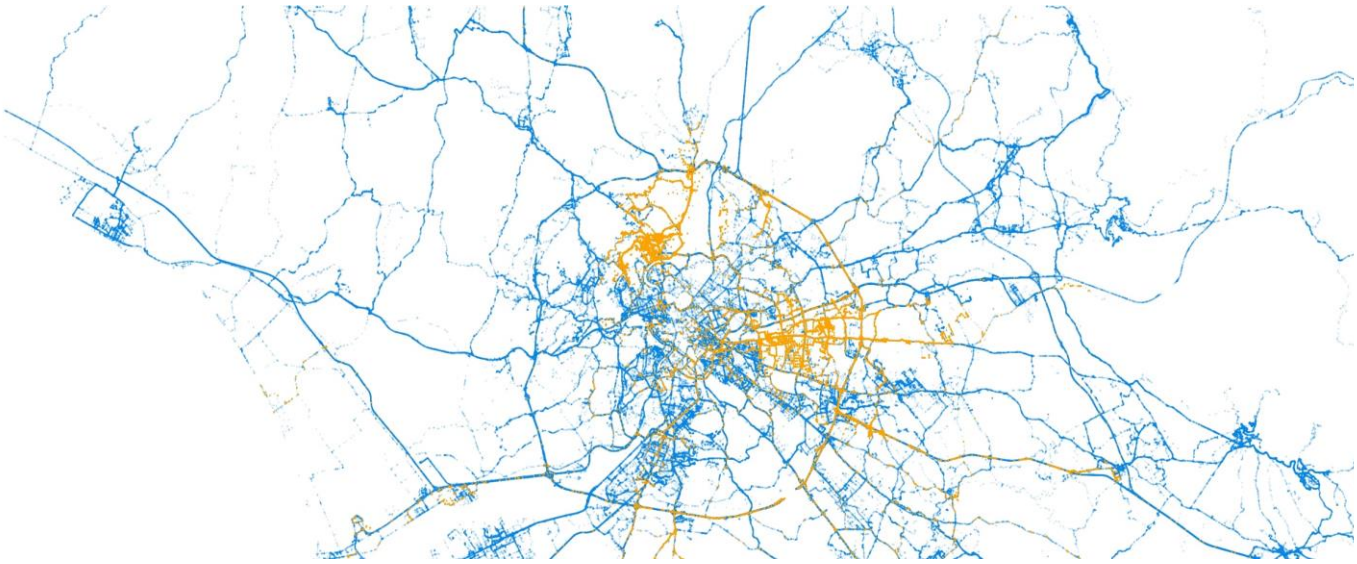
A European Insurance leader works with Milliman to process raw telematics data and detect driving behaviour

Remi BELLINA, IA
Antoine LY, IA
Fabrice TAILLIEU, IA

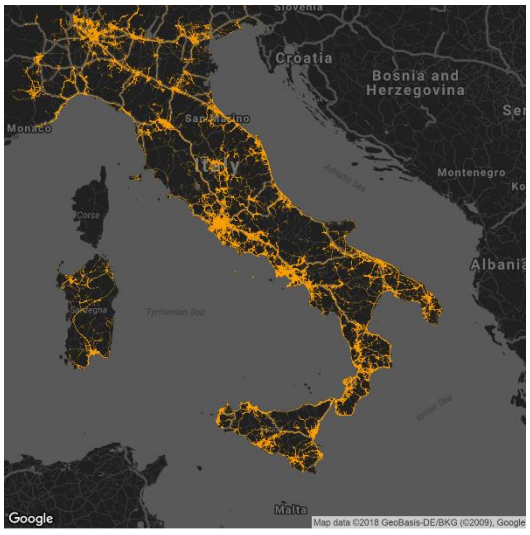


The digital revolution has been disrupting industries for some years now, and things will accelerate with the arrival of 5G technologies. Companies need to adapt their business models to anticipate technological advances and boost productivity. At a time when users increasingly expect trust, responsiveness and transparency, the real challenge is often to provide new services adapted to their emerging needs. The insurance world is not immune to this revolution and telematics is an excellent illustration of this change initiated by the insurtech companies. In a highly competitive market—where motor insurance is often referred to as a 'consumer appeal product'—margin management is essential. This article focusses on the future of motor insurance and telematics, providing feedback on some of the projects led by Milliman's Analytics team.

