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At present, most of the traffic-related data is manually received through sensors and social media, e.g., traffic statistical report, accident statistical report, road information, and public comments. In this paper, a novel framework for traffic risk mining from various heterogeneous road data. Traffic risk refers to the great issue of traffic accidents. Specifically, we focus on two issues: 1) predicting the number of accidents on any road and 2) clustering heterogeneous roads to identify an element of danger for risky road clusters. We present a unified approach for addressing these issues by means of feature-based Expectation-maximization Algorithm [EM]. In particular, we develop a new multiplicative update algorithm for EM to handle big traffic data. Using real-traffic data, we demonstrate that the proposed algorithm can be used to predict traffic risk at any location either it may be an urban or rural area more accurately and efficiently than existing methods or that a number of clusters of risky roads can be identified and characterized by two major causes of risk. In summary, our work can be regarded as the first step to a new research area of traffic risk mining and accident analysis.

