The Future of Prediction

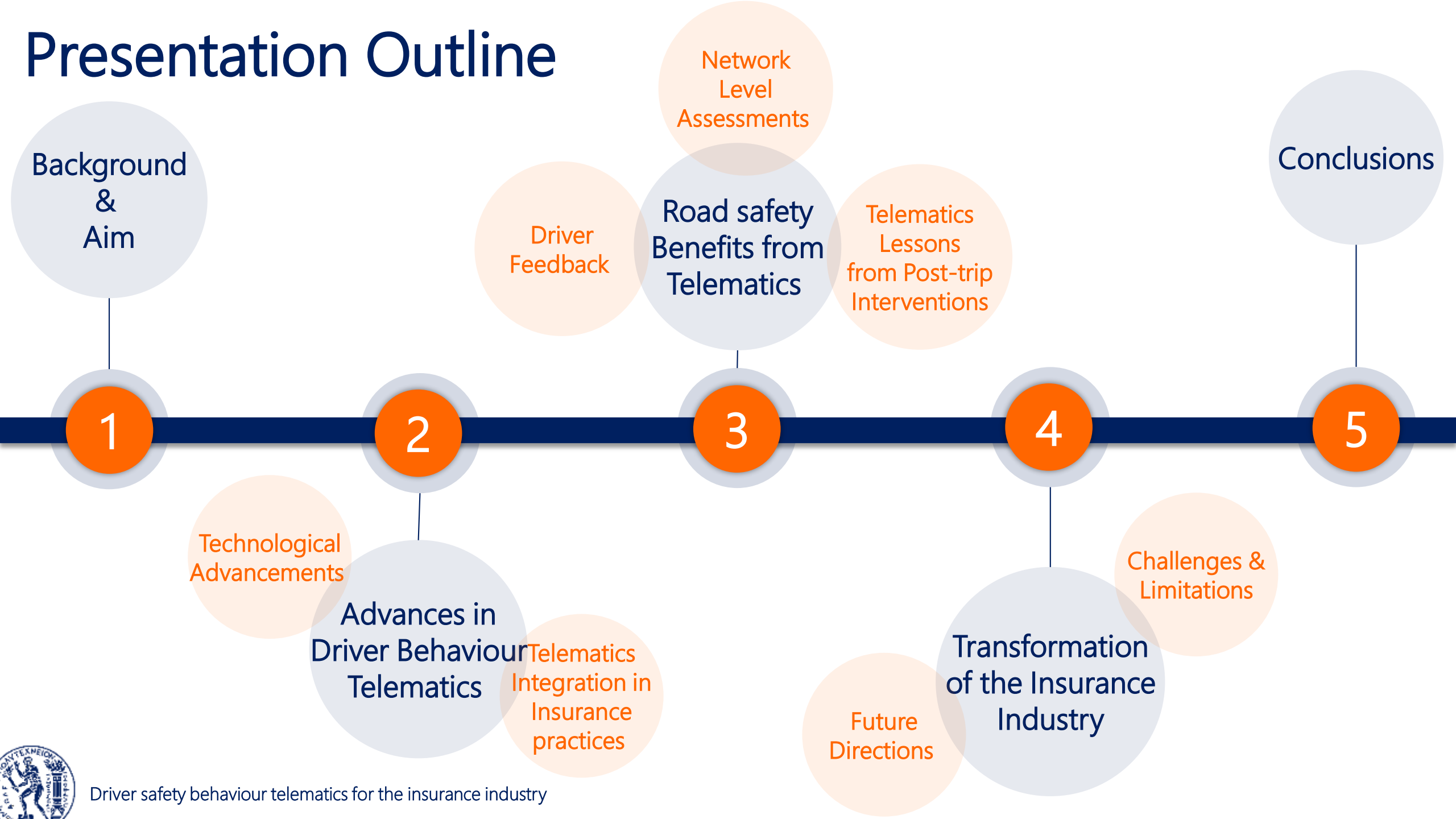
Workshop "The Future of Insurance. How Does Algorithmic Prediction Affect Insurance Practices?"
18-19 November 2021, Bologna

