Convergence of human and artificial intelligence for better tax audit selection
Prof. dr. Anne Van de Vijver
28 May 2021
Human intelligence

- Big data, but ... physical limitations
  - Limited working memory, fatigue, ...
- Human reasoning is “noisy”
  - Influence of external matters such as the weather, weekend football results, ...
- Implicit biases
  - Confirmation bias, racial bias, ...

⇒ Limitations & risk of arbitrary, discriminating decision-making, ... police, prosecutors, judges, ... and also ... tax audit selection
Human reasoning

“In fact, most of the errors that people make are better viewed as random noise, and there is an awful lot of it. Admitting the existence of noise has implications for practice. One implication is obvious. You should replace humans by algorithms whenever possible. Even when the algorithm does not do very well, humans do so poorly and are so noisy that, just by removing the noise, you can do better than people.” (Kahneman, 2019)
Predictive algorithms

- Huge capacity, speed, accuracy, consistency
- However
  - (Accidental) correlation, no causation
  - Bias in training data is replicated, perpetuated and amplified
  - Automation bias: propensity to favor suggestions from automated decision-making systems

⇒ How models are being used is crucial, e.g., NL court of De Haag, decision of 5 February 2020, SyRi case
Mirror, mirror on the wall who’s the fairest of them all...

Transparency

Awareness
How does the legal framework support the convergence of human and artificial intelligence to mitigate bias in tax audit selection. How do predictive models improve fundamental taxpayer’s rights?
Transparency

- Systemic level
  - Datasets, architecture of the predictive model
  - Blackbox problem? Explainable AI, ...

- Individual level
  - Information on the processing of personal data, on risk prediction, right to access
  - Level of detail, e.g., NL court of Gelderland, decision of 24 December 2020 (profiling, indicators, double nationality)
Awareness

- Process
  - Development of the model, testing, intervention, risk management
- Architecture of the predictive model
  - Training, automation bias
- Individual decisions
  - Human oversight, e.g., e.g., French law of law no. 2019-1479, 28/12/2019 & decree no. 2021-148 of 11 February 2021 on webscraping by tax authorities
  - Visualization, debriefing
The operational logic of the automatic data processing and reasoning performed by the system and the models used.

Model architecture

An algorithm has been developed that can find relationships and patterns in a large amount of information about illegal housing. The algorithm calculates which information can be associated with illegal housing and to what degree, and which information cannot. The algorithm does this by performing mathematical calculations according to the probability tree principle. A large number of probability calculations are performed by the algorithm, and an average is then taken. This average is used to generate the mathematical expectation of illegal holiday rental at an address. This expectation of illegal holiday rental at an address is only calculated by the algorithm when a new report is received for suspicion of illegal holiday rental at an address.

This type of algorithm is called a “random forest regression”. To make sure employees understand the consideration that the algorithm is making, the “SHAP” method is used (SHapley Additive exPlanations: https://github.com/slundberg/shap). SHAP calculates, which features in the data have resulted in high or low suspicion of illegal housing. This ensures that an employee can always understand what the algorithm based its risk assessment on, so they can make a well-considered decision.

Human oversight

Human oversight during the use of the service.

There is no automated decision-making. An investigation into a suspected illegal holiday rental is always the result of a report. This report is, for instance, submitted by a citizen or rental platform. The algorithm helps the employee of the department of Surveillance & Enforcement to prioritize the most probable cases from the workload so that they can select them for a field investigation. The algorithm facilitates a planner’s specific consideration of starting a field investigation at an address. The employee is provided with a visualization that shows which data features play a key role in the “risk assessment” of the algorithm, and which don’t. With this visualization, they can assess if they should follow the risk assessment of the algorithm or not.

The responsible supervisor and the project enforcer are the ones to determine if there is actually a case of illegal housing. They determine this by conducting preliminary research and field investigations. The case is then discussed intensively in a debriefing with the employees who partake in the decision-making process. The algorithm, therefore, has a significant influence on the planner, but it does not make independent decisions on whether or not illegal holiday rental is determined.

A work instruction has been drawn to prevent employees from having excessive confidence in the algorithm. In addition, the employees undergo training to recognize the opportunities and risks of using algorithms.


Prof. dr. Anne Van de Vijver
Faculty of Law, University of Antwerp (Belgium)
Antwerp Tax Academy, DigiTax Research Centre
anne.vandevijver@uantwerpen.be
https://www.uantwerpen.be/en/research-groups/digitax/