Lane modelling algorithm for video-based driver assistance system

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In video-only driver assistant systems, the input for lane modelling algorithm consist of e.g. free space information, segmented video lanes with several attributes, e.g. color, confidence. As a first processing step, the road geometry can be investigated via exploring connectivity relation between different lane segments to obtain estimation for lane borders.

In this work, the connectivity relation is represented by a weighted graph, where the nodes are the lane segments and link weights are calculated with a similarity function, which incorporates common Gestalt principles for e.g. continuity, alignment.

As a naive approach, the elements of the weighted neighborhood matrix can be transformed to binary via thresholding to obtain a simple graph and connected components of the graph form clusters, which provides basis for curve fitting algorithm approximating lane borders. This threshold is derived from the statistical features of the individual video measurements, so it is adaptive. The connected components determined by depth-first search.

A more sophisticated approach applies spectral clustering on the weighted graph, which strongly relates to spectral drawing of graphs. The following explanation is the basic link between spectral drawing and clustering. If one can draw the vertices correctly i.e. the drawing reflects well on the structure of the graph, then its vertices are easy to cluster by any trivial clustering method, like k-means. A combination of these concepts leads to a new and efficient method, which is easily interpretable and controllable.