Onboard measurement of risk of accident with SafetyNex (real time driving risk assessment) : Application to prevention, auto insurance pricing, respecting privacy of driver

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1 – Introduction

Onboard telematics, smart phones, connected devices, are now in use to monitor driver's behaviour: habits, way of driving, etc... Many organizations are interested to collect, use and monetize those data, and one of the key questions is about the driver, privacy and choice to share data, and also his interest: What will he/she get in return (new and important): Is it possible to offer security and safety new features that could save his life? Does it have an economic interest? Can we guarantee not to record (in the cloud) of personal data to respect privacy?

We describe the use case of automotive telematics for insurance companies.

2 – Goal of Insurance Companies with automotive telematics

Embedded telematics in vehicles could revolutionize the business of insurance companies. Indeed, insurers must price their guaranty and they must take care of the accident rate for a given driver:

. if costs of accidents (for a driver) is more expensive that the price he/she pays, then the insurer loses money on this driver (*)

. if the price to be paid is too high, then the driver may quit and find another insurance company.

(*) Insurers reduce risk by using the actuarial expectation (sum of paid prices minor sum of risk-weighted by associated loss costs), thereby modulating prices taking into account actuarial expectation (that should be positive) and not only individual risk: actuarial expectation has the effect of neutralizing the randomness of individual risk if portfolio is large enough.

The scope for the insurers in terms of pricing is quite narrow. They need to estimate as accurately as possible risks, and associated loss costs, in order to offer consistent prices.

Similarly, it would be interesting to act on the driving style of the driver, and thus decrease the loss cost and / or reduce the risk of accidents. In such a case, it would increase margin, or it may allow to lower price and be more competitive.

One can imagine many ways to achieve pricing using telematics:

. production of more accurate customers segmentation,

. « Pay how you drive »

. a mix of both approaches.

Main useful information is the risk profile of the driver and, for better understanding, usage statistics (number of kilometres, used types of infrastructure - highway road city - hourly statistics, etc. ...). In no case does the actuary need to know precisely where the driver went, how fast he was driving, and at what time. Even the driving style is not important (as we could explain in the previous white paper, see references, severe braking is no help to estimate risk of accident): Those data are not part of the data needed for insurance companies.

Risk is as we said the main needed variable for insurance companies, with statistics of uses, the there is no need to collect confidential data (like timestamped geolocation and speed, for instance). We can say then, that it is normal that insurance companies all look for devices and smartphones to collect data.

For the driver, this may allow in particular reduce pricing injustices:

. young drivers pay in France three times the average price (in other countries it is much more) because statistically risk profile is very high. Telematics lets the insurer know the individual actual risk of a young driver (and THIS young driver may be an excellent driver even though he/she is young!)

. a driver who has three accidents because he/she is a risky driver, or a safe driver who really had bad luck (it happens) are currently seen the same way by insurers. Penalizing the safe unlucky driver is really unfair! And it doesn’t correspond to the probability of accident.

Similarly, helping seniors to go on driving their individual car as long as possible is an important social issue in view of the aging of our populations: the individual vehicle is still a social connection tool, and the best suited to ensure the mobility of senior citizens (no stairs to climb, no rush hour, no long walks in the corridors, etc.), but declining reflexes and bad eye sight can cause road safety problems. A unitary measurement of the risk profile can may lead to rapidly detect any deterioration in driving performance (increased risk), and thereby enable the insurer to propose preventive and corrective effective actions, appropriate and personalized (updated knowledge of road risks, visit the ophthalmologist, etc.).

3 – Data needed for insurance to build its pricing

As mentioned before, relevant data for insurers are:

. risk taken by the driver

. kilometres

. used types of infrastructure (city, road, motorway)

, Dayparts

. days of the week

. habitual nature or not for a path

. geographic area of main use of the vehicle (not trips or places visited by the driver, just the regions to see how some areas are more accident-prone than others).

The insurer (unlike other professions such as fleet managers), needs no accurate location data and time stamped (except for anti-theft function or post-theft). Data of interest must be gathered into histograms (aggregate) and contingency tables (aggregate data still there). Aggregation warrants the driver that there is no spying. With those data, it is absolutely not possible to reconstruct the path or know any crimes he committed (it is not known where the driver went, for how long and at what time, or how fast).

So one can say that the real need of data for the insurer meets a priori requirements of every national agency for data privacy monitoring (including CNIL in France), and more generally meets the elementary rules of ethics.

4 – Data required to calculate a risk

Contrary to what we sometimes read, the risk of accident cannot possibly be inferred from a measurement of the brutality of breaking (with accelerometers). Work on this subject has been published in scientific congresses, and the reader is invited to consult the chapter « 8 - references ». It is too bad, but you will never get a proper risk assessment if you use this so called « severe breaking » - based intuition.

Thus, current deployments based on detecting severe braking and other seemingly logical ideas (but false) are they doomed to failure.

NB: It is easy to understand that if you drifts and do severe braking on a disused airport runway is not dangerous. If you do the same thing in front of a school, it is extremely dangerous. If you do this on an open road with crossing roads, it is both dangerous for the others and for you. Similarly, if you drive with no severe braking and if you don’t stops at the stop sign … it is extremely dangerous.

The context is very important (talking about contextualization of driving behaviour).

Then, because you must compare driving behaviour to context (infrastructure characteristics, for instance, variables to determine risk are mainly:

. vehicle speed (and related data: acceleration, etc.)

