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How Drug Manufacturing Experts Are Navigating Artificial Intelligence Hype

by Bowman Cox

There are so many ways to use artificial intelligence to boost the quality of drug products, but which ones are overblown, misconstrued or inappropriate for the problem you are trying to solve? Here's how some experts are working through these challenges.

How can biopharma organizations figure out the realistic potential for artificial intelligence and machine learning models, avoiding the hyperbole and inflated expectations that sometimes surrounds these tools?

Participants in a recent workshop on AI/ML in pharmaceutical manufacturing shared their approaches to cutting through the hype around these emerging technologies to determine what specific AI/ML models do and how beneficial they might be. They also shared advice on evaluating third-party vendors' AI/ML systems and on auditing their performance.

The ideas and lessons learned arose in wide-ranging discussions at the 26-27 September virtual Product Quality Research Institute AI workshop, where much of the focus was on the types of AI/ML technologies the industry is adopting. (Also see "*The Long Learning Curve For Artificially Intelligent Drug Manufacturing Begins Now*" - Pink Sheet, 29 Dec, 2023.)

Several participants warned about the hype which can inflate expectations regarding these next-generation software tools. For example, Doug Kiehl, who leads *Eli Lilly and Company*'s Disruptive/Transformative Technologies Team, said, "One thing I blame the media a bit for is AI has now developed kind of its own mystique and its own field of gravity. Everybody thinks of Westworld and Terminator ... and it's just an advanced tool," he said, likening it to a power drill in a world where everyone has been using screwdrivers.

Firms are even applying the AI mystique to old-school software. A CMC expert with UCB Global said his firm is trialing AI and natural language processing for answering questions from

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different regulators by probing a database. But the examples the software developer provided just used search engine tools. "I was a little bit lost when I saw some of those examples," he said. "I was wondering, 'are they really using AI, or are they just using process automation?'" *Insert Options*

Cat Vicente, who oversees enterprise regulatory outreach at *Johnson & Johnson*, experienced the same problem when J&J started its AI transformation. "People were saying AI when they really meant that they were automating something." The reason? "AI was a sexier term than automation."

[*Workshop panelists and key opinion leaders are quoted here by name, while many regular attendees who participated in the discussions are not, although in cases their companies are identified.*]

Learn More

This is one of a three-article series on current discussions surrounding the use of AI tools in manufacturing quality. The other articles are:

- *The Long Learning Curve For Artificially Intelligent Drug Manufacturing Begins Now*, and
- *Safety Limits On AI Could Emerge From US And International Initiatives*

And follow all of Pink Sheet's coverage of *AI in biopharma regulation.*

Why Everything Is Supposedly Deep Learning

The hype is particularly intense for a subset of machine learning systems called deep learning models.

They are a type of neural network algorithm that Richard Braatz, a chemical engineering professor at the Massachusetts Institute of Technology, said is good for large language models and games like chess but not process control. "They require very, very large quantities of data and are not relevant for any kind of process application."

Firms in the process industries like Pavilion Technologies Inc., an advanced process controls supplier that Rockwell Automation Inc. acquired in 2007, always use shallow neural networks, said Braatz, whose research focuses on advanced biomanufacturing systems.

But that doesn't matter in today's amped-up AI hype cycle. As *Gilead Sciences, Inc.* quality engineer Hua Wally Xie explained, "because of hype, because of marketing, a lot of people would like to say no matter what that they're using deep learning algorithms. It helps with venture capital funding."

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Watch Out For Inaccurate Algorithms

Several participants in the discussions warned about the need to evaluate third-party machine learning models carefully.

Braatz, who advocates primarily mechanistic methods in process modeling, said the research literature is replete with unstructured, open machine learning models that require persistent "excitation" so they don't drift off.

"I think that it's going to be very messy in the next five years, just based on the last five years, where someone will just take whatever fancy technique and write a simulation paper, but it won't necessarily be of really any value to companies, it will be just too high risk and not reliable."

Nailing It With The Wrong Model

A Bayer participant stressed the importance of defining user requirements before buying machine learning solutions that might solve the wrong problem.

There are lots of algorithms out there in fields like natural language processing and computer vision, he said.

It's important to hire people who can understand these tools, while also following the rapid evolution in these models and methods, he said, noting that models developed a couple of years ago are already obsolete, as there are faster, better algorithms today.

Organon's quality systems and compliance executive director, Christine Moore, underscored his point, saying the way people are throwing machine learning solutions at problems reminds her of the way they threw multivariate analysis at problems when it was new. "People are like, I have a hammer and everything looks like the nail."

What's Under The Hood?

Gilead's Xie said it is often difficult to confirm just what an AI/ML model does.

He said Gilead is studying large language models for responses to regulators, comparing Amazon's offering through its AWS frameworks to that of the Microsoft/OpenAI collaboration using an "imperfect" heuristic, qualitative approach.

"A lot of this stuff is proprietary. It's under the hood. It makes benchmarking and the quality control of these tools a huge challenge to folks in the group."

Purdue University professor Gaurav Chopra shared some suggestions on this point. An expert in AI/ML manufacturing automation, he said firms can develop solutions to such challenges with

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tools like LangChain and can retrain models for tasks like report generation using tools from Auto-GPT Github repositories.

Retraining a model like ChatGPT would be prohibitively expensive, Xie said, noting that OpenAI only lets Nvidia, Microsoft and one other company do the retraining. Chopra acknowledged there's a cost-benefit ratio and observed that "it takes a heart and a soul to train these models."

QA Roles For The FDA And Audit Trails?

Xie also raised the possibility that the FDA could help provide quality assurance regarding third-party AI/ML software, given the "collision between intellectual property and the ability to review and evaluate code freely to see if that code is really doing what a company says it's doing."

He suggested the FDA could perhaps "have some kind of internal review panel where code is kept discreet, not shared, but that there can be some kind of peer review going on."

The agency does something similar with drug master files, enabling agency experts to assess the quality of proprietary ingredients applicants sourced for drug products.

Meanwhile, workshop participants said, it is difficult though possible to use audit trails with AI tools, the challenge being that they must be found to have matching metadata. A Gilead quality assurance expert suggested starting with configuration control, noting that GitHub tracks changes you make to your models and your data. "You might need some kind of auxiliary program that's actually doing the tracking, but that's something to consider."

The bottom line: AI/ML systems can improve pharmaceutical manufacturing processes and quality oversight but like anything else, they must be assessed and tracked with healthy trust-but-verify skepticism.