How edge computing and AI technology can be used for EPR and auditing

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The path toward the circular economy is riddled with challenges. The greatest challenge of all, however, is the need to incentivize proper circular practices at the source. While great strides have been made in the past decades to reduce material waste and increase the efficiency of recycling, they do little to solve the problem at the source; the production of unsustainable products and packaging materials. If businesses and corporations continue to increase their production and usage of packaging, without any thought to the post-consumer phase of their product's lifecycle, the problem will continue to grow as the amount of material outstrips the capacity of recyclers.

Faced with this growing issue of increasing waste, many governments have attempted to implement new policies that shift greater responsibility for the post-consumer phase of certain goods back onto the producers of these products. Extended Producer Responsibility (EPR) is a policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products. Tasked with this responsibility, producers would be held responsible not only for ensuring that their products are properly recycled or disposed of, but also to design products that comply with the principles of the circular economy.

As with any other regulatory policy, however, EPR requires those involved to be consistently monitored to ensure compliance. This is where EPR faces obstacles; how do you track the ever-changing composition of packaging materials in recycling streams to ensure producers are reducing waste as much as they claim? Not only must the material be individually identified, but it must be tracked throughout its post-consumer lifecycle to ensure its ultimate destination is one of reuse. Even if such information can be found, how can such tracking be scaled up to handle the sheer volume of products in high-flow facilities such as municipal recycling?

Current best practices for such reporting rely on documentation, mass balances, and the occasional sample audit to determine that the management requirements of each waste program are being met by producers. These practices rely on the laborious task of measuring and weighing individual shipments or samples of material and recording the results. Unfortunately, there are many challenges with such an approach. Manual auditing is time-consuming and cumbersome. As materials must typically be separated into at most 70 separate categories, a large amount of time must be spent on assaying the typical 150-kilogram samples. Furthermore, there is no confirmation that these assayed samples are truly representative of the real composition within each facility.

Thankfully, technology can be utilized to lighten the burden of manual auditing, and even improve accuracy. Deep neural networks have begun to show amazing promise as a tool for identification and classification in a variety of fields; the waste industry is no exception. As such, some companies have already begun to utilize these deep learning technologies within the waste sector. While much focus has been placed on the use of AI for waste sortation, such fixation fails to consider the simpler and likely much more important use of AI for pure data collection and inference. For such tasks, all that is required is a single vision controller, lighting, and a camera. Such a vision system, relieved of the need for robotics, would require less sophisticated hardware and could be smaller, simpler, and far cheaper than all-in-one sorting systems.

Devices such as this, which employ computation and data storage near to the source of the data, are called edge computing. Edge computing improves response times, saves bandwidth, and promotes the capture and storage of data throughout processes. In conjunction with deep learning, edge computing could prove to be the ideal method of managing the immense reporting needs of EPR. Instead of manually assaying samples of material, edge devices utilizing neural networks could automatically scan material as it passes by a camera. Such material could then be classified by type, OEM manufacturer, or even individual products; the detail is limited only by the dataset utilized for training. Results could then either be saved to local storage, a company database, or even the cloud. Compared to manual auditing, such a process, performed continuously by edge devices, would allow for greater, more accurate information to be available in real time to processors, producers, auditors, and government regulators. Performance metrics could be further utilized to steer the direction of future regulation changes or highlight deficits and necessary improvements to current processes or methods.

As different EPR regulations begin to take effect in a variety of waste sectors, the need for a comprehensive and effective method of monitoring compliance becomes ever more important. Overall, AI and Edge computing together provide a cost-effective and straightforward method for more reliable monitoring in the waste sector. As technology continues to mature and more pressure is put on regulators, it is likely the adoption of such technology will continue to grow in the coming years.

An example of edge computing for EPR auditing is Neatco's recent addition to the IntelSolve family of products, IntelSight. IntelSight harnesses the strength of edge computing and deep neural networks to identify and classify a wide range of recyclable materials for both auditing and sorting purposes. IntelSight can even estimate the weight of each individual object and add the amount to the daily totals of each material category. To learn more about our IntelSolve family of products including IntelSort and IntelSight, please visit:

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