

## **Is Artificial Intelligence used in fiber network design?**

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### **For the Fiber Optic Association**

With recent artificial intelligence (AI) platforms, such as ChatGPT, the general public is quickly discovering that AI isn't something out of science fiction, but rather closer to us than most people were aware of. It is now being used to boost digital productivity applications, drive driverless vehicles, power next-generation smartphones, and enable home automation. AI applications for everyday users are plentiful. However, some in the fiber optic community wonder, "how is AI driving innovation and supporting everyday tasks for telecom workers?" While there are numerous AI-supported systems and jobs in telecommunications, this article will focus on fiber optic network design, leading us to the question: "Is AI used in fiber network design?"

The short answer to that question is a resounding yes. But before we delve into the details, let's demystify "what is AI?" For that, let's ask an AI language model to define it for us:

My prompt: "In simple terms, what is AI?"

ChatGPT: "AI, short for Artificial Intelligence, refers to the development of computer systems and programs that have the ability to perform tasks typically requiring human intelligence. It involves the creation of algorithms and models that enable machines to learn from data, recognize patterns, make decisions, and solve problems. AI encompasses various subfields, including machine learning, natural language processing, computer vision, and robotics."

As noted in the response given by ChatGPT, machine learning is one of the foundations of AI. Machine learning refers to a computer's ability to gather and "learn" data, which involves organizing and indexing data for access, analysis, regression analysis-based pattern recognition, predictive insights, and knowledge development for decision-making. In essence, this is how AI works – automated knowledge management at its core. From this perspective, it becomes apparent that most common digital and cloud-based devices are constantly learning by gathering information that can be transformed into knowledge. This is essentially what AI is in its most fundamental form.

Machine learning and algorithms are used to program computing devices to make decisions and perform tasks based on data. This is why data has become highly valuable, especially for big-tech companies. However, it's important to note that machine learning and AI are not new concepts. While recent powerful AI language models like ChatGPT and Bard have made AI a buzzword in the headlines, these technologies have been around for many years and even decades. What has changed is that we now have greater access to AI technology through cloud-based applications and faster broadband internet than we had a decade ago. Additionally, the ability to gather more detailed data from users has exponentially increased, enhancing machine learning and decision-making capabilities. As a result, AI can power chatbots to produce human-like conversations and replicate the performance of tasks that knowledge workers, including fiber optic network designers, used to perform manually using human intelligence.

If all this holds true, then by the same logic, machines can gather historical data on fiber optic network designs, learn patterns, and use regression models to predict and plan things like fiber routes and network elements based on known topologies, geographical or other spatial

information. They can also configure these elements for optimal network performance while applying naming conventions to support operations and business support systems, network inventory, and other administration systems.

The key to making this work is having reliable and confirmed data, which isn't always readily available. Despite the availability of commercially available automated design software using AI, these are typically used only for high-level designs or desk designs, which are based on available, often unconfirmed, information. Unless designers have recently confirmed data, high-level designs almost always require field audits to gather geo-referenced information and photographic records. This data is then processed through software to generate spatial representations of designs and planned networks.

It's important to emphasize that the reliability and accuracy of fiber network designs, whether generated by software or humans, depend on the quality of the data they use. However, if reliable data is available, AI or machine-generated designs are likely to outperform humans due to factors such as information processing and regression modeling capacity, as well as the near absence of bias (unless embedded in the software by the programmer). Mainstream articles claim that AI can make fiber network design over 80% more efficient than human network designs and can produce highly accurate high-level network designs within seconds, including predictions of bill of materials and other planning information.

However, it's important to note that absolute trust in these designs may not be recommended yet. Remember that the key factor is "visually confirmed" information and prompts, which almost always require of human-performed site surveys and intervention.

Regarding the question of which companies offer machine-based or AI fiber network design, one popular company is Biarri Networks, headquartered in Australia, with offices in Colorado, US. Since over a decade ago, Biarri Networks has been developing proprietary algorithms to process data for problem-solving and predictive insights to support automated fiber network planning and design ([biarri.com](http://biarri.com)). Like Biarri, there are several other companies that have been deploying similar platforms with automated fiber network design software for years with various capabilities.

Now, let's address the question of whether AI can be used for gathering the data needed to automate fiber network design. The answer, once again, is yes. Various methods have been used over the years for automated data gathering, such as robots reconnaissance, vehicle-mounted cameras with data analytics, and aerial surveys with drones. Some of these technologies can be used to generate automated designs with high confidence and minimal deviations. For example, in the fiber industry, there are technologies like beyond visual line of sight (BVLOS), which employ drones for routine inspections and initial deployment for visual inspection of locations with suspected outage-generating events. These systems are automated, and when they detect a loss of signal using fiber sensing and OTDR technology, they deploy drones with GPS for visual inspection of the site before humans can arrive. Similar technology is used for surveys, where drones gather geo-referenced visual information that is used for fiber network designs.

So, in conclusion, the answer to the question "is AI used in fiber network design?" is a definite "absolutely!" AI not only performs machine-generated fiber network designs but does so exponentially faster and more efficiently than humans. However, it's important to note that AI's accuracy and precision rely on the informational context, data inputs, and prompts, all of which require human intervention. While AI may not be taking our jobs soon, as the systems gather more data and learn, they will improve their capabilities in fiber network design and other knowledge-based roles in the industry, so keep learning and stay ahead!

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