Telematics in Europe: A heterogeneous market dominated by Italy

Beyond insurance, driving habits and road usages are changing: chauffeur-driven car services, carpooling, electric vehicles, new means of urban transport, autonomous vehicles etc. However, while vehicle safety is constantly being improved and studies are being carried out on speed regulation, claims costs remain high. Therefore, cost control and a better knowledge of risks in this changing landscape is of great importance to insurance companies. Telematics provides concrete solutions. More and more countries are now offering new digital products such as Pay As You Drive (PAYD), where drivers can benefit from lower premiums if they drive less, or Pay How You Drive (PHYD), which rewards 'good' drivers. Although these products are offered in several European countries, not all are equal and they have different successes.

FIGURE 1: RANDOM SITUATION OF THE MARKET STUDIED



With over 5 million users, Italy is one of the most developed telematics markets. It is the European leader with the UK. While their neighbors appear to be following the trend, usage-based insurance (UBI) penetration is nevertheless lower. The deployment of telematics is indeed not without difficulties in Europe, mainly because of: the costs of equipment where

margins are already tight, the difficulty of penetrating a market where prices are very competitive, the fragile relationship of trust between policyholders and insurer in a climate where data confidentiality is essential (e.g., the General Data Protection Regulation [GDPR]) etc. Policyholders do not want to be spied on, or have their rates increased or even their claims rejected for false reasons.

Depending on the culture, products are designed and marketed differently. For example, calculating mileage for young drivers is popular in the UK. PHYD offers are marked in Italy, while telematics is more used for security in Switzerland and constitutes a real added value for luxury cars. In France, Germany or Spain, users are less attracted to solutions they consider intrusive. Thus, for the moment, only several tens of thousands of vehicles are equipped in these three countries. The consideration of professional fleets adds to this figure.

Italy is by far the largest European market and if the objective of telematics equipment had been motivated by the reduction of fraud, this now makes it possible to draw broader conclusions. The prospects for risk knowledge and the design of new services are real. The trend is changing, European projects are increasing and things are accelerating.

Technological choices and broad horizon of opportunities

The easiest to deploy is the smartphone solution. Using the integrated components of mobile phones, software development kits (SDKs) make deployment fast and also capture driver distraction[1]. However, the diversity of mobile devices (all GPS and accelerometers are not the same) and the difficulty of controlling how they are used (with the possibility of deactivation by the user) sometimes lead to a preference for components directly linked to the car: dongles or boxes. The dongle can be connected directly to the vehicle by the user while the boxes usually require a specific installation. Both have the advantage of collecting impartial information and they are more difficult to disconnect. They are therefore very useful for providing assistance services. However, it represents higher initial fixed deployment costs, which tend to decrease. Solutions sometimes embed the combination of the smartphone and the box.

Regardless of the device selected, driver behaviour data (DBD) can be collected. This data then provides useful information for answering questions such as 'where, when, and how' to better understand the risks associated with driving.

In concrete terms, telematics provides a large number of new variables (distance travelled, accelerations, turns, geographical areas etc.) that an insurance company can use in various fields: scoring, pricing, underwriting, claims management or even assistance.

FIGURE 2: SIMPLIFIED DIAGRAM OF TELEMATIC STUDIES

Historically, the PAYD and PHYD offers, giving access to premiums better adapted to drivers' profiles, are the most developed insurance products. However, we are seeing the emergence of new models focussed on services and the relationship with policyholders: personalised assistance, parental control for young drivers, a transparent summary of the driving profile, predictive maintenance of vehicles, simplification and acceleration of claims processing etc. The ultimate ambition is even to encourage road maintenance by detecting sections where the indicators are abnormal. The possibilities are immense and the discourse is becoming clearer: services and prevention for policyholders are at least as important as personalised pricing.

Telematics is the future of automobile insurance. Much more than pricing, it is prevention that is at stake via services to policyholders. Controlling and reducing risks is the very essence of insurance. This is an opportunity for insurers to return to their core business.

Extract and enhance relevant information

For many insurance companies, telematics data represent new raw materials. The information is retrieved every day: time-stamped GPS coordinates, accelerometer and gyro data etc. These are new sources that need to be understood and processed in order to design relevant indicators, for example a UBI telematics score.

The massive amount of data must be processed with a statistical approach to infer general average trends, but the specificity of some trips must also be monitored and understood to ensure proper interpretation. Knowledge of data

[1] Scott, S.L. (22 August 2017). Zendrive Crunches 30 Billion Miles of Smartphone Data and Works With Milliman to Build One of the Industry's Strongest Predictive Models. Milliman White Paper.
Retrieved May 2018 from http://www.milliman.com/driving-risk-score/.

is therefore the cornerstone of a quality customer experience. Thus, various algorithms are often required to explore and analyse the data.

