

2020

Predicting Traffic Accident Severity



Applied Data Science
Capstone

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Coursera Applied Data Science Capstone

This project is for the Applied Data Science Capstone-car accident severity, this is the final project for Data Science Professional certificate by IBM.

Introduction

Every year the lives of approximately 1.35 million people are cut short as a result of a road traffic crash. Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury.

Road traffic injuries cause considerable economic losses to individuals, their families, and to nations. These losses arise from the cost of treatment as well as lost productivity for those killed or disabled by their injuries, and for family members who need to take time off work or school to care for the injured. Road traffic crashes cost most countries 3% of their gross domestic product.

Analyzing a significant range of factors, including weather conditions, special events, roadworks, traffic jams among others, an accurate prediction of the severity of the accidents can be performed.

These insights, could allow law enforcement bodies to allocate their resources more effectively in advance of potential accidents, preventing when and where a severe accident can occur as well as saving both, time and money. In addition, this knowledge of a severe accident situation can be warned to drivers so that they would drive more carefully or even change their route if it is possible or to hospital which could have set everything ready for a severe intervention in advance.

Governments should be highly interested in accurate predictions of the severity of an accident, in order to reduce the time of arrival and thus save a significant amount of people each year. Others interested could be private companies investing in technologies aiming to improve road safeness.

Key Facts

1. Approximately 1.35 million people die each year as a result of road traffic crashes.
2. The 2030 Agenda for Sustainable Development has set an ambitious target of halving the global number of deaths and injuries from road traffic crashes by 2020.
3. Road traffic crashes cost most countries 3% of their gross domestic product.
4. More than half of all road traffic deaths are among vulnerable road users: pedestrians, cyclists, and motorcyclists.
5. 93% of the world's fatalities on the roads occur in low- and middle-income countries, even though these countries have approximately 60% of the world's vehicles.
6. Road traffic injuries are the leading cause of death for children and young adults aged 5-29 years.

Who is at risk?

Socioeconomic status More than 90% of road traffic deaths occur in low- and middle-income countries. Road traffic injury death rates are highest in the African region. Even within high-income countries, people from lower socioeconomic backgrounds are more likely to be involved in road traffic crashes.

Age

Road traffic injuries are the leading cause of death for children and young adults aged 5-29 years.

Sex

From a young age, males are more likely to be involved in road traffic crashes than females. About three quarters (73%) of all road traffic deaths occur among young males under the age of 25 years who are almost 3 times as likely to be killed in a road traffic crash as young females.

Risk factors

The Safe System approach: accommodating human error The Safe System approach to road safety aims to ensure a safe transport system for all road users. Such an approach considers people's vulnerability to serious injuries in road traffic crashes and recognizes that the system should be designed to be forgiving of human error. The cornerstones of this approach are safe roads and roadsides, safe speeds, safe vehicles, and safe road

users, all of which must be addressed in order to eliminate fatal crashes and reduce serious injuries.

Speeding

- An increase in average speed is directly related both to the likelihood of a crash occurring and to the severity of the consequences of the crash.
- For example, every 1% increase in mean speed produces a 4% increase in the fatal crash risk and a 3% increase in the serious crash risk. The death risk for pedestrians hit by car fronts rises rapidly (4.5 times from 50 km/h to 65 km/h)..
- In car-to-car side impacts the fatality risk for car occupants is 85% at 65 km/h.

Driving under the influence of alcohol and other psychoactive substances

- Driving under the influence of alcohol and any psychoactive substance or drug increases the risk of a crash that results in death or serious injuries.
- In the case of drink-driving, the risk of a road traffic crash starts at low levels of blood alcohol concentration (BAC) and increases significantly when the driver's BAC is ≥ 0.04 g/dl.
- In the case of drug-driving, the risk of incurring a road traffic crash is increased to differing degrees depending on the psychoactive drug used. For example, the risk of a fatal crash occurring among those who have used amphetamines is about 5 times the risk of someone who hasn't.

Nonuse of motorcycle helmets, seatbelts, and child restraints

- Correct helmet use can lead to a 42% reduction in the risk of fatal injuries and a 69% reduction in the risk of head injuries.
- Wearing a seatbelt reduces the risk of death among drivers and front seat occupants by 45 - 50%, and the risk of death and serious injuries among rear seat occupants by 25%.
- The use of child restraints can lead to a 60% reduction in deaths.

Distracted driving

There are many types of distractions that can lead to impaired driving. The distraction caused by mobile phones is a growing concern for road safety.

- Drivers using mobile phones are approximately 4 times more likely to be involved in a crash than drivers not using a mobile phone. Using a phone while driving

slows reaction times (notably braking reaction time, but also reaction to traffic signals), and makes it difficult to keep in the correct lane, and to keep the correct following distances.

- Hands-free phones are not much safer than hand-held phone sets, and texting considerably increases the risk of a crash.

Unsafe road infrastructure

The design of roads can have a considerable impact on their safety. Ideally, roads should be designed keeping in mind the safety of all road users. This would mean making sure that there are adequate facilities for pedestrians, cyclists, and motorcyclists. Measures such as footpaths, cycling lanes, safe crossing points, and other traffic calming measures can be critical to reducing the risk of injury among these road users.

Unsafe vehicles

Safe vehicles play a critical role in averting crashes and reducing the likelihood of serious injury. There are a few UN regulations on vehicle safety that, if applied to countries' manufacturing and production standards, would potentially save many lives. These include requiring vehicle manufacturers to meet front and side impact regulations, to include electronic stability control (to prevent over-steering) and to ensure airbags and seatbelts are fitted in all vehicles. Without these basic standards the risk of traffic injuries – both to those in the vehicle and those out of it – is considerably increased.

Inadequate post-crash care

Delays in detecting and providing care for those involved in a road traffic crash increase the severity of injuries. Care of injuries after a crash has occurred is extremely time-sensitive: delays of minutes can make the difference between life and death. Improving post-crash care requires ensuring access to timely prehospital care and improving the quality of both prehospital and hospital care, such as through specialist training programs.

Inadequate law enforcement of traffic laws

If traffic laws on drink-driving, seatbelt wearing, speed limits, helmets, and child restraints are not enforced, they cannot bring about the expected reduction in road traffic fatalities and injuries related to specific behaviors. Thus, if traffic laws are not enforced or are perceived as not being enforced it is likely they will not be complied with and therefore will have very little chance of influencing behavior.

Effective enforcement includes establishing, regularly updating, and enforcing laws at the national, municipal, and local levels that address the above-mentioned risk factors. It includes also the definition of appropriate penalties.

What can be done to address road traffic injuries?

Role of Government

Road traffic injuries can be prevented. Governments need to take action to address road safety in a holistic manner. This requires involvement from multiple sectors such as transport, police, health, education, and actions that address the safety of roads, vehicles, and road users.

Effective interventions include designing safer infrastructure and incorporating road safety features into land-use and transport planning, improving the safety features of vehicles, improving post-crash care for victims of road crashes, setting and enforcing laws relating to key risks, and raising public awareness.

Role of Data Science

Analyzing a significant range of factors, including weather conditions, special events, roadworks, traffic jams among others, an accurate prediction of the severity of the accidents can be performed.