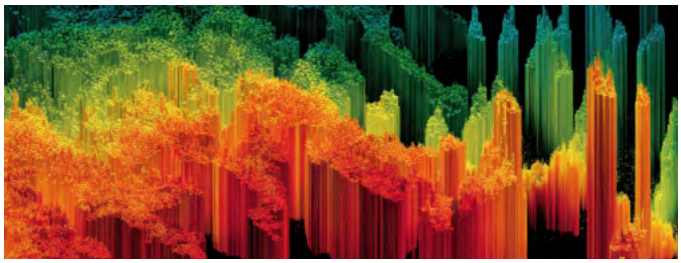
Using AI to Pinpoint and Predict Methane Leaks

Artificial intelligence (AI) has already transformed human society around the globe and businesses across multiple sectors. This still-developing technology is completely changing the way that we conceive, create, quantify and optimize all of the digital information on which our systems depend.

One of the many ways in which AI has revolutionized modern life is in its ability to identify patterns and make projections based on the instant computation, organization and analysis of almost unfathomably large data sets. This unique capacity has special significance for climate action, the success of which depends on our ability to process sizeable volumes of information about greenhouse gas emissions – at both the global and the local levels – with precision, accuracy and speed.

One of the greenhouse gases driving global climate change is methane (CH_4), which is 86 times more potent than carbon dioxide (CO_2) at warming the planet over the first 20 years of its entry into the atmosphere. The International Energy Agency (IEA) has estimated that methane is responsible for nearly 30% of the rise in global temperatures since the industrial revolution. Leakage from upstream and midstream oil and gas operations has historically been a major source of methane emissions, but – as the IEA has also noted – around 70% of methane emissions from this sector could be avoided using existing technologies, and at a relatively low cost to operators. This is one reason why so many experts believe that reducing methane emissions from oil and gas operations represents one of the fastest and most impactful ways of fighting climate change that we have at our immediate disposal.

AI-driven technologies are already being harnessed to analyze climate data, predict weather patterns, monitor air and water quality and track deforestation. But AI's capacity for synthesizing massive amounts of data and then making projections based on that data – both of which can be done in an instant – has made the technology especially attractive to those working in the field of methane mitigation. They and others believe that AI has the potential to dramatically improve the accuracy, efficiency and cost-effectiveness of leak detection, enabling proactive intervention, reducing environmental damage and enhancing the safety and reliability of energy infrastructure all at the same time.



APPLICATIONS FOR AI IN DETECTING METHANE LEAKAGE

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Oil and gas operators who employ a supervisory control and data acquisition (SCADA) system to monitor conditions at their facilities are continually receiving troves of actionable data collected by their system's meters, sensors and other equipment. By integrating AI into SCADA, operators can enhance their system's performance in a number of ways that include:

- **Real-time anomaly detection:** AI algorithms can sift through the data provided by SCADA systems and instantly detect aberrations from normal patterns, including aberrations that suggest new sources of methane leakage. Operators can be notified at the moment of detection, allowing them to take immediate action.

- **Predictive analytics:** By analyzing historical patterns in minute detail, AI can leverage this data to make predictions about when, how and under what circumstances a methane leak might occur. Algorithms can calculate the potential impact of weather conditions, wind, geology and other factors; armed with such knowledge, operators can undertake proactive maintenance measures. The technology can also fuse data across scales – from local to global – and identify correlations that make this predictive power even stronger.

- **Optimizing operations:** Relatedly, AI can identify patterns and trends that maximize efficiency and reduce production-related downtime.

- **Strengthening compliance and transparency:** AI can assist operators in finding the most accurate and up-to-date emissions data and reporting it to regulators, shareholders and/or the general public.

Beyond its ability to work closely with SCADA systems to identify issues or opportunities that can lead to reduced methane emissions, AI has the ability to help us find unplugged orphaned oil and gas wells that have been inoperative for many decades but continue to leak methane. Researchers are currently training AI models to identify symbols from nearly 200,000 historical topographic maps – some dating back to the 1880s – indicating the possible sites for thousands of wells that have been abandoned and long forgotten. By comparing the locations of these symbols with modern databases, AI can identify potential orphaned wells that don't appear in official records.

