Changes in the Geospatial Industry Will Transform Broadband

Augmented reality, reality capture, computer vision, and machine learning will automate data capture of physical broadband infrastructure for service providers.

By Peter Batty / *IQGeo*

The beginning of a new year is always a good time to look ahead at what might be in the future. I have worked in the geospatial industry for 34 years, and think more dramatic changes will occur in the next few years than have in the past 34. In particular, I believe that a number of emerging technologies will transform the way people capture and maintain data about the world, shifting from manual processes to fully automated ones. These include augmented reality (AR), reality capture, computer vision, and machine learning (ML). There is some overlap between these areas.

These changes will lead to communications companies having hugely improved data quality and currency in their network asset records, which is critical for many aspects of the digital transformation initiatives happening in the industry.

FIELDSOURCING TO SOLVE THE DATA MAINTENANCE PROBLEM

A longstanding challenge for communications companies has been how to keep geospatial network asset data up to date as networks are extended and maintained. Currently, it can take weeks if not months for "as-built" changes to make their way back into the enterprise system of record, typically a geographic information system (GIS). There are many business reasons inaccurate and out-of-date information on network infrastructure is unacceptable, including issues related to network reliability, customer service, time to market and safety.

The only viable solution is crowdsourcing, or what people sometimes call fieldsourcing: having the people who make changes to networks record what they change when they do it. Existing mobile solutions can enable workers in the field to capture data about network asset data updates. However, new technologies make this data capture process much more automated, simpler and faster, which leads to broader adoption in a wider range of situations.

SELF-DRIVING CARS

William Gibson, the author of the science-fiction novel "Neuromancer," in which he coined the term "cyberspace," once said, "The future is already here – it's just not evenly distributed." This applies very well to the technologies I mentioned. They are already being applied in a range of different industries but have not yet made a significant impact on geospatial applications for communications companies.

One particular market really advancing the state of the art in automatic recognition is self-driving cars. A video from Tesla (https://bit.ly/3sYjEPy) shows how a car recognizes, and accurately locates, a wide range of features in the physical world. In the space of a fraction of a second, it identifies street signs, traffic lights, moving cars, people, curb lines, lane markings and more. This is almost all done using just

A video from Tesla shows how a car recognizes, and accurately locates, a wide range of features in the physical world. The same technology could be used in the broadband industry.

cameras. Clearly, these same principles could be applied to capture data about infrastructure, such as poles, manholes, cabinets and more.

In another Tesla video (https://bit.ly/3a4O1eA), Andrej Karpathy talks about the company's "fleet of cars." Unlike cars from most other manufacturers, all Tesla cars are permanently online and communicate information back to Tesla. Karpathy explains that Tesla has about 1 million cars on the road that play an integral role in the company's software development and testing process by capturing data and testing new algorithms in the background as they drive around. This all happens without any involvement from drivers. Trucks and field workers could play a similar role across the workforce in infrastructure companies.

Another fascinating element of the video is the extent to which Tesla uses machine learning in its self-driving software. The initial focus for using ML was recognizing the features in the environment around the cars, but Tesla also has massive amounts of recorded data on how drivers interact with the pedals and steering wheel in different situations, and now it applies ML by using that data to decide what a car should do in any given situation. For these complex problems, ML is rapidly taking over from traditional software development.

This has applicability to other various areas within broadband infrastructure, including data capture and automated design.

REALITY CAPTURE

A general term for the idea of automatically capturing data about the real world is reality capture. A wide range of devices can be used for different types of reality capture:

- Stationary LiDAR scanner ($15,000)
- Vehicle-mounted LiDARs and 360-degree cameras
- Any vehicle
- Drone (UAV)
- Consumer 360-degree camera
- Action camera
- Smartphone
- AR glasses/headsets

Some are more specialized and expensive; others are relatively inexpensive and widely available. The latter is most relevant to the idea of fieldsourcing for data maintenance. Devices must be practical for all field workers to carry with them (or must be devices they already carry, such as smartphones). Cameras alone can capture a lot of information, but an interesting development is that the newest high-end iPhones and iPads contain LiDAR scanners, which can help capture three-dimensional models of the real world more quickly and accurately.

MACHINE LEARNING

An important technology related to reality capture is ML, as I have already mentioned. This is applicable in multiple areas, but it is already quite mature and easily usable in image recognition applications.

For example, Amazon's Rekognition service can digitally identify detailed characteristics of a photo, such as a person, a mountain bike, the presence of rock and the outdoor surroundings to a high degree of accuracy (>80 percent). Microsoft, Google, Apple,

> Technologies such as AR and ML will significantly improve data quality of broadband infrastructure, including poles, manholes, cabinets and more.

IBM and many other companies offer similar services. These algorithms can be easily trained to recognize objects in a particular domain, such as poles, cabinets, manholes and more. Recognition of text, barcodes and QR codes is also now a commoditized capability. All these technologies are very useful in automated data capture.

AUGMENTED REALITY

Augmented reality capabilities continue to advance. Another video (https://bit.ly/3cdm9rm) shows some examples of how the addition of LiDAR scanners to high-end iPhones and iPads enables more advanced AR applications. Ikea and Shapr3D use AR for design (see https://bit.ly/39pm2HC), and both have obvious parallels with design creation for infrastructure companies. Feature recognition is part of the process.

Currently, AR works best indoors over relatively small spatial areas. Up to this point, outdoor AR applications over larger areas have mainly focused on using GPS together with orientation sensors, but this approach has intrinsic limitations in terms of accuracy. Using accurate point clouds to locate objects is a much more precise approach and a current area of major focus for many large companies, including Google, Apple, Niantic and others. The idea of building an accurate point cloud of the whole world as a foundation for AR and other applications is generally known as the AR cloud.

It will be a few years before this vision is fully delivered, but when it is, it will dramatically improve the accuracy with which people can calculate locations of items in the real world. Elements of this concept are usable now, such as measuring distances between nearby objects with greater accuracy than is possible with GPS.

IMPACT ON BROADBAND INFRASTRUCTURE COMPANIES

These technologies will dramatically change the nature of geospatial applications in infrastructure companies by significantly improving data quality regarding the physical infrastructure, keeping it up to date in near real time as changes are made in the field. Data capture will transition from a largely manual process to a fully automated one, using a variety of sensors.

Both ML and AR will begin to play major roles in design. This, in turn, will mean that manual editing of GIS data will become largely obsolete. AR and virtual reality will be commonly used for the visualization of geospatial data. However, two-dimensional maps won't become obsolete because they are still a useful abstraction for communicating many types of information.

Overall, these technologies mean that the vision of a "digital twin" is much closer to reality: the ability to maintain accurate and up-to-date digital copies of real-world networks can be a foundation for the digital transformation of business. ❖

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