SMART PARKING

P. Stanchev, J. Geske

Kettering University

pstanche@kettering.edu

One of the challenge to build smartcities is the smart parking. Several solutions have been proposed: different types of sensors (magnetometers, light sensors, microphones, etc.), different communication technology (wired, wireless), and different types of cameras. Smart Parking is a system capable of extracting specific information from the captured images and different sensors. Solutions based on computer vision and big data are deployable on top of visual sensor networks. The IoT paradigm fits particularly well in urban scenarios as a key technology for the Smart City Concept.

The paper presents an efficient solution for real-time parking lot occupancy detection based on Convolutional Neural Network classifier, real time image segmentation and analysis, and streaming data. It takes in account different light conditions, parts of the day, and seasons. It has been used benchmarks collections for parking occupancy detection. Problems that we solved are: significant changes of lighting conditions - sunny, rainy and snowing days; different time of the day;partially occupant, moving cars and peoples, additional objects. In our approach we use OpenCV library (http://opencv.org/) and Python to find the frames spaces. The parking classification is done with mix of the following techniques: background subtraction, defining and analyzing moving cars, applying Gabor filters as feature extractor to train a classifier with empty spaces under different light conditions, using edge detection algorithms. Deep Learning that allow computers to learn complex perception tasks. With the help of Caffe system (http://caffe.berkeleyvision.org/) we train the neural networks.

We use HAAR CASCADE to detect moving cars. The system interface is done for mobile app to show the free space and live time images. The project is in process of realization on Raspberry Pi platform equipped with a camera module.

References
1. Giuseppe Amato, Fabio Carrara, Fabrizio Falchi, Claudio Gennaro, Carlo Meghini, Claudio Vairo, Deep learning for decentralized parking lot occupancy detection, Expert Systems With Applications 72 (2017) 327–334
2. Paulo R.L. de Almeida, Luiz S. Oliveira, Alceu S. Britto Jr., Eunelson J. Silva Jr. Alessandro L. Koerich, PKLot – A robust dataset for parking lot classification, Expert Systems with Applications 42 (2015) 4937–4949

Prof. Peter Stanchev is Chair of the Software Engineering and Information Systems Department at the Institute of Mathematics and Informatics, Bulgarian Academy of Sciences. He has forty years of professional experience in of multimedia systems, database systems, multimedia semantics, education, open access to scientific information and data and medical systems. He is also a professor at Kettering University, Flint, Michigan, USA. He has M.Sc., Ph.D. and D.Sc. in Mathematics/Computer Science from Sofia University. He has published 2 books, more than 200 chapters in monographs, journal and conference peer-reviewed papers, more than 200 conference papers and seminars, and has had more than 1500 citations, h-index - 33, impact factor – 77.03. Serving also on many database and multimedia conference program committees, he is currently editor-in-chief and member of the editorial boards of several journals. He is the Bulgarian representative in the EU OpenAIRE 2020 project.

Dr. John G. Geske, department head and professor of Computer Science. Ph.D. in Computer Science from Iowa State University, with expertise in software engineering, computational

complexity, theoretical foundations, discrete mathematics, logic and the philosophy of computing. Geske, who has taught at Kettering since 1994, describes Kettering students as driven, self-assured and hard-working. In his eyes, they are also more career-oriented and inquisitive than students at other schools.