The transformation of the insurance industry & road safety by driver behaviour telematics

George Yannis, Apostolos Ziakopoulos, Virginia Petraki, Armira Kontaxi

National Technical University of Athens
Department of Transportation Planning and Engineering

Presentation Outline



General Background & Presentation Aim

- Driver Behaviour
- Driver Behaviour Telematics
- Telematics in the Auto Insurance Industry
- UBI Penetration Rate
- Aim of the present Presentation

Driver Behaviour

- Road crashes constitute a major public health problem worldwide, accounting for approximately 1.35 million fatalities annually across the globe
- Human factors are the leading cause of road crashes; 95% of total road crashes
- Also, driver behaviour has a significant influence on traffic flow, fuel consumption, carbon emissions and air pollution
- Therefore, driving behaviour must be improved for a safer and more sustainable transportation system

Driver Behaviour Telematics

- Driver behaviour telematics were initially based on On-Board Diagnostics (OBD), having access to data from the engine control unit
- Current technological advances make data collection and exploitation substantially easier and more accurate through smartphone sensors
- The high penetration rate of smartphones the two last decades has offered new possibilities for faster, more accurate and more affordable driver behaviour data collection
- The interpretation of these data can be made possible thanks to progress in computing power, data science and artificial intelligence

Telematics in Auto Insurance

- Considering the persistent road safety, congestion and environmental issues, combined with the technological evolution of the field of telematics, insurance companies have developed Usage-Based-Insurance (UBI) schemes
- UBI schemes, namely Pay-as-you-drive (PAYD) and Pay-how-you-drive (PHYD), are a quite new concept in the auto insurance market
- Such schemes bring significant societal benefits, since driver insurance rates are affected by their travel and driving behaviour instead of traditional auto insurance pricing factors, such as driving experience, vehicle type etc.

UBI Penetration Rate

- In the current global market, no country has attained adoption rates of auto insurance telematics that exceed 20%
- However, UBI remains a very promising insurance concept given that further technological advances are expected to boost the UBI market
- The global UBI market size was valued at $28.7 billion in 2019
- This size is projected to reach $149.2 billion by 2027, growing at a compound annual growth rate of 25.1% from 2020 to 2027

Aim of the presentation

The aim of the present research is:

- to expand on the aforementioned topics based on trends from recently published research
- and discuss the transformation of the insurance industry by driver behaviour telematics

Advances in Driver Behavior Telematics

- Technological Advancements
- Telematics Integration in Insurance Practices

Technological Advancements (1/3)

- The telematics industry is growing and changing rapidly due to the continuous advancements in Internet of Things (IoT), connectivity, and sensor hardware
- Data are recorded either by vehicle OBDs or smartphones sensors and transmitted to a control center
- Transmission methods include:
  - USB cable connection of the OBD and the central database
  - a GPRS/CDMA network
  - transmission through a micro-SD card
  - wireless transmission from a Bluetooth built-in the OBD

Technological Advancements (2/3)

- Smartphones can be easily programmable allowing for a wide array of sensors such as:
  - accelerometer
  - digital compass
  - Gyroscope
  - GPS
  - Microphone
  - Camera

- ...to record and monitor driving behaviour through applications that do not need any user engagement

- With the full coverage in urban areas and increase in data transmission rates, mobile networks have recently become widely used by ITS applications, especially for gathering data from various sensors

Technological Advancements (3/3)

- Although several telematics services are possible with today's 4G Long Term Evolution (LTE) networks, the 5G networks support new types of information including new bandwidth-heavy computations and video-based services
- The development of connected vehicle technology, transforms rapidly the future of global auto insurance industry through the digitizing and optimization of the driver and vehicle data production and collection process
- The integration of Advanced Driver Assistance Systems (ADAS) with Vehicle-to-everything (V2X) communications has the potential to prevent 80% of reported road crashes

Telematics Integration in Insurance Practices (1/3)

