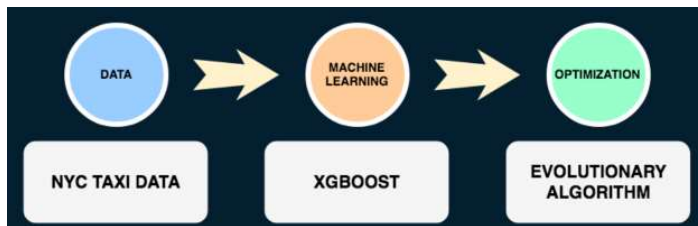


# Route Optimizer for Swiss Online Supermarket Delivery

## 1 Introduction and Aim of the study

The aim is to quantify potential improvements with state-of-the-art route optimization based on the last mile delivery on a practical case. The optimization of the travel routes for a delivery vehicle is a two-component problem. First, a machine learning model trains on the data to predict the two respective round trip timeseries. The training is based on weather data, traffic data and historical structures (seasonalities, non-normal distribution and probabilities). Second, these predictions are fed into the open source algorithm which decides the most time efficient visit order for a given set of customers. By using Amazon's Web Service (AWS), the following model is applied:

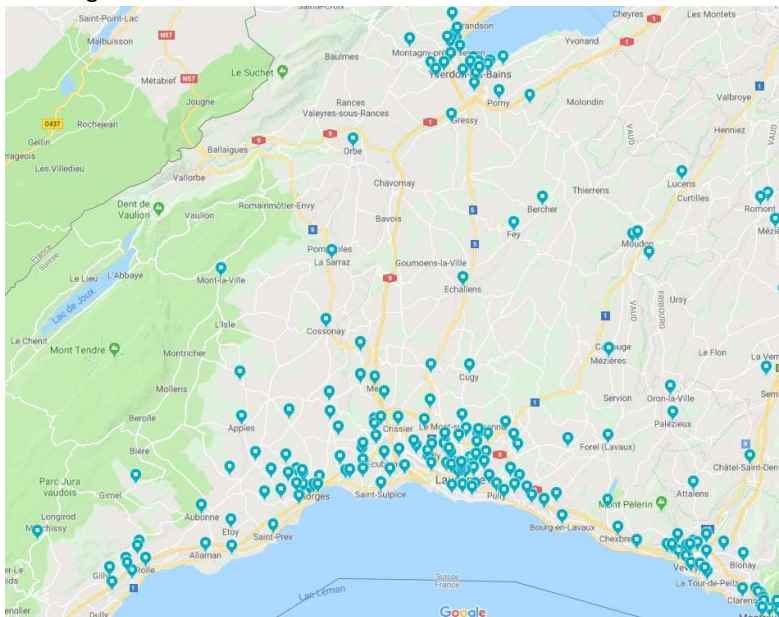


<https://github.com/vlazovski/route-optimizer-machine-learning>

## 2 Practical Case

With 180 MCHF Turnover, LeShop is the biggest Swiss online supermarket market-leader owned and mainly supplied by the major Swiss supermarket store Migros. The Distribution of LeShop has ever been outsourced to PostLogistics, a subsidiary of the Swiss Post. The route planning to solve is known as the vehicle routing problem with time window (VRPTW). Normally, experienced expert dispatchers are best in considering all influences and react on nonstandard situations. Recent scientific progress in data science has proven to perform route optimization similar as expert dispatching. Data availability and the capability to efficiently process it, has made this possible. Migros operates two Swiss fresh-food distribution centers in Ecublens and Bremgarten with seven daily time window deliveries from Monday to Saturday without holidays, whereas Saturdays and pre-holidays have limited half-day availability. The following customer data base with main aggregation of the big urban areas such as Lausanne, Yverdon, Vevey, u.s.w. has been **randomly** put together for simulation purposes.

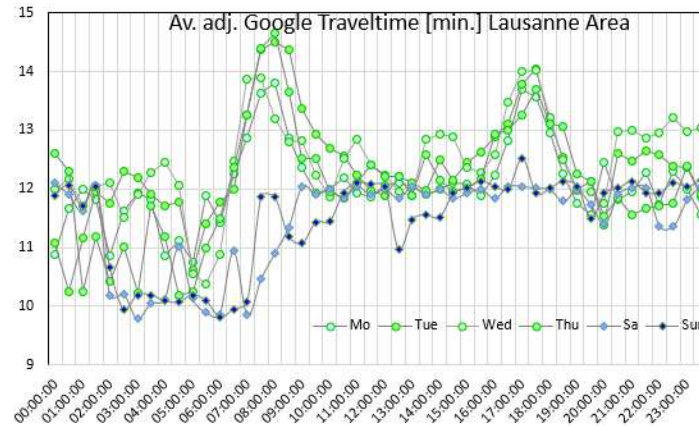
Graphic: Random Customers in Google API



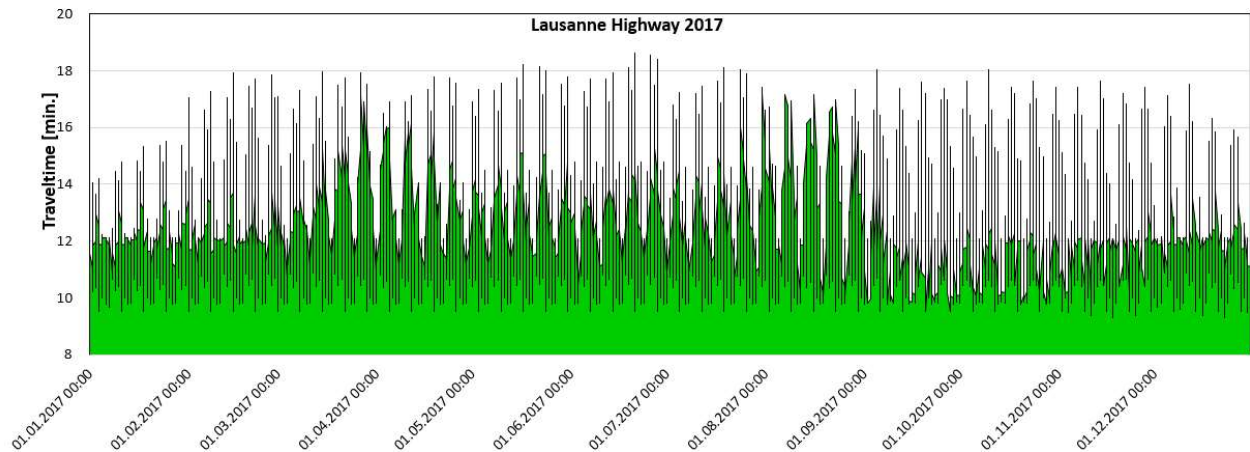
### 3 Travel Time Characteristics in Lausanne

First examples are the adapted travel times of a motorway route in the Lausanne area by Google and road usage. Other local routes show similar structures and high correlation.

Weekly Profile



Yearly Profile 2017 as a reference



### 4 Results of hypothetical case

	No. Time Windows (see SLA)	Routes	Distance [km]	No. Max Vehicles	Total Deliveries	On-time deliveries
Initial Project Situation	7	6 330	182 455	12	14 035	12 210
Sim. same Vehicles	7	3 165	98 245	12	14 035	14 035
Sim. unrestr. Optim.	7	3 798	126 315	7	14 035	13 754
Data Period	01.01.2019		31.07.2019			