EDITORIAL

In recent issues, we have used this page to express our concerns about the way both environmental concepts and activists are being manipulated by current political actors, and the need to return to an approach that relies on careful, defensible and transparent scientific work in collecting relevant data, as well as applying an equal level of care and defensibility in our analysis. We have also called for giving greater attention to the loss of existing, proven protective measures and legislation, sometimes in the name of generic action like "action on climate change", without adoption, continuation or replacement measures to prevent our former achievements in cleaning up the air, water and lands from falling back to prior conditions.

Today's editorial, however, looks at a more hopeful development, which may point the way to achieve some of those goals. It arises from consideration of a report by mathematician and Member of the French Parliament, Cédric Villani, entitled, *For a Meaningful Artificial Intelligence: Towards a French and European Strategy* (online at https://www.aiforhumanity.fr/pdfs/MissionVillani_Report_ENG-VF.pdf). Villani sets out ways in which artificial intelligence (AI) can make governmental action more effective, in general, but in Part 4, goes on to discuss how AI can "help create a more ecological economy".

When analysing the challenges of modern environmental action, it does not take long to realise that a key obstacle is lack of accurate, appropriate data. Examination of recent analytical studies indicates that a very large number of them appear to be based on data compiled in one of four ways:

- Reliance on data collected and collated by some other person or government agency;
- Collection of published data from other studies;
- Collation of responses to online surveys; and
- Electronic searches for particular language in articles, speeches or presentations (often used to support a statement that "X percent of experts in the field agree that….").

As available funding for research has diminished, "desk studies" based on information obtained in these ways is perceived to be the economically feasible option. Moreover, current environmental attention is globally focused – a kind of issue that cannot be approached using the empirical approach. Up to the point where it lost funding, environmental data collection was limited – "study areas" or a focus issue was chosen in which data was collected and that data was used to inductively suggest scientific conclusions regarding other areas or issues as well. The scientific validity of the results was normally dependent on the selection of the study area, the manner in which data were collected, the consistency of that process and the validity of the interpretation/analytical process. This inductive reasoning approach has proven to be remarkably ineffective at both predictions and analysis at a global scale. Consequently, some commentators have criticised international environmental actions after CITES and the Montreal Protocol as "a costly process for negotiating a global letter to St Nicholas" – a listing of the issues that all signatories promise to care about and act upon, with no specifics. Such criticism is not deserved since the specifics of environmental challenges, as well as the specifics of the means of combatting them, vary from village to village, not to mention from country to country.

All of this leads to Part 4 of Villani's report on AI's potential contribution to action to protect and repair the global environment. Although it will still require careful design of the data collection and analysis processes, the use of AI's immensely greater capacity will enable environmental researchers to operate at all levels up to global – to obtain data on a broad scale, to detect and explain inconsistencies more rationally and check those explanations against an enormous volume of data from around the world – to "help us understand the dynamics and the evolution of whole ecosystems by focusing on their biological complexity". If coupled with a return to transparency and replicability as priorities in scientific analysis and reporting, the broad use of AI in collating and confirming research results could provide a major step towards both understanding and consensus, not only in global negotiations, but on the political level as well – returning to an era in which particular problems are recognised by all, so that the political argument is whether and how to address them, rather than whether the problem exists. Environmental concern can return to being a province of the informed mind, rather than a public relations issue to be twisted to make even those most opposed to environmental action appear to be good friends with Gaia herself.

Legal and policy issues regarding AI abound. First among these is the question of access to data. The existence of AI, and of its development of the ability to contribute to environmental protection and clean-up, does not ensure that the necessary huge volume of data will be collected, that data collection will be consistent, or that the data will be available to the AI researcher. Absent a massive investment in data collection, AI's promise in the environmental arena

depends on access to (and the transparency/comparability of) the large volume of data being collected around the world. Recognition of the value of their data has caused many data collection systems to seek to control such access.

Another aspect of "big data" that is being discussed with regard to the environmental field is that of global/satellite information. As Villani noted, GPS and GIS systems have long been used (and expanded use long discussed) in monitoring environmental factors from air pollution to tracking herds of protected species and identifying hunters and fishing vessels poised to capture or kill them illegally. Villani also mentions "reforestation using drones [and] the mapping of living species using new possibilities furnished by image recognition".

The prospects for AI as a force for environmental protection and restoration in the Anthropocene Era are currently perceived in their extreme and most positive view:

> *Developments in AI could result in the emergence of new ways to maintain and protect the natural environment, both on land and at sea; from autonomous robots that can remove invasive species of starfish to intelligent fences that can divert fauna so as to preserve them – there are a great number of possibilities for the development of new, more adaptable and respectful ways to interact with nature.*

There are also, of course, potential risks. While few postulate the 1960s science fiction image in which computers take over the world and effectively enslave humanity, Villani notes a more recently recognised risk – further increase in dependence on (or as some would call it "addiction to") computers and other data and analytical devices. As Villani describes it, this is "a well-known paradox concerning optimization: gains in energy saving and new possibilities in terms of consumption need to be offset against the fact that AI may result in various rebound effects". He notes that such an effect may partially or completely outweigh the expected savings in energy or resources: "AI may prevent us from rethinking our patterns of growth and consumption and change how we measure output, but at the same time result in consumption being at least as great, if not greater, than it was before". An easy example is the modern trends toward solar power and electric automotive transportation – clearly a way to minimise contributions to air pollution, but with unknown implications on other factors and how they will impact the environment (not to mention global politics and national economies). One of these relates to the fact that these technologies currently are placing an increased demand on very rare and, at best, partially recyclable rare-earth elements, which are already in short supply, and are mined in environmentally damaging ways.

The potential cascade impacts are myriad, and difficult or impossible (even with better AI capabilities) to predict. Villani offers the example in which "the savings made on a heating bill may be reinvested in another product or activity which then adds to energy consumption". In addition, he notes in detail the optimisation paradox that has already become apparent:

> *Two years ago, the American Association of Semi-Conductor Manufacturers predicted that by 2040, the global demand for data storage capacity, which grows at the pace of the progress of AI, will exceed the available world production of silicon. Furthermore, by 2040 the energy required for computation will equally have exceeded world energy production; the progress of the block chain may also cause our energy requirements to rocket…. At a time when global warming is a scientific certainty, it is no longer possible to pursue technological and societal developments if those are completely detached from the need to preserve our environment.*

He even applies two predictive models. First,

> *Digital energy consumption increases by 8.5% per year and its contribution to world electricity consumption (which is growing by 2% per year) could reach 20% (moderate scenario) or even 50% (pessimistic scenario) by 2030, and therefore be multiplied 10-fold in 20 years' time. Given the global energy mix, the digital contribution to greenhouse gas emissions will thus increase from 2.5% in 2015 to 5% in 2020.*

He goes on to state that "By 2040 the energy required for computation will equally have exceeded world energy production". His paper goes on to note ways in which his country could take the lead in promoting AI development, its standardisation and its employment to solve global environmental problems.

Over the past six months, *EPL* has been encouraged to put forward research results and opportunities relating to the environmental implications and prospects provided by AI. To do this, we need two new kinds of resources:

i. Submissions of articles and other writings on the interface of AI/big data on environmental policy and law; and
ii. Experts with sufficient professional understanding of these issues to review those articles for accuracy and publishability.

If you are able to help us in either of these ways, we look forward to hearing from you. Contact us via the IOS Press website at https://www.iospress.nl/contact/offices/.

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