

Project Proposal

Forecasting the road conditions for Montreal's municipal area

What is the problem?

Roads connect the Greater Montreal area from North shore to South shore, East to West. It is the most common and imperative transportation medium for the Greater Montreal Metropolitan area residents. People rely on roads and highways to travel and get to work. For that reason, it is vital to maintain roads and highways in good condition to reduce the number of car accidents, traffic jams, and the degradation and wearing out of vehicles which are all burdens that Montreal drivers must bear.

Rundown roads add significant dollars to the driver's cost of driving. Canadian drivers pay an average extra cost of \$126 per year. Quebec drivers have suffered the most from bad roads, paying an average extra cost of \$258 per year. Montreal has spent \$2.19 billion on roadwork from 2018 to 2020, yet the road conditions are not getting significantly better. Potholes are still a massive problem in Montreal, and potholes cause around 10% of a total of 19,327 car accidents in 2019 (approximately 2000 accidents are caused by potholes alone).

The main issue with evaluating road conditions is that it's a very expensive task that requires much time and money. It requires a great quantity of funding for the city to send inspectors to assess the condition of every or even most roads in the city. Furthermore, there can be significant time between an assessment and actions taken to improve the conditions of the roads. As an example, the most recent evaluation was done in 2019, and issues from that time linger still, it's

quite possible that accidents have occurred due to roads in poor condition which have been in such a state since 2019 or even before. It is impossible to monitor every highway and road and provide live data; however, a training model can be developed to forecast future roads' level of degradation with the help of road conditions' explanatory data such as weather, car accidents, and potholes.

It is our hope that through the analysis of various datasets relating to road conditions we may be able to train a machine learning model which could accurately predict the deterioration of roads due to various factors and thereby bypass the expensive process of conducting “field” assessments. Such a model would allow the city to take pre-emptive actions to prevent extensive deterioration and thus greatly improve the driving experience, lifespan of vehicles, and most important of all, the safety of Montreal drivers.

Why is it important to me?

Roads in poor condition are an infamous problem in Montreal and cause a lot of extra government spending on construction, increased traffic times, extra economic burden on car owners, and most unfortunate of all, they induce a great number of accidents and casualties each year. Two of our team members have personally experienced car accidents which were partly the result of damaged roads.

This is far from an abstract issue that affects only a small number of residents. Even if as a resident of Montreal, you are fortunately never involved in a car collision or road accident, the great amount of traffic due to construction (and potentially road-conditions related accidents and /or closed roads) and the extra expenses incurred on car upkeep will be an unfortunate part of

your life. Driving is a daily necessity for most residents and consequently we believe it is imperative to ensure that it is as pleasant, efficient, and most of all, safe experience as it can be for all drivers in the city.

Why Can Machine Learning Help?

Machine learning technology can interpret behaviors and recognize patterns based on collected data. In our problem, we believe machine learning could allow us to investigate and find relationships between road conditions and our collected data, such as the relationship between weather variables and road conditions. Our aim is to find significant data from a variety of sources which can help us determine which variables correlate with and/or explain the deterioration of road conditions. We would then forecast the future value of those significant factors and finally, those predicted significant factors would help us forecast the future state of Montreal roads.

What Data to use?

Since road conditions are challenging to explain, we will try to find as many datasets as possible. We have found multiple datasets, including street conditions, road accidents, car and pedestrian counts at certain intersections, and precipitation. Every dataset will be tested on whether it is statistically significant with respect to road conditions deterioration, and the statistically significant datasets will assist us in predicting the future quality of roadways. In 2019, the city of Montreal visually inspected the conditions of Montreal streets. The dataset includes around 7,000 observations and a score for each of the conditions of the surface and draining system from 1 to 5. Additionally, the ensemble of Montreal's police department and Quebec's automobile insurance society share data detailing all road accidents on the island from 2012 to today. The

data includes details of over 204 million accidents. Furthermore, since 2008, the city has been counting, with the help of sensors, the number of vehicles, pedestrians, and cyclists at 1187 stop signs and intersections. Between 2017 and 2021, almost a million observations were taken. All data was published on the city's open data portal. (<https://donnees.montreal.ca/>) We will of course continue to look for significant variables in more datasets which will allow us to understand the intricacies of our issue and enable us to construct a predictive model.