While traditional insurance data is 'static' and focusses primarily on vehicle and customer profiles, telematics data processes movement and behaviour. This is an opportunity for the insurer to get closer to the road and to include variables which, at least intuitively, will have a wider propensity to be explanatory of the claims experience. Without even talking about causality, the correlation is proven, and its perception is all the easier for users as they feel 'actors' of their own risk: you cannot change your age—a traditional approximation in insurance—but you know how to improve your driving. The tariff is ideally no longer only charged but understood. In the midst of the Insuretech boom, where the customer is at the centre of the business model, the insurer has an important role to play and an opportunity to multiply contacts with its policyholders, where traditionally the latter limit themselves to the customer experience when a claim occurs.

Understanding raw telematics data

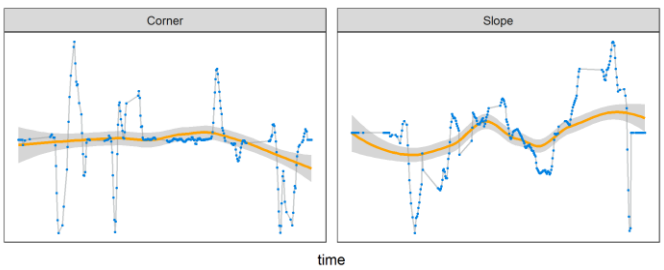
To design usage-based services, insurance companies, manufacturers or any other providers must control their telematics data.

FIGURE 3: DATA EXAMPLE

Latitude	Longitude	Elevation	Time
degree	degree	meters	dd/mm/yyyy hh:mm:ss
48.8755	2.2848	50	21/05/2018 20:30:00
48.8760	2.2868	55	21/05/2018 20:30:05
48.8757	2.2884	60	21/05/2018 20:30:10
48.8755	2.2905	65	21/05/2018 20:30:15
48.8753	2.2919	75	21/05/2018 20:30:20

From time-stamped GPS coordinates, multiple indicators can already be extracted: average paces, instantaneous acceleration approximations, curve radius, mileage etc. Some relevant values have been calculated—and smoothed—along time for one specific trajectory in the illustration below.

FIGURE 4: CONTEXTUALISED INDICATORS ALONG TIME

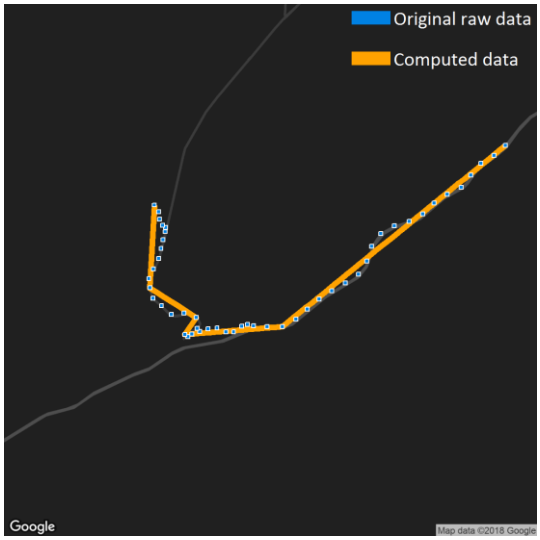


In addition, external data such as population density, weather conditions or even the general topography of the region are also available. Considering all these characteristics, it is then possible to draw up a profile of drivers or trips. This data is sometimes enriched with information from accelerometers and gyroscopes, particularly used in accidentology.

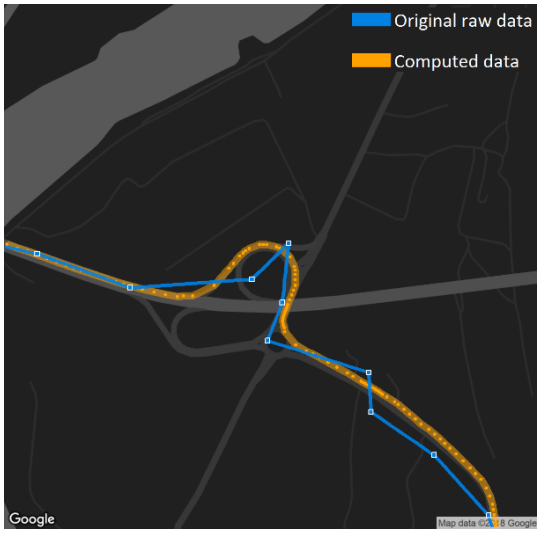
Processing these variables often involves the use of open source solutions such as Python or R that offer a low-cost opportunity to understand and study the data collected. Coupled with large data infrastructures such as Hadoop/Spark solutions, traditional machine learning algorithms (supervised or not) can also be used on a large scale.

