Driver Behavior Detection Using Smartphone Signals

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About Our Dataset

In this project we will explore a the Driver Behavior Detection Using Smartphone - Dataset[1]. It is a public dataset for driver behavior classification (normal, aggressive, risky) based on accelerationelerometer (X,Y,Z axis in meters per second squared (m/s2)) and gyroscope (X,Y, Z axis in degrees per second (°/s)) data.
Some more specifics about the data:
Sampling Rate: 50, Hz default Cars: Ford Figo 1.2, Maruti Suzuki Swift VXI, Tata Nexon XMS Drivers: 3 different drivers aged between 35-40 yrs. Driver Behaviors: Normal, Aggressive, and Risky Smartphone Sensor: Accelerationelerometer, Gyroscope Smartphone Device: Redmi 4, MI A3.

About The method

We will try to apply a method for similar data patterns which is called the "D3: Abnormal driving behaviors detection and identification using smartphone sensors"[2].
In particular, we will focus mostly on detecting sudden stops by drivers, as detected in the article.
The authors demonstrate this procedure by extracting unique features from readings of smartphones' accelerometers and orientation sensors. They first identify the representative features to capture the driving behavior patterns.
Then, a machine learning method, Support Vector Machine (SVM), is employed to train the features and output a classifier model that conducts fine-grained identification.
The following figures from the article show the acceleration and orientation patterns of sudden braking. When a vehicle brakes suddenly, acceleration_x remains flat while acceleration_y sharply downs and keeps negative for some time. Thus, the standard deviation and value range of acceleration_x are small. On acceleration_y, the standard deviation is large at the beginning and ending of a sudden braking, and the range of acceleration_y is large. Moreover, there are no obvious changes in both oriantation_x and oriantation_y. Since sudden braking is an abrupt driving behavior, the duration is short.

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[1] Wawage, Pawan (2022), "Driver Behavior Detection Using Smartphone - Dataset", Mendeley Data, V2, doi: 10.17632/9vr83n7z5j.2

[2] Z. Chen, J. Yu, Y. Zhu, Y. Chen and M. Li, "D3: Abnormal driving behaviors detection and identification using smartphone sensors," 2015 12th Annual IEEE International Conference on Sensing, Communication, and Networking (SECON), Seattle, WA, USA, 2015, pp. 524-532, doi:

10.1109/SAHCN.2015.7338354.

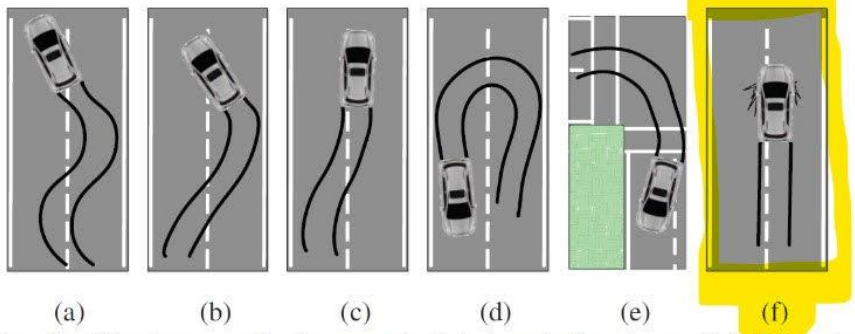
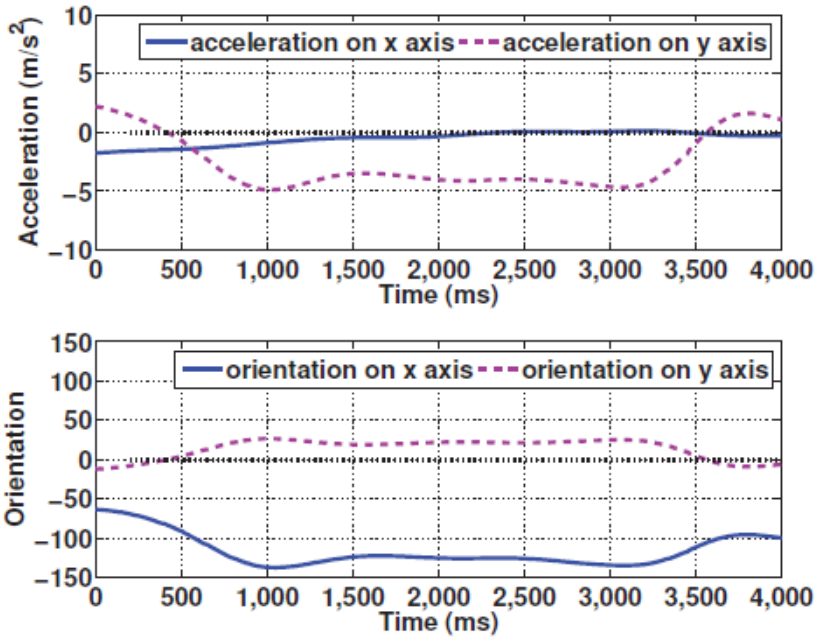


Fig. 1: Six types of abnormal driving behaviors: (a) Weaving, (b) Swerving, (c) Sideslipping, (d) Fast U-turn, (e) Turning with a wide radius, (f) Sudden braking.



(f) Sudden braking