Traffic Events Identification with a Sensor Network on a Dutch Highway Bridge

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In the field of Intelligent Transportation Systems (ITS), different equipment is employed to collect data, including video cameras, sensors, loop-detectors, mobile devices and GPS-enabled vehicles. A number of methods are developed to extract traffic events from the collected data, such as vision-based methods (Yoneyama et al., 2004) and time series models (Vespier et al., 2011). Due to environmental factors, such as shadow, lighting, the vision-based methods face the challenge of maintaining detection accuracy (Yoneyama et al., 2004). The time series models can also be problematic on certain types of time series (Vespier et al., 2011).

In this work, we present a supervised method to extract traffic events from the datasets collected with a sensor network installed on a highway bridge. Part of the work was recently published in the international IABSE conference (Miao et al., 2013). The sensor network is is composed of 145 sensors, installed on three cross-sections of one bridge span. We choose one strain sensor on each side to catch traffic events on the bridge.

Traffic events are represented as peaks in the strain signal. In practice, we cannot simply extract these peaks from raw strain signals, because the strain sensors are sensitive to environmental factors. We remove baseline drifts, caused by temperature or traffic jams, with the improved *first derivative method* (Wolfgang et al., 1991), and extract a number of peaks from the preprocessed strain signals. Each peak can be featured as amplitude, duration, area and label. The label indicates the peak type, which is obtained by referring to video streams collected with a camera. According to video streams, the peaks are divided into 5 groups: noise, big vehicle (of two directions), small vehicle (of two directions).

We choose a dataset with a length of 1 hour at night as training dataset. Based the extracted peak features from the training dataset, we create a decision tree using the *C4.5* algorithm in Weka (Hall et al., 2009). We test the obtained model on a testing dataset, which is also collected at night. We succeed in classifying 99.55% of the peaks in the testing dataset. At night, the traffic is not heavy and there are less overlap peaks in the collected signals. In the future, we will work on traffic event identification methods for signals collected during the rush hour.

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