CUTTING INTELLIGENCE

The use of AI in mapping and polishing diamonds has already improved the process. What else does this technology have in store?

By Isabella Yan

The diamond-manufacturing industry has made significant strides in integrating artificial intelligence (AI) into scanning, planning, polishing, quality control, and other elements of the process. Through advanced algorithms and machine learning, AI analyzes the characteristics of each natural diamond to minimize material loss and maximize brilliance. This has lowered costs and improved consistency and precision. How much further can the industry push the boundaries of innovation?

EVER-EVOLVING MACHINES

Synova, a Swiss company that specializes in diamond-manufacturing equipment, is known for its expertise in laser-cutting technology. In 2020, it launched the DaVinci system, capable of cutting 57 facets of a round brilliant diamond in a single automated operation. Synova doesn't map the stones itself; instead, it utilizes files from leading third-party diamond-planning providers like Sarine Technologies, Lexus, or Octonus.

AI is set to play a larger role in Synova's cutting and shaping machines, according to Jörg Pausch, head of the company's diamond business. "Our processes [at Synova] are currently based on [pre]determined software routines. We are currently developing our premium product, the DaVinci Diamond Factory, to integrate various sensors for collecting specific processing data."

The company plans to use this data in machine-learning algorithms so it can adapt the manufacturing process in real time, he explains. "Today, the operators of our laser [sawing] machines observe the cut results of the diamond only after the machine has completed the process. We anticipate a future where adjustments to process parameters will occur during the process itself, leading to optimized results." There are also plans to incorporate traceability and blockchain processes, he adds.

For its part, Sarine released the Advisor diamond-mapping system in 1995 as the first automated planning software for diamonds. The company's AI-driven analytics and planning tools have since enabled manufacturers to optimize the entire production process.

At manufacturer Kiran Gems, meanwhile, AI-based software has achieved a 90% precision rate for polishing melee goods. "This technology facilitates more effective planning of rough purchases and polished inventory, allowing us to allocate the right materials to the right individuals for optimal results," says company vice president Varun Lakhani, who anticipates that the accuracy rate will reach 100% once the program gains enough data.

NO REPLACEMENT FOR HUMANS

Diamond manufacturing is still a very traditional process, admits Pausch, noting that the industry still widely employs small, decentralized manual

or semi-automated units. "In some locations, traditional blade saws, rather than lasers, are still utilized for cutting diamonds. Consequently, the adoption of AI in the diamond industry appears to be in its nascent stages, and it may take some time before the industry transitions to less manual and more automated processes."

For Shreyans Dholakia, brand custodian of Shree Ramkrishna Exports (SRK), the human tactile element remains crucial. "Humans are skilled at sensing the diamond's movement on the wheel, which is essential to achieving the desired outcome," he says. "This hands-on skill, performed by our master craftsmen, plays a vital role in ensuring precision and quality."

Embracing AI cannot come at the cost of disregarding the invaluable knowledge passed down through generations of craftsmen, he stresses. "AI is a supporting tool in the overall process, not the enabler, which means that with the help of AI, we can make certain decisions faster and more accurately. But AI cannot do everything. There is still a long way to go before AI could think like humans with multiple senses."

THE BIG PICTURE

Dholakia believes further advancements in AI will make the future of diamond cutting more efficient, precise and sustainable. "AI-driven systems will continue to streamline processes, minimize waste, and optimize resource utilization. Better prediction for rough-diamond planning can be achieved through precise resource allocation, ensuring the right cutter." Studying factors such as diamond breakage can also help improve processes, he adds.

For Romy Gakh-Baram, Sarine's director of global marketing and brand, the potential for further AI innovation lies in the automated-grading field. "Our AI-based grading systems Sarine Color and Sarine Clarity mimic the activity of a human grader, yet with far more accuracy, consistency and efficiency. Automated grading uses machine learning to assess the grading results of tens of thousands of diamonds to arrive confidently at its color and clarity grades."

