prof. dr hab. inż. Bogusław WIĘCEK
Łódź University of Technology
Institute of Electronics
Department of Electrical Engineering, Electronics, Informatics and Automation
Al. Politechniki 8
PL-93-590 Łódź
Poland
e-mail: boguslaw.wiecek@p.lodz.pl

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ABSTRACT

PRESENTATION

PAPER

Bogusław Więcek is working in the field of infrared thermography, mainly with respect to its applications to medicine, non-destructive testing, and IR spectroscopy. In addition, his complementary research area is thermal modelling and measurements of electronic and biomedical multilayer, non-homogenous, anisotropic and non-linear structures. He was a chief of the research group developing the first in Poland metrological microbolometer camera based on VOx detector. Currently, he is working on photonic system applying the Raman scattering in NIR for temperature and material content measurements using low-power lasers. He was a supervisor of 9 Ph.D. dissertations. He is a co-author of 13 patents. He is the chairman of the International Conference on Infrared Thermography and Thermometry. Currently, he serves on the editorial board of three journals and scientific committees in six organizations.

APPLICATIONS OF ARTIFICIAL INTELLIGENCE AND LEARNING SYSTEMS IN INFRARED TECHNIQUES - THEORY, PRACTICE AND EXAMPLES

The lecture will mainly focus on Deep Learning systems for solving regression and classification problems in infrared signal and image processing. The different architectures of Convolutional Neural Networks (CNN) will be discussed, including 2D filters and feature layers, connections between layers, activation functions, feature map size reduction (pooling), padding, normalization, etc.

Loss functions and typical learning algorithms will be discussed. In the learning phase, elements of knowledge acquisition will be presented underlying the transfer learning, enriching training datasets (augmentation), regularization methods and preventing overfitting. The problem of gradient vanishing while training with some optimization methods and the use of ResNet networks with bypass connections will be highlighted.

An example implementation of a CNN network in the popular and frequently used TensorFlow/Python environment using the Keras library will be demonstrated. Available pretrained CNNs will be presented, such as AlexNet, GoogleNet, VGGNet and other 'light' networks for remote applications.