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Member Success Case Study | Written By: Audrey Woods

Computer Vision and Machine Learning: Rapid, Accurate, and Scalable . VCJ™ Technology

Inkbit 3D printing offers enormous promise in many industry areas, from aerospace to fashion to medicine to robotics. Faster, cheaper, and more flexible than traditional manufacturing methods, 3D printing has been touted as a potential solution to supply chain issues, a way to increase sustainability, and is projected to become a huge market in the coming years. However, until recently the technology was only reliable as a means to make prototypes, not yet capable of the quality throughput needed for volume production.

MIT spinoff and CSAIL Alliances Startup Connect member Inkbit aims to change that by offering a 3D printer that combines computer vision and machine learning for a rapid, accurate, and scalable industry solution.

Inkbit began in the lab of CSAIL Professor Wojciech Matusik, who studies computational fabrication along with other research interests like computer vision, graphics, and human-computer interaction. In 2015, he was one of a group of researchers who built a relatively low-cost 3D printer that tackled some of the main issues at the time, including printing with multiple materials, embedding complex components like circuits, and, most relevantly, the ability to self-calibrate based on a computer vision system watching the printing process and making corrections in real time. The central idea was to develop a "printer with a set of eyes," adding artificial intelligence to the process of 3D printing.

Improving upon that first iteration, Professor Matusik — along with fellow co-founder Javier Ramos and other Inkbit collaborators—developed a custom optical coherence tomography (OCT) scanner which could visualize materials at the width of a human hair and was 100 times faster than anything available at the time, giving the printer vision-based feedback control at a commercially viable speed. Using this technology, they developed a prototype that was the foundation for the company's launch in 2017. After receiving early funding from DARPA, NSF, IMA, and Johnson & Johnson, Inkbit set up an office in a Kendall Square incubator and later moved to Medford, MA the same year.

CEO Davide Marini describes their funding process as "unconventional," saying, "instead of going for the traditional venture capital funding strategy, I chose to raise money from corporations and strategic investors because they gave us an understanding of the market and they could potentially become our customers." This strategy helped them gain support from leaders in the 3D printing industry like Stratasys and DSM, as well as 3M, Saint Gobain, and Ocado. In 2021 they launched their keystone product Inkbit Vista, which merged their technical innovations into a complete Additive Manufacturing System. A year later, they began shipping machines out for customer use.

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When asked what makes Inkbit unique, Dr. Marini answers that they are differentiated by the "multidisciplinary nature of their technology." He says, "we want to offer our customers a seamless solution for enabling faster product innovation comprising software, hardware, and materials as a cohesive additive manufacturing system that scales from prototyping to production. At Inkbit we have chemists, engineers and software developers working together, which creates a very vibrant atmosphere." Due to their approach, Inkbit's large and multi-material machines can support a wide range of products with high accuracy and precision, which Dr. Marini believes could "disrupt nearly every industry."

One of the most pivotal moments in the early development of the company, according to Dr. Marini, was during a CSAIL Alliances event when their presentation caught the interest of British grocery shipper Ocado. He describes how Ocado was intrigued by Inkbit's technology and requested a site visit. "Within 48 hours they decided to invest in us," Dr. Marini says, which initiated not only a thriving business relationship but also an exciting use case for the technology.

To ship groceries quickly and affordably, Ocado uses warehouses full of robots which run along tracks in a grid formation, picking up groceries and packaging them for the trucks to then drive out to consumers. With thousands of robots per warehouse moving at more than 8 miles per hour all day long, design efficiency becomes an important consideration. Ocado CEO Tim Steiner says, "Inkbit has built a proprietary 3D vision system. We're working very closely with Inkbit on some of our own future developments where they're enabling some really fantastic transformational advances."

This association has been beneficial for Ocado, who used Inkbit's system for important technical advances. But Dr. Marini describes how this was also an important step for Inkbit, explaining that this collaboration "proved to the public that our technology can be used in the areas of robotics and automation," which has "important implications for our business strategy." Dr. Marini sees a growing awareness in industry that smart manufacturing and 3D printing can fill gaps and provide services that were previously thought to be impossible, and their relationship with Ocado offers one such example. To Dr. Marini, Inkbit's ongoing relationship with Ocado, who is still a major customer, is a "great success story that would have not been possible without that [CSAIL Alliances] event."

Another important introduction was with technology-focused venture firm Future Labs Capital, who Inkbit also met through CSAIL Alliances. As Dr. Marini tells it, the supply chain issues of the pandemic were a challenge for Inkbit, delaying their technology and threatening funding. But when Future Labs Capital came to visit the company after a meeting with Professor Matusik—organized by CSAIL Alliances—it was the beginning of another fruitful relationship. Dr. Marini says, "Future Labs was essential to us because it allowed me to catalyze both internal and external conversations and make everybody move faster." For this and other "fantastic introductions," he's thankful to CSAIL Alliances.

Looking Forward

"We're at the stage where we're starting the commercial journey of the company," Dr. Marini says, elaborating that they're now focused on growth and expanding into new areas such as underwater vehicles, soft robotics, complex soft structures, and medical devices. In the long term, Dr. Marini is personally "very excited about integrating different technologies into our platform. For example, the ability to integrate electronics inside printed parts, the ability to print conductive traces on top of parts... The idea will be to be able to 3D print entire products, not just parts." Generally, he says Inkbit is ready to explore different applications of their technology and work side-by-side with companies to help them design, develop, and print innovative solutions at scale.

In terms of their relationship with CSAIL, Dr. Marini says that Inkbit is looking to leverage many of the benefits offered by CSAIL Alliances, including recruiting, connecting with other businesses through events, and increasing campus-wide awareness of what Inkbit has to offer. He invites any interested collaborators to visit the Inkbit location in Medford, saying, "I think companies will be fascinated because it's such a beautiful integration of different disciplines." Overall, Dr. Marini has "only thoughts of gratitude" for Alliances and he's excited about what comes next.