As illustrated below, data reprocessing usually involves both (a) reduction and (b) enrichment, here using Google API, according to whether one wishes to obtain a general synthesis of a trip on highway or to explore finely an uneven zone.

FIGURE 5: DATA TECHNIQUES ILLUSTRATION



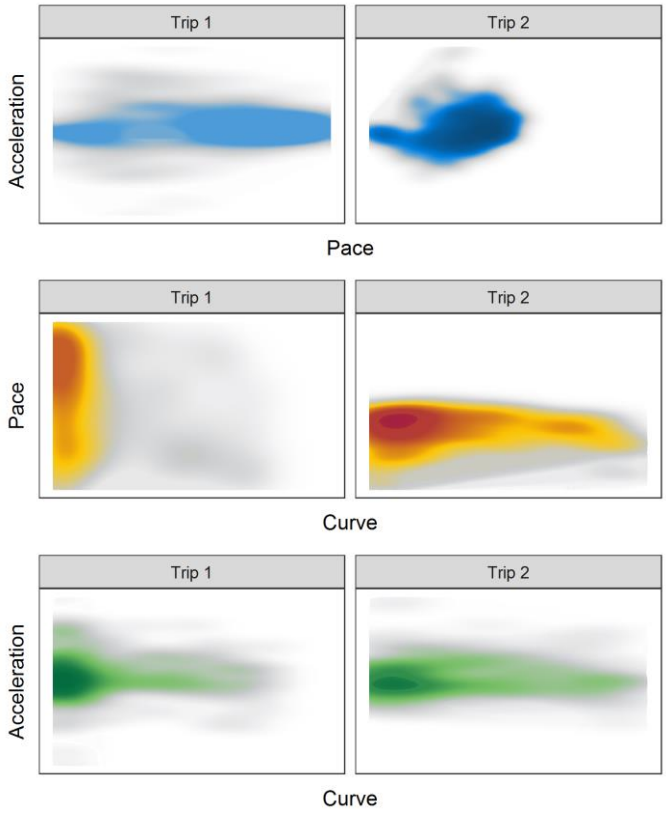
(a) Reduction



(b) Enrichment

Once reprocessed, the data is analysed. Using physical and mathematical formulas, Milliman's data scientists help the insurance company study driving behaviour: what is this driver's 'road footprint'? Using adapted indicators emerging from preliminary studies, the following figure illustrates the intuition behind this driving footprint. The interpretation of the heatmaps makes it possible to deduce specific typologies.

FIGURE 6: VISUALISING DRIVER BEHAVIOURS



For instance, will you accelerate intensely when you turn? Or maybe you brake hard in a straight line? Such tools and visualisations play then a preponderant role to explore behaviours and find patterns. More generally, it allows a better understanding and offers a second direct opinion on the collected data. Abnormal value detections are for instance more easiliy initiated.

Events analysis can then be generated to correlate previous risk experience with driving information. However, it is not necessary to approach telematics from a risk perspective (i.e., with claims data).

Deduce driving habits and develop related services

In order to offer new services, it is indeed possible, for example, just to define driver profiles or to detect atypical routes. Simple GPS data information (which can be collected with a smartphone as well as with a connected box) then makes it possible to better understand the driving behaviour of policyholders. Unsupervised classification algorithms have thus been applied to highlight such behaviour.

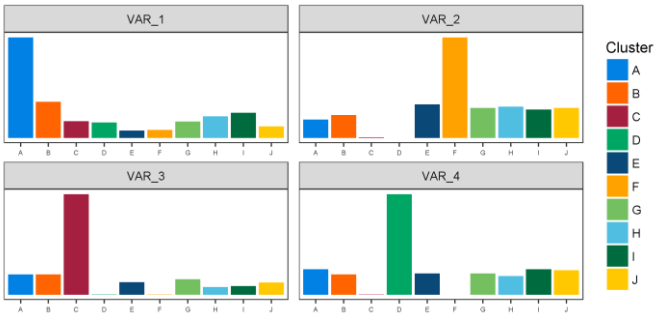
In detail, the study consisted of an exhaustive analysis of a random extraction of approximately 1,000 vehicles from the insured portfolio: both on the trips as a whole with rough precision; and on ‘events’ reported by the data provider, this time with a particularly fine frequency. For insurers, the challenge is twofold: to reassure themselves about the quality of the information provided and how to interpret it, but also to highlight avenues for change.

