only works for imagery similar to that of the data used to train this model. For other application areas, such as the security domain, the models need to be updated with specific domain imagery, such as infrared or typical used in these applications. We present examples where DL technology can be applied to improve different tasks using imagery in different applications, such as perimeter security, detection of people in the sea, autonomous systems and decision support systems for public organizations.

We identify different challenges:

- the applications may be different from the domain that is trained for,
- there is (too) little training data available,
- there is a need for trust in the results of the system
- with a specific the need to avoid biases in the results in most cases,
- there is a need for online, adaptive systems and
- there is a need for edge processing systems.

To tackle the first two challenges and improve the models, recently developed approaches such as transfer learning, learning with less labels, learning by detection parts of the object, data simulation and data augmentation and zero-shot learning can be applied. Trust in the system can be achieved using different approaches, e.g. by explaining the results to the operator or by adding knowledge, e.g. from the operator, to the system. The bias in the model needs to be measured and if possible mitigated. The last two challenges need different hardware and training solutions. Awareness of the challenges of AI and possible solutions for will improve the applicability of AI developments in the different application areas.

Biography

Judith Dijk obtained a PhD on Applied Physics at Delft University of Technology. Since 2003 Judith works at TNO, a Dutch research institute. Her research focuses on research and development of imaging systems for defense and security applications, both on the hardware and on the software needed for these. In recent years, this includes insight in how Artificial Intelligence can be best used for different tasks in various domains, and what is needed in the technology development to achieve these capabilities. As one of the lead scientist of TNO's AI program, Judith is at the center of low TRL research on this topic at TNO.