

Speed Breaker/Pothole Detection Using Hidden Markov Models: A Deep Learning Approach

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Abstract : A large proportion of roads in India are not well maintained as per the laid down public safety guidelines leading to loss of direction control and fatal accidents. We propose a technique to detect speed breakers and potholes using mobile sensor data captured from multiple vehicles and provide a profile of the road. This would, in turn, help in monitoring roads and revolutionize digital maps. Incorporating randomness in the model formulation for detection of speed breakers and potholes is crucial due to substantial heterogeneity observed in data obtained using a mobile application from multiple vehicles driven by different drivers. This is accomplished with Hidden Markov Models, whose hidden state sequence is found for each time step given the observables sequence, and are then fed as input to LSTM network with peephole connections. A precision score of 0.96 and 0.63 is obtained for classifying bumps and potholes, respectively, a significant improvement from the machine learning based models. Further visualization of bumps/potholes is done by converting time series to images using Markov Transition Fields where a significant demarcation among bump/potholes is observed.

Keywords : deep learning, hidden Markov model, pothole, speed breaker

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