mgr inż. Marcin Kłos Katowice, 29.11.2018
Wydział Transportu
Politechnika Śląska

Abstract of the doctoral thesis:

'A method for determining traffic parameters based on the transformation of the video stream depicting road traffic'

The functioning of ITS is determined by the quality of identification of the state of the transport system, first of all by the effectiveness of mapping of the conditions of road traffic. Utilisation of cameras allows for a convenient adjustment of the observation areas to the measurement requirements, thus easing the preparation of measuring systems for complex evaluation of the traffic conditions.

The aim of this work is to develop a method for mapping chosen road traffic parameters using a transform of the video stream depicting the road traffic situation. A discussion of the properties of mapping methods based on studies presented in literature is done. Three dimensional discrete wavelet transform, that accounts for dynamic changes in the content of the frames, is proposed for representing the videostream.

Two versions of the method are prepared: occupancy of the detection field (ZPD) and image of the traffic lane (OPR) and their capability to map flow and density of traffic is assessed. Transforms based on Haar and Daubechies wavelets are used and optimal parameters for calculations are derived.

The ZPD version evaluates the traffic parameters indirectly by mapping the movement of vehicles. Vehicles are detected in chosen places of the road. Entry times and occupation records are used for calculating traffic parameters assuming that the place is representative of the observed road. Two element detection function consisting of weighted sums of transform coefficients is used for detecting vehicles. The OPR version calculates traffic parameters on a traffic lane directly using the sum of weighted transform coefficients. In both cases the weights are determined on the basis of previous road traffic measurements at the sites.

Validation of the method is performed using an extensive set of traffic measurements, two kinds of traffic sites that is urban sites and dual carriageway sites are distinguished. Mapping results prove the effectiveness of the proposed method. In the case of OPR mean errors of calculating flow and density of traffic do not exceed 9 [%], and at some sites fall below 5 [%]. The mapping errors are compared with the performance of videodetection devices available on the market.

The mapping of road traffic parameters using transforms based on Daubechies wavelet is much less accurate.

The elaborated method can be implemented by incorporating the "lifting scheme" which may be the core of a hardware solution working in real time.