Satellites are increasingly being used by governments, environmental groups and businesses to measure methane plumes and concentrations from space. By applying AI deep learning models to the geographically sweeping, region-wide data collected by these satellites and combining it with the more granular data obtained via on-the-ground methods of detection, such as optical gas imaging cameras, these groups will be able to generate comprehensive and highly accurate emissions reports that were simply not possible to generate in the past.

Case Study: CleanConnect.ai

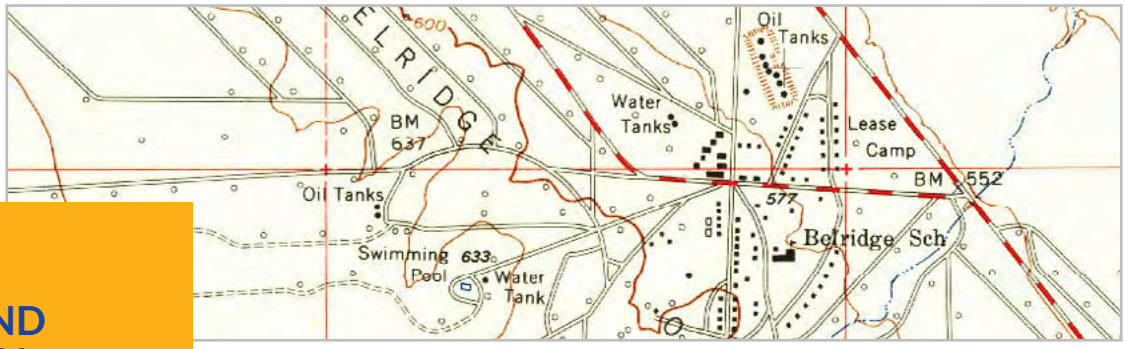
In helping oil and gas operators solve their methane-leakage problems, AI technology can go much further and actually create new – and profitable – opportunities.

CleanConnect.ai is a Colorado-based business that leverages AI to help its energy industry clients obtain the most accurate, empirically supported emissions data possible. Its automated visual inspection (AVI) system takes information collected by high-precision optical, thermal and acoustic sensors and processes it through an AI-powered complement that applies visual analytics and pattern recognition to identify leaks and other irregularities.

A few years ago, the company was approached by a client facing a consent decree from the U.S. Environmental Protection Agency for violations to the agency's storage tank emissions monitoring (STEM) system. Between fines and mitigation expenses, the client was anticipating more than $3 million in losses – and even the risk of shutdown if the consent decree wasn't satisfied.

CleanConnect.ai worked with the client to install a connected suite of technologies, including its then-brand-new signature optical gas imaging camera, that could detect leakage from storage tanks and other equipment at the facility but could also address a number of other safety- and emissions-related issues at the same time. The automated, comprehensive aspect of these combined technologies effectively turned the system into a "virtual operator" that was on call 24/7.

The application of AI to the AVI system boosted the capacities of these technologies to such a degree that the client was not only able to meet the terms of the consent decree, but also save $8 million in costs associated with leak detection and repair (LDAR) and the need for night operators. When the time came for the client to compete with three other energy companies for a thousand permits worth more than $1 billion, state regulators awarded the bid to CleanConnect.ai's client, whose system for detection and mitigation stood head and shoulders above those of its competitors.



PROMISE AND PROTECTION

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Just as it's doing across multiple other sectors, AI is revolutionizing the way that the oil and gas industry collects, organizes and analyzes data. This technology's specialized capacities for pattern recognition and deep learning make it especially useful in strategies for mitigating methane emissions – not just from today's operational wells and related infrastructure, but also from older, abandoned equipment that no longer produces but still releases fugitive methane in large quantities.

As this technology develops even further, oil and gas operators will want to take full advantage of its special capabilities. By integrating AI into the quantification and interpretation of methane emissions data, these operators will be able to act informedly – and much more quickly – to keep this highly potent greenhouse gas out of the air. Chubb works closely with clients in the oil and gas sector to help them reduce methane leaks from their operations, improve their efficiency and lower their operational risks. As part of this mission, we have established the multimedia Chubb Methane Resource Hub to share with these clients and others the most up-to-date information on methane mitigation strategies, including information on which emerging technologies show the most promise for tackling our global methane emissions problem.

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