The ROI, while difficult to quantify, is certain. This study emphasises the possibilities of the evolution of the insurer’s offer, always more centred on an insured with that person's requirements and feeling.

Trip analysis

Based in particular on our expertise in risk, statistics and pricing, it was therefore possible to define different classes and typologies of routes. Each of these classes could then be analysed and interpreted a posteriori (see illustration below).

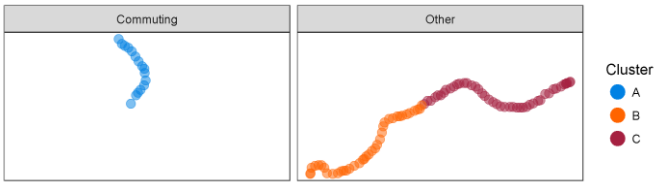
FIGURE 7: INSIGHT OF CLUSTERS



Thus, depending on the time of day, the distance to the starting point or the geography of the area, for example, different types of trips have been defined. About 30 explanatory variables were selected. On the basis of these classes, each driver can be described according to the distribution of that person's repartition across these categories.

The driver's prism was only added at the end. Indeed, beyond the traditional indicators, we wanted to evaluate the quality of unsupervised modelling. The results are conclusive: for nearly 60% of drivers, their trip typology is summarised by almost three trip classes only. In other words, clusters decomposition is robust enough.

FIGURE 8: TRIP CLASSIFICATION ILLUSTRATION



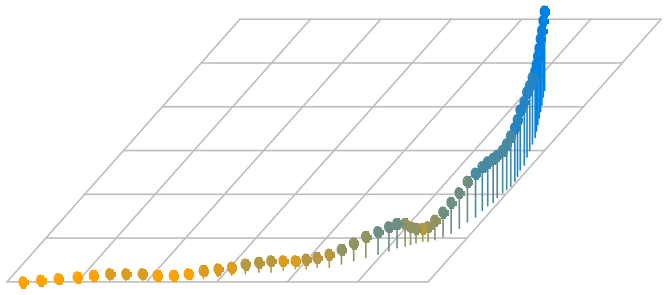
The study shows that the distribution of their trips across these classes characterises the driving styles of policyholders. The analysis also enriches the company's knowledge of its policyholders, without any prior link with claims data. The use of relatively simple telematics data (i.e., raw data with low frequency without using the events reported by the data provider) allows an initial definition of driving profiles to be

established. By combining machine learning techniques and business expertise, this data can be used for different purposes: atypical route and driving profile detection, geofencing services etc.

Events analysis

While GPS data already provide a large amount of information on the driving profile, information collected by onboard units detail specific events that occurred during the trips. In order to offer personalised services such as post-accident assistance or claims reconstruction for faster claims processing (or possible fraud detection), the analysis of finer data such as the accelerometer is necessary.

FIGURE 9: SIMPLIFIED TRAJECTORY RECONSTITUTION FROM ACCELEROMETER DATA



We worked on data acquired at high frequency. Using the initialization data, it was possible to contextualise a vehicle's trajectory at the time of acquisition in three dimensions using a simplified physical approach (Figure 9).

We point out that these are only approximations, and that inference of positions from variations is a much more complex problem. With these rough visualisations, the insurer becomes able to better understand events and define its own indicators.

Quality control of events is crucial when it comes, for example, to using them for assistance. In addition to the impact on brand image, an error in accident detection can result in a net loss of margin due to the unnecessary start of an assistance process. The return on investment (ROI) is clearly on how to deeply know and understand the data through this second opinion.

Understanding telematics data is therefore at the heart of the relevance of any new services. Even with a small sample size, the conclusions are sound and pave the way for future large-scale projects.

Big data and Analytics is not only applying the latest algorithm to terabytes of data, it is also knowing '**how to scale up**' from targeted studies with high added value.

The coming months will be full of challenges: **car insurance has here a real opportunity to renew itself and change its face while avoiding drifts. Beyond pricing, both prevention and customer experience are at stake.**

Milliman

Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in life insurance and financial services, property & casualty insurance, healthcare, and employee benefits. Founded in 1947, Milliman is an independent firm with offices in major cities around the globe.

milliman.com

CONTACTS

Remi BELLINA, IA
Consulting Actuary & Data scientist, **Paris**
remi.bellina@milliman.com

Antoine LY, IA
Consulting Actuary & Data scientist, **Paris**
antoine.ly@milliman.com

Fabrice TAILLIEU, IA
Principal & Consulting Actuary, **Paris**
fabrice.taillieu@milliman.com

Nicola BISCAGLIA
Principal & Consulting Actuary, **Milan**
nicola.biscaglia@milliman.com