. accurate geolocation (GPS signal) and positioning on a map (whether you are on a disused airport in front of a school, or on an open road with crosses, etc.).

From these data, it is possible (but not easy) to determine the risk taken by the driver.

Only contextualised approaches as indicated above are scientifically credible, others are eliminated directly.

5 – Trick of « recording raw data » in the cloud

It is tempting to record all the raw data (speed, location, acceleration, etc.) in the cloud and then build offline, on high capacity servers, "risk scores". This would allow the use of modern methods of deep learning, for example, and would also allow the use of very high memory capacity and computing power.

NB: this off-line approach fails to warn the driver that he/she is in danger (because even if the computation in the cloud is fast and real time, data transmissions latency for upload or download is not guarantied). It's a shame to estimate risk and not to warn the driver in situ!

Recording of raw data in the cloud faces a major problem: from timestamped speed of the car and GPS signal, you can locate the vehicle on a map … that has many points of interest including speed limits!

Therefore, it is extremely easy, from those raw data to detect any speed limit infringement. In France the detention of violations of law by private companies is generally not legal (except special mission given by the Government): it is strictly prohibited by the Penal Code (which is monitored by the CNIL): see "8-references" Art. 226-19 of the Penal Code. In other countries where data privacy protection is not as strict, we believe that the detention of law violation by insurance companies is contrary to the basic ethics. Especially since the insurer does not need this information to compute pricing, as explained above.

It is very important to clearly understand this problem: an insurance company that collects raw data including speed and GPS, and that records them into a cloud (on computer servers) indirectly owns offenses to the law. In France, for instance, it is likely to be prosecuted, and rightly so, by the CNIL.

This solution of « recording raw data in the cloud » to estimate a risk must be avoided: it's tempting, of course, but do not.

6 –Disruptive solution SafetyNex

SafetyNex computes every second the risk taken by the driver. The computation is not done in a cloud on remote servers, but directly inside the smartphone. This means that in no case the raw signals (speed and GPS) are recorded on computer servers accessible by the insurer or by NEXYAD. These are only temporary raw data used by the computer program **SafetyNex** and then raw data is erased from the smartphone.

The risk computed by **SafetyNex** has been validated by the experts of the road equipment, tested on 50 million km, and it uses proven knowledge extracted during the past 15 years by NEXYAD from road safety experts and researchers (French collaborative research programs on road safety PREDIT).

Since the risk assessment is performed in real time, it is possible to warn the driver in case of danger ahead. Prevention (alert) is important both for the driver and for the insurance company:

. For the driver, being alerted in case of danger is likely to save his/her life.

. For the insurer, the alert lets statistically avoid accidents, and for those who have not been avoided, it leads to accidents with lower speed (because the driver had time to slow down) which on average corresponds to lower insurance costs.

SafetyNex aggregates data (kilometres risk histogram, etc. and all contingency tables) directly in the smartphone and sends to a cloud only such statistical data, 100% relevant to the insurer. On NEXYAD cloud, data is anonymized. No raw data is recorded, no law infringement may be held by the insurer or NEXYAD, either directly or indirectly.

SafetyNex gives advices ("off-line") to the driver, telling him/her on demand what driving behaviours should be modified in order to increase safety.

7 – Conclusion

It should not be allowed (in most countries it is not) to record speed of the car and GPS (raw data) on a cloud for insurance risk assessment applications because it would mean that the insurance company knows every over speed of the driver. Even if it is allowed, it is a complex situation (where the insurance company is aware of illegal behaviour of their customers … what should they do then?).

There is a real time onboard risk assessment tool able to overcome this: **SafetyNex** that achieves its risk assessment locally (within the smartphone) and then that is natively designed to be compatible with the requirements of the French Penal Code and the CNIL (compliance with Pack for the connected vehicle), and more generally with the elementary rules of ethics and laws of other countries, to protect privacy of the driver.

The risk assessed by **SafetyNex** has a specific definition in accident and its relevance has been validated by 50 million km of driving.

SafetyNex alerts in real time the driver of a dangerous situation ahead (letting time enough to slow down). In doing so, accidents may be avoided, and when they are not, if the driver had time to slow down, they are statistically less severe. **SafetyNex** therefore influences in a good way, both the risk and the cost of accident.

SafetyNex is perceived by the driver as a useful driver assistance, and can help to personalize the services offered by the insurer.

Finally, **SafetyNex** offers coaching explaining what behaviours may change to lower the risk.

8 – References

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méconnaissance des dispositions du II de l'article 34 bis de la loi n° 78-17 du 6 janvier 1978, est puni de cinq ans d'emprisonnement et de 300 000 € d'amende.

. FRENCH LAW : CODE PENAL Art. 226-19 Le fait, hors les cas prévus par la loi, de mettre ou de conserver en mémoire informatisée, sans le consentement exprès de l'intéressé, des données à caractère personnel qui, directement ou indirectement, font apparaître les origines raciales ou ethniques, les opinions politiques, philosophiques ou religieuses, ou les appartenances syndicales des personnes, ou qui sont relatives à la santé ou à l'orientation ou à l'identité sexuelle de celles-ci, est puni de cinq ans d'emprisonnement et de 300 000 € d'amende.
Est puni des mêmes peines **le fait**, hors les cas prévus par la loi, **de mettre ou de conserver en mémoire informatisée des données à caractère personnel concernant des infractions**, des condamnations ou des mesures de sûreté.

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