Remote Sensing Technology and Artificial Intelligence for Utility Vegetation Management: A Regulatory Perspective Sprouting from a Pilot Study

Tulane University LAW SCHOOL

Providing unbiased research and guidance to assist in the setting and establishment of wise and well-reasoned laws, regulations, policy and practices at the intersection of the built and natural environments is part of the mission of Tulane University Law School's Utility Vegetation Management Initiative (UVMI). A recent pilot study conducted by the UVMI has indicated that satellite-driven remote sensing technology is valuable in amplifying human inspection for tree and power line conflicts.

Introduction

About a century ago, the United States embarked upon one of the most ambitious public works projects ever conceived – the provision of electric power to every home, business and government installation in the country. The work involved unprecedented land clearing activities to make way for the new utility infrastructure that was to transform the American way of life. By and large, these efforts, together with those that followed, were successful in delivering a system of electric power that enabled nearly everyone in the country to have access to electricity. The utility companies that operated and maintained this system were charged with providing safe and reliable power at a reasonable cost, and regulators were installed at both the federal and state levels to ensure that the utilities met this mandate. That mandate remains intact and unchanged to the present day. Safe and reliable power is critical to the functioning of modern society, but the ability to provide it is under constant threat.

The Scope of the Challenge

As we prepare to energize the next hundred years of growth, it must be recognized that competing vegetation has grown to become the single largest threat to utility infrastructure, and even to electric utilities themselves, as well as their officers and directors. Tree and power line conflicts are responsible for as much as 70-80% of all outages nationwide, and are one of the main causes of some of the most destructive wildfires in our nation's history. Vegetation and utility conflicts are also a significant cause of death and severe injuries to tree workers, utility line workers, and ordinary people, including children. These deaths, injuries, outages and wildfires have been responsible for substantial human misery as well as hundreds of billions of dollars of damage and lost economic productivity each and every year.

Utility Vegetation Management (UVM) programs are mandated by utility regulators in order to improve reliability and safety of electric service to the public by addressing incompatible vegetation. But with over 5.5 million miles of electric distribution lines crisscrossing the United States, largely through wooded areas that create exposure to an estimated hundred billion trees or more, UVM inspections for potential tree and power line conflicts are a costly, time-consuming, and error-fraught endeavor. The best strategy currently widely employed to attempt to avoid catastrophic incidents is to rely heavily on inspections aimed at detecting problematic trees and to thereafter address those challenges as swiftly as possible through either tree modification or removal work in accordance with ANSI A300 standards and/or through engineering controls.

Remote Sensing

Strategies and technologies that have the potential to amplify the current inspection and observation practices and reduce or eliminate human error should be deployed in order to eliminate tree and power line conflicts. If proven viable, such technology clearly has a place in wise UVM policies and practices.Several companies have suggested that remote sensing technology could be exploited for its potential to amplify the results produced by human observation. Satellite data is but one form of remote sensing information that has potential for use in detecting tree and power line conflicts. Today, there are thousands of satellites in orbit around the earth that take imagery of nearly every square inch of the planet's land mass; companies purchase the data produced by satellites, and use their own proprietary AI-driven technology to interpret this data to detect tree and power line conflicts and predict the severity of such conflicts so as to assist utilities in directing corrective and efficient UVM actions.

Some utilities have been quick adopters of this technology while others remain skeptical. Regulators often have utilities from both camps within their jurisdiction and are presented with a quandary as to how to proceed. Regulators have an obligation to ensure that utilities are taking appropriate steps to protect against tree and power line conflicts, but also have a responsibility to make sure that rate payers are not charged for "gold plated" programs.

Pilot Study

The UVMI conducted an independent, unbiased pilot field study on the use of satellite technology to determine the effectiveness of satellite technology in improving data accuracy and decision-making for UVM. The results of his pilot, proof-of-principle field study are presented in a report that is now ready for publication.