- Auto insurance has become one of the most important application fields of vehicle telematics
- Usage-Based Insurance (UBI) is a type of auto insurance that tracks travel and driving behaviours allowing insurance companies to align driving behaviours with premium rates
- Depending on the variety of driving data availability and the usage level of telematics, UBI can have several variants
- The traditional charging policy of auto insurance companies, which is a fixed price for every driver, has been regarded as unfair and inadequate

Telematics Integration in Insurance Practices (2/3)

The two main telematics insurance schemes are Pay-As-You-Drive (PAYD) and Pay-How-You-Drive (PHYD)

- PAYD: the parameters that affect the insurance charging is the driven distance or time
  - **Pay-per-mile insurance (PPM)**: uses driven distance as the main parameter for price calculation
  - **Pay-per-hour insurance (PPH)**, or pay-as-you-go: the cost calculation depends on the driven hours
- PHYD: the parameters that affect the insurance charging are related to the driving behaviour such as speeding, hard acceleration, hard braking, hard cornering, mobile phone use etc.

Telematics Integration in Insurance Practices (3/3)

Some relatively new and upcoming telematics insurance schemes are:

- Manage-how-you-drive (MHYD):
  - includes all the essential characteristics of PAYD and PHYD schemes in terms of monitoring of travel and driving behaviour with a richer component of driver feedback
- Some of the upcoming forms of PAYD schemes are:
  - **Variable Mileage Plan (VMP)**: the drivers choose their monthly distance based plan
  - **Rolling Top-Up (RTU)**: drivers pay a premium including a travel distance of their choice without an annual renewal
  - **Monthly Miles Rewards (MMR)**: drivers select a contract with a standard travel distance; the drivers who drive less miles than the threshold, receive a reward
- Try-Before-You-Buy (TBYB) gives the opportunity to drivers to test out a telematics insurance scheme for a short period of time before committing to obtain that service

Road Safety Benefits from Driver Behaviour Telematics

- Driver Feedback
- Telematics Lessons from Conventional post-trip Interventions
- Network Level Assessments

Driver Feedback (1/2)

- The ultimate objective when providing feedback to drivers is to trigger their learning and self-assessment process, thus enabling them to gradually improve their performance
- 22 studies investigating the quantified impact of telematics on road safety were examined
- Studies investigating the impact of telematics on the number of road crashes report a 20% to 43% reduction in road crashes after the use of some form of telematics while driving
- Similar studies have been conducted with the aim of quantifying the telematics impact on crash risk with reduction rates ranging from 37% to 50%

Driver Feedback (2/2)

