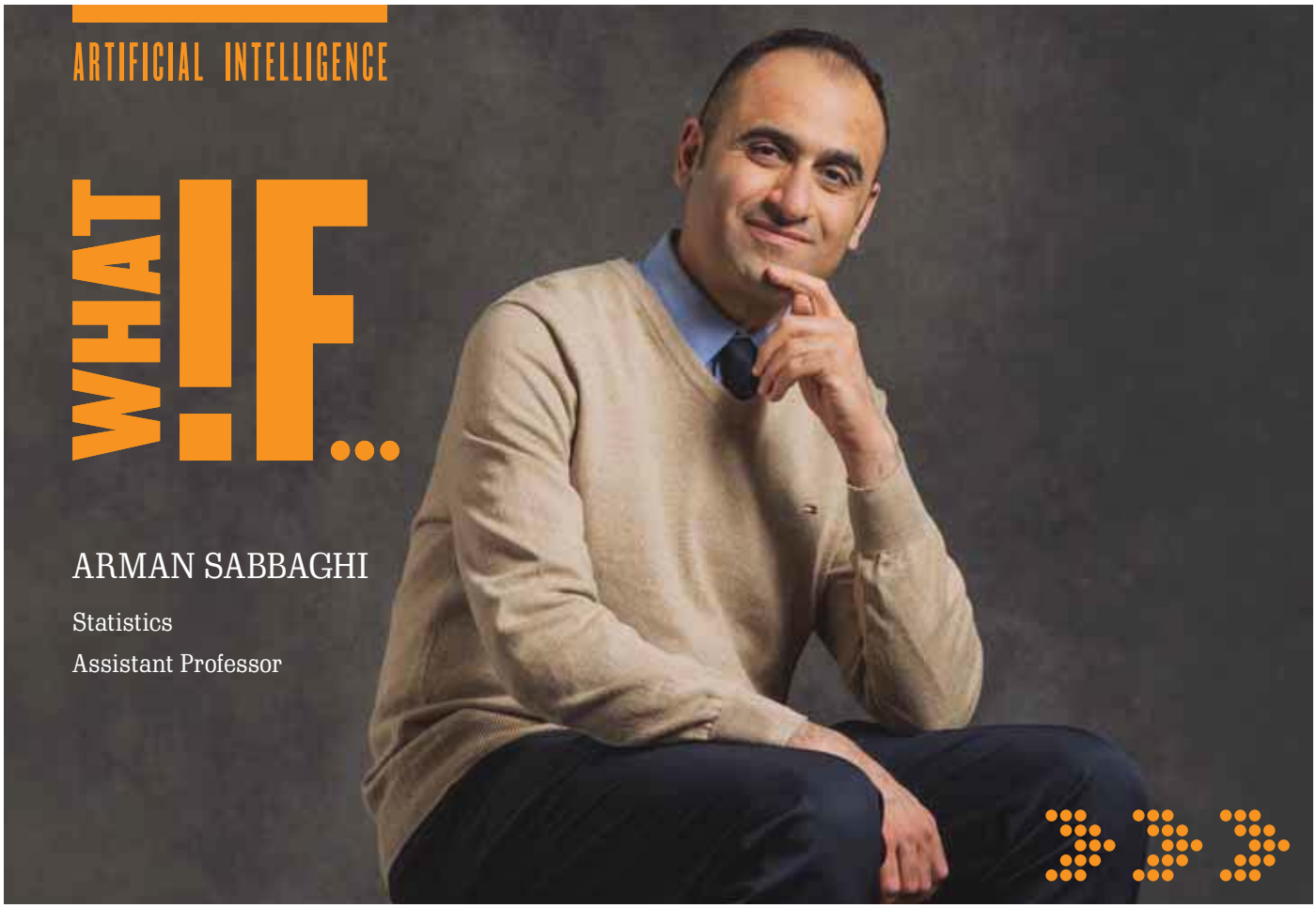

Though novelists have induced paranoia about intelligent machines for nearly a century, Arman Sabbaghi says the potential to make things better is not only possible, but worth exploring. Specifically, in his world of additive manufacturing, or 3D printing, systems.

"One of the important things to recognize is that 3D printers have a lot of advantages," he says, referencing speed and economy.

But there's room for improvement. It took a few attempts at that improvement for Sabbaghi to realize the real need at the core of his work in additive manufacturing — using statistics to transfer knowledge and models across processes for smart shape deviation control. It began in the winter of 2011-12 when, as a Harvard statistics PhD student, he was invited to the University of Southern California to collaborate on data analyses for shape deviations in an additive manufacturing process.

"The product went from a liquid to a solid very fast," he says. "So, a perfect circle would shrink in on itself and become more elliptical." He and his collaborators were successful with controlling deviations for cylinders, but dealing with new shapes stopped the process cold. His model for cylinder deviations didn't appear to be immediately transferable to other polygons and complicated shapes.

Though they managed to address this problem later, the real record-scratch came in 2014, when a technician changed the machine settings. "Everything we did up to that time was no longer directly applicable to the new shapes that were manufactured," Sabbaghi says. "The data we collected after 2014 were completely different from what we had in 2012."

It was demoralizing, but it brought up an important issue: All machines having the same settings was unlikely. Since separate experiments for every single process would be absurd, Sabbaghi made it his mission to find a way to automate the transfer of hard-earned knowledge and models from one process into the next.

And, he adds with a downward glance and a smirk, "We were able to do it successfully, by the way. We got a paper published, and we're further extending that work."

He adds, "I'd love to see people transferring knowledge across different processes and apply them to social sciences, medical sciences. Wouldn't it be great if you could take knowledge from one group that you've already modeled, understand what's going on in terms of effective treatment, and transfer that to more efficiently learn what will happen in another group?"

He pauses and chuckles, then says, "I actually don't even know if that's possible, since humans are so complicated, and trying to model them is difficult. But I would love to see people explore it."