Artificial intelligence in environmental monitoring

AI is increasingly being used for the purpose of environmental law enforcement and the impact for businesses is significant. This article discusses the implications of the use of AI in environmental law and gives practical guidance to in-house legal teams supporting businesses which impact on the environment.

AI and machine learning is currently being used to automate environmental inspections through AI analysis of images obtained by satellite or drone. AI technology has huge potential and can extend the reach and efficiency of environmental inspections and significantly enhance regulatory effectiveness. Machine learning methods can also help optimise resource allocation by predicting where on-the-ground manual inspection resources would be most beneficial. Businesses are subject to greater scrutiny and regulatory supervision, because the authorities are able to detect or predict potential violations in a cost effective manner. As a result there is a higher risk of potential violations being detected and respective sanctions materialising.

Why it matters?

What is the risk of potential sanctions materialising? This is the fundamental question for any business failing to comply with applicable environmental regulations. Businesses have faced regulatory risk for a long time. However, recent years have brought significant changes in environmental risk management. This is thanks to increasing social awareness, in particular regarding the importance of the quality of the environment, and growing regulatory pressure on the industry. However, the increased pressure has not usually been accompanied by relevant additional human and financial resources for regulators and environmental authorities. Just like most public authorities, those dealing with the environment must constantly make reasonable decisions on how to allocate their resources. This is because environmental authorities cannot audit every entity or plant due to their extensive responsibilities, overwhelming volume of obligations and their limited capacity. Therefore, environmental inspections are usually undertaken if there was a reasonable suspicion of a breach. Against this background, it has not been difficult for businesses to slip under the radar of the environmental authorities and thus the risk of being inspected has been manageable so far. However, AI may be a game changer as it provides a low cost method for detecting potential breaches of environmental law.

How machine learning can help the environmental authorities?

Machine learning is widely used in image analysis and so applying this existing technology to the problem of analysing satellite or drone images of the environment is relatively straightforward.

Stanford scholars have figured out a way to recognize unregistered large-scale, concentrated animal feeding operations (CAFOs) by using publicly available satellite images. The researchers focused on determining where the CAFOs, believed to generate substantial pollution, are located. Currently, no authority in the U.S. has reliable information on the location, number or size of unregistered CAFOs. This is because applicable regulations require some permitting for operations that actually cause pollution, but not for those that could potentially do so (intentionally or not). Some environmental and public interest groups have previously tried to manually identify these facilities themselves, however it was extremely time-consuming. In order to solve these problems, the researchers

trained an existing image-recognition model to recognize CAFOs. They used information collected by non-governmental organizations (NGOs) and publicly available satellite images and focused on seeking to identify swine and poultry operations, most of which are not required to have permits. The model was trained to analyze details that the regulators had been manually monitoring, such as shape of barns accompanied by dry manure storages. The scholars estimated that their invention could recognise 95 percent of CAFOs using fewer than 10 percent of the resources required to identify them manually.

Another group of researchers from Stanford focused on U.S. water regulations (the Clean Water Act), under which the U.S authorities supervise more than 300,000 facilities but are capable of inspecting less than 10 percent of those annually. The researchers developed a series of models (algorithms) to predict the likelihood of failing a water-pollution inspection. They used data from past inspections and facility characteristics, such as for example data on location, industry and inspection history to create a series of models. Then they launched the algorithms on all facilities (inspected or not). These models produced an assessment for every facility, determining the risk of failing an inspection. The researchers then analyzed four hypothetical inspection scenarios involving different difficulties – such as limited budgets and insufficient frequencies of environmental inspections and used the above risk assessment to establish the order of inspections priority and predict violations. Depending on the scenario, the researchers predicted from two to seven times the number of violations compared to the current state of affairs.

Practical advice for businesses

It is known that many types of AI technology are inaccurate in certain situations which are commonly referred to "adversarial examples". In the case of an adversarial example, an image which looks to a human as though it depicts a particular object is predicted to depict a different object by a trained neural network. The trained neural network otherwise appears to work well. Therefore decisions made by AI technology are open to challenge. It is easy to imagine satellite or drone images of the environment being processed wrongly by AI technology and predicting presence of an environmental law breach when none in fact exists.

Another point for businesses to bear in mind is that AI technology is relatively inexpensive as compared with the cost of a fine for an environmental breach. Businesses can consider investing in AI technology for carrying out their own environmental audits; or perhaps buying the services of an AI technology environmental audit.

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