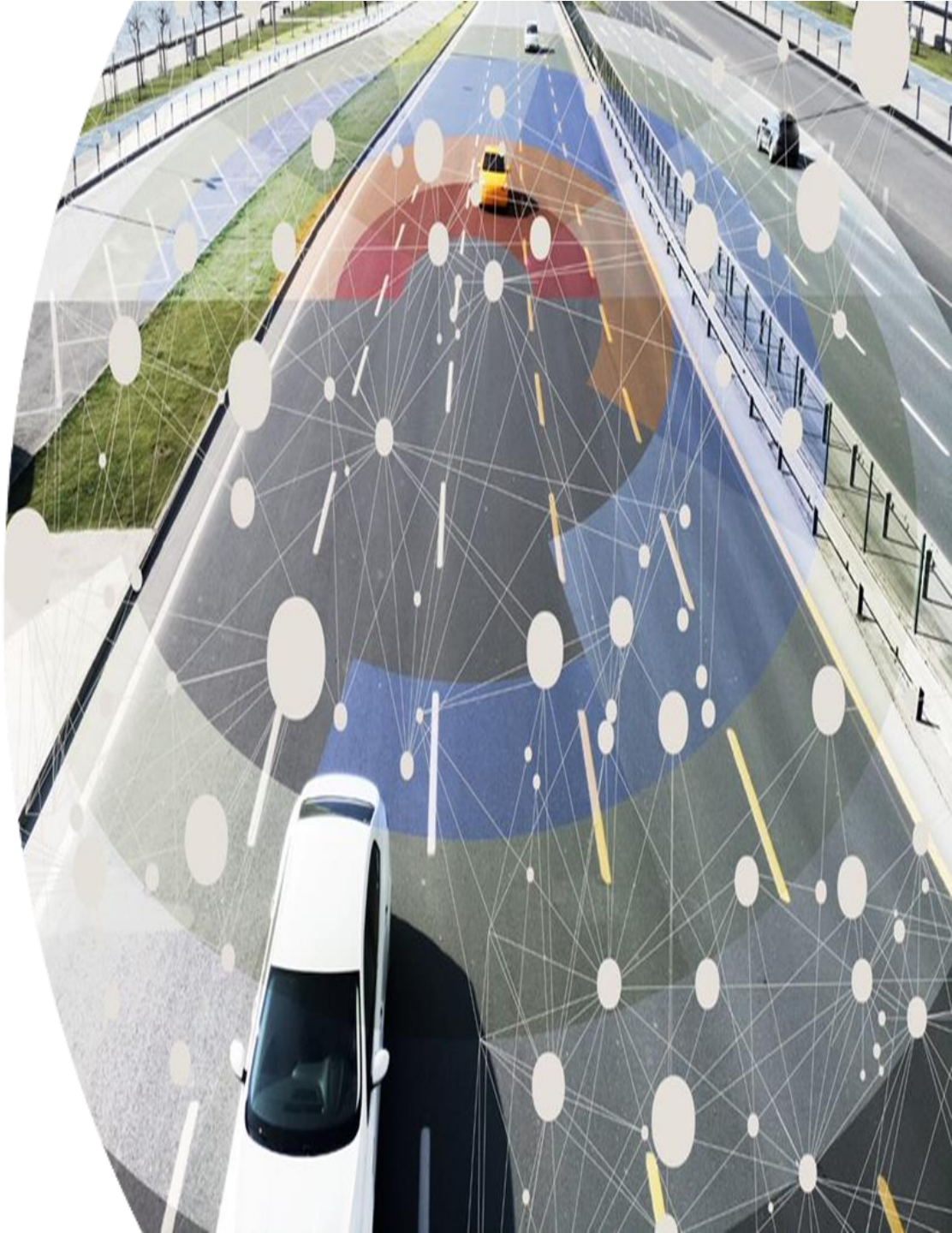
- Providing drivers with feedback on critical deficits or unsafe behaviours results in a reduction of speeding incidents between 15% and 80% and a reduction of harsh events between 20% and 52%, respectively
- However, the provision of feedback alone may be insufficient to install behavioural change in drivers
- Incentives within a social gamification scheme, with personalized target setting, benchmarking and comparison with peers may have a greater impact
- The combination of financial incentives in the form of PAYD incentives with personalized feedback was found to potentially lead to statistically significant changes towards safer behaviours

Telematics Lessons from post-trip Interventions

- Telematics lessons can be seen as guidelines for the design of more efficient and longer-lasting telematics interventions
- Providing drivers with tailored feedback regarding their performance can help them appropriately self-regulate their driving behaviour
- However, if follow-up efforts were not made, neither of the impacts was sustained over time
- Each post-trip intervention technology should be only used supplementary to other safety countermeasures in order to enhance road safety

Network Level Assessments

- Harsh driving events can be regarded as surrogate road safety measures (SSMs)
- Such measures are alternative data that can complement or replace crash data and enable proactive road safety assessments for road networks
- Insurers can therefore obtain estimates of the degree of hazard posed by specific networks proactively by using harsh events
- Higher degrees of sophistication in insurance schemes and monitoring can not only create more fair or competitive insurance products, but can materialize the data to actively reduce crashes and suppress their respective costs



Transformation of the Auto Insurance Industry

- Future Directions
- Challenges & Limitations

Future Directions (1/4)