We identified a test plot within the Southeastern United States that covered approximately 70 square miles. That test plot contained 54.3 line miles of distribution line made up of 1076 spans. AiDash provided analysis as to the threat level at each span, as well as a factor relating to efficient work:

- The predicted growth direction of the vegetation
- The predicted clearance
- The predicted density of the vegetation
- The predicted equipment that would be needed to address the vegetation threat

We then turned this predictive analysis over to a team of arborists who were tasked to do the following

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1. Determine whether the satellite analysis was correct or incorrect with respect to each factor
2. If the satellite risk analysis was correct, determine whether it would have been detected on any (or all) of the following:
   a. A Level 1 Driving Inspection
   b. A Level 1 Walking Inspection
   c. A Level 2 Zig-Zag Walking Inspection
   d. A Level 3 360° Walk-Around Inspection
3. Report on the forest cover type

Statistical Findings

The results of this pilot study strongly support adoption of satellite analysis as a strategy to reduce outages and wildfires and to prevent electrocutions and related injuries. Highlights from the data produced showed as follows:

- The satellite accuracy was **97%** with regard to side growth, the most common form of encroachment within the study area, which made up over 80% of the spans;
- The satellite accuracy was **95%** in identifying spans that were 10' or more from the centerline of the conductors, a critical factor in UVM work planning;
- The satellite accuracy was **95%** or better with respect to vegetation density, another critical factor in UVM work planning; and
- The satellite accuracy was **97%** accurate when recommending the form of intervention as requiring the use of a bucket truck or mechanical trimming.

Critical Impact

These accuracy ratings are certainly impressive, but the most significant takeaway from this pilot study was not the accuracy of the technology with respect to these particular items, but was instead with regard to the ability of the technology to detect tree and powerline conflicts that would have been missed by humans – even highly skilled arborists – acting without the benefit of the technology.

With respect to the question of whether arborists would have found these tree and powerline conflicts during a standard inspection, **in *55* cases the answer was no**. What this means is that the satellite found *55* situations which posed a dangerous conflict that human inspectors would not have seen during a standard Level 1 Driving Inspection: an average of approximately one such potential disaster-in-the-making for every mile of distribution line inspected. **Even more critically**, in one case the arborist determined that the conflict would not have been found at **any** level of standard inspection, including a Level 3 360° walk-around.

Recommendation to Regulators

Assuming similar results can be replicated in future studies, an extremely strong case exists for regulators to mandate the use of AI-supported remote sensing as a strategy for ensuring the safe and reliable delivery of energy, and that the use of satellite analysis should form part of wise UVM strategy in this regard.

Indeed, on the strength of this pilot, regulators should initiate the regulatory process now.

About the Tulane UVMI

Founded in 2020, the UVMI's mission is to serve as the world's preeminent center for the understanding, development, and improvement of law, policy, and practice of utility vegetation management in order to promote the creation of safe and environmentally sound co-existence among people, infrastructure, and the natural environment while also ensuring safe and reliable delivery of energy and other utilities.

The UVMI is led by Director Lawrence J. Kahn.With prior civilian work for the U.S. Army with oversight of the hazard tree removal program, management of Army timber, flora and fauna resources, and protection of Army air, water and land resources, he thereafter received his B.A. from Columbia University in 1992 and his J.D. from Tulane University Law School in 1995. After nearly twenty years practicing law in New York City with an emphasis on litigation, he thereafter became an entrepreneur and an educator. He has helped to found companies in California's green industry and co-founded and developed the UVMI. He is an active member of the UAA and the ISA. He is a frequent guest on The UVM Podcast and is the author or co-author of over 35 scholarly articles and publications.

Prof. Lawrence J. Kahn
Director,UVMI

Professor Kahn's work on this pilot study and paper was greatly assisted by co-authors David Anderson, Ph.D., Associate Professor of Mathematics at Xavier University of Louisiana, and Jacob Roschmann, a 2023 J.D. candidate at Tulane Law School who holds a B.S. degree in Civil Engineering.This research work was supported by an unrestricted gift to the UVMI from AiDash, a SaaS business that provides vegetation management and other satellite- and AI-powered solutions to help utilities make more informed decisions. The arborist work of Plank Road Forestry, who performed the field test, was also critical to the study.