GETTING MORE COMPLEX

For all its advantages, integrating AI into diamond cutting has come with challenges, primarily due to the distinct characteristics of each natural diamond. At present, manufacturers use AI mostly for planning and mapping melee diamonds, but Lakhani anticipates a transition to large sizes in the future.

"Designing algorithms that can effectively process and interpret the vast amount of data generated during the diamond-cutting process is complex," comments Gakh-Baram.

To address these challenges, Sarine has collaborated with diamond manufacturers and industry partners to gather and annotate large datasets of diamond images and cutting parameters. By leveraging advanced machine-learning techniques like deep learning and reinforcement learning, Sarine has developed more accurate algorithms that can handle the complexity of diamond characteristics.

On the whole, says Dholakia, "AI-enabled predictive analytics will facilitate proactive decision-making, leading to improved product quality and reduced operational costs." ⦿
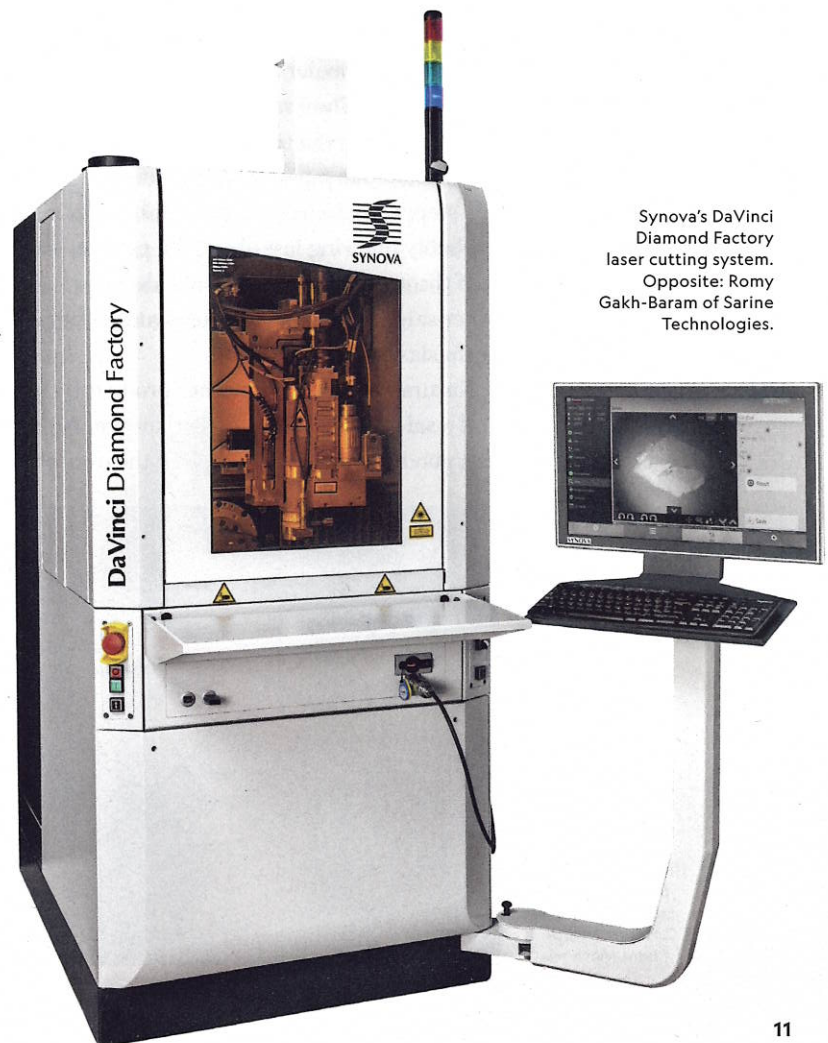
Synova's DaVinci Diamond Factory laser cutting system. Opposite: Romy Gakh-Baram of Sarine Technologies.