- New technologies including automation and machine learning are providing impetus for the introduction of new types of insurance operations
- Several aspects of technology and application remain unexplored for telematics operation in an insurance context
- There is much potential for further transformation of the telematics insurance industry by providing specialized UBI schemes per road user category
  - Professional drivers have distinct UBI needs compared to conventional road users
  - Powered-two-wheeler riders are vulnerable road users who have their own mobility patterns & demands

Future Directions (2/4)

- Complete individualization, remains an open question, despite the addition of several dynamic elements in telematics-based insurance
- Regarding road environments, more holistic approaches should be considered
- This need is enhanced if UBI schemes are to be seamlessly implemented in environments where innovative interventions in road safety and traffic management measures take place
- If additional particular road environments are taken into account, the problem quickly becomes highly multidimensional with possible data scarcity issues

Future Directions (3/4)

- Lack of data across any dimension may severely affect attempts to attain the individualization of premiums
- Even before full automation becomes reality, connected vehicles may introduce new road users such as people with mobility or visibility impairments, which will require further refinement of insurance frameworks
- A critical task would be to create a scheme that is representative of the complexity of transport operations, but which remains manageable and transferable
- The thorough investigation of the effectiveness of telematics-driven post-trip interventions, and how they may be optimized for maximum net impacts, remains another open research direction

Future Directions (4/4)

- Tools such as gamification or risk-reward systems add further dimensions to the problem
- UBI telematics systems may require 'cold start' inputs for new users or for when an intervention or road safety measure is being implemented for the first time in their road network, but previous knowledge may exist
- Feasible transferability methods need to be set in place for effective UBI
- UBI will need to consistently prove its reliability to cover larger market shares across countries that may be unprepared or unwilling to adopt it

Challenges & Limitations (1/2)

- Despite building anticipations, the insurance industry will have to surmount considerable challenges
- The thin line between safety monitoring and breaches of privacy remains one such major obstacle
- The General Data Protection Regulation (GDPR) laws affect the manner of permissible monitoring, the data available to the analysts and the forms of feedback which can be provided to the road users
- Insurers could be expected to be held accountable for shielding consumers from adverse effects on consumers from GDPR breaches

Challenges & Limitations (2/2)

- Data form, acquisition, storage, cleaning and analysis are processes playing a critical role in present investigations of driver behaviour, possibly inserting bias in telematics-based research
- OBD/IVDR data can accurately measure crash involvement probability and can be used in real-time traffic modelling, but the required sampling frames remain unknown
- Smartphone-based schemes are considerably demanding in data storage, handling and analysis, filtering and quality control to ensure accurate data outputs
- Newer data manipulation schemes can be expected to lead to even more rapid and multifaceted analyses of the driving task
- The effectiveness of several more sensors remain to be explored for driver telematics

Conclusions

Conclusions (1/2)

- The vehicle insurance industry is undergoing a period of vast transformations driven by advances and innovation in vehicle telematics
- Aided by telematics, the shift towards UBI has been gradual but constant
- Telematics have opened new research venues in road safety by providing vehicle trajectories, surrogate safety measures and other similar indicators which would be otherwise unobtainable
- An integral part is the provision of driver feedback, which has been found to urge drivers towards safer behaviours

Conclusions (2/2)

- The insurance industry will have to carefully balance between the most efficient monitoring, the algorithmic methods to be deployed as well as data protection regulations
- This balance will assume a 'transferability vs individualization' dilemma that will need to be solved by insurers
- Additional emphasis needs to be placed in newly emerging or less covered types of road users and road environments to deliver holistic and competitive insurance products, especially taking into account the technological advancements in the respective fields

The Future of Prediction

Workshop "The Future of Insurance. How Does Algorithmic Prediction Affect Insurance Practices?"
18-19 November 2021, Bologna

The transformation of the insurance industry & road safety by driver behaviour telematics

George Yannis, Apostolos Ziakopoulos, Virginia Petraki, Armira Kontaxi

National Technical University of Athens
Department of Transportation Planning and Engineering