

Driving Drug Innovation With AI

► The global AI market has been showing rapid growth as major pharmaceutical and medical technology companies invest heavily in internal and external AI partnerships.

According to some reports, more than 50% of executives expect broad scale AI adoption by 2025. Further, revenue generated through AI-based solutions in the industry is projected to rise at a CAGR of 21.94% and reach \$2.199 billion by 2022, according to Frost & Sullivan. Meanwhile a report by Global Market Insights forecasts that the U.S. healthcare AI market will exceed \$10 billion by 2024. With total investment exceeding \$7.2 billion across 300-plus deals between 2013 and 2018, the pharmaceutical industry continues to lead the healthcare sector in terms of attracting AI-related VC funding.

The COVID-19 pandemic has propelled growth in AI investments with a new wave of transformative technologies being developed in an effort to contain the pandemic, such as smart machines and robots. AI is also being put to use to determine the effectiveness of existing drugs in the treatment of the virus.

Transformation Through AI

Many pharmaceutical companies see huge opportunities to transform their operations with AI capabilities, from productivity improvements to better outcomes across the value chain to using AI to create new offerings.

AI is top of mind for GSK, which announced plans to recruit 80 AI specialists by the end of 2020. The company's AI headquarters will be in San Francisco, but experts will be spread across Europe and the United States. The goal is to use AI in the search for treatments in various therapeutic categories, including cancer and autoimmune diseases. The company is also working with several AI platform developers to advance drug discovery.

Another company that is investing heavily in AI is Bayer. Together with Merck, Bayer has developed the CTEPH Pattern Recognition AI Software to help radiologists recognize chronic thromboembolic pulmonary hypertension, a rare form of hypertension. FDA has granted breakthrough designation for the software, which will be deployed through Bayer's Radimetrics platform.

In addition, Bayer is using a combination of real-world data and AI-driven solutions to improve the characterization and stratification of disease as well as patient populations. A

key objective is to predict which patients are at risk of cardiovascular disease and then determine the treatments that might work best.

Scientists at Janssen Research & Development have found a way to use AI to speed the process of discovering new potential treatments. They are using AI to sort through how cells representing certain diseases react to a variety of compounds. Then, through collaborations with academic partners, they are using computer algorithms to predict how other cells are likely to react to those same compounds. The benefit for scientists is they don't have to start over for every study, which means they can potentially get treatments to patients faster.

Many other companies are partnering with AI leaders to drive innovation. For example, Pfizer formed a partnership with Atomwise to help identify potential new drug targets by using deep neural networks to quickly analyze millions of molecules. This further expands Pfizer's AI-led initiatives, which have included partnerships with IBM Watson and investment in MIT's Machine Learning for Pharmaceutical Discovery and Synthesis Consortium.

Other pharmaceutical companies have formed partnerships with Atomwise to drive drug discovery, including Merck, Bayer, and AbbVie. In addition, AbbVie is working with AiCure to monitor medication adherence in patients with schizophrenia.

One small biotech company that has been putting AI into practice in its drug development process is Verge Genomics. The company uses similar processes to those that power Google's search engines to map out hundreds of genes that cause disease, and from there find drugs that target all the genes at once. By using AI, Verge is taking products into clinical trials rapidly thanks to its approach. For example, it is expected to start a small molecule ALS program in 2021, followed by four more programs. It has achieved this by building a massive database of brain tissue sequences.

Another biotech company committed to AI is Healx, which has created an AI platform for rare diseases. The company's purpose built AI platform, Healnet, serves to fill crucial gaps in knowledge about rare diseases and speed the discovery of new treatments.

Another AI-driven bioscience company, Biovista, is applying augmented and AI tech-

How Pharma Can Use AI for Drug Innovation

- Create internal expertise and support AI employees with the right resources
- Collaborate with start-ups and others using AI in drug discovery
- Partner with academic groups that focus on AI R&D
- Consider open science projects or various R&D challenges

Source: A Guide to AI in the Pharmaceutical Industry, Stefani Group

nology to find treatments that will mitigate disease complications that arise during and after infection. Its Project Prodigy platform maps all known drugs against every possible mechanism in which the COVID-19 virus operates and causes complications, and seeks to build scenarios to identify non-obvious medical solutions as well as non-linear risks.

Challenges to AI Innovation

One of the biggest barriers to growth in AI capabilities is the limited number of AI experts. According to a report by Tencent, there are about 300,000 AI researchers and practitioners worldwide but the market demand is for millions of roles. Other barriers include regulatory pathways. Since innovation must be balanced with safety risks, there is a need for robust strategies to enable well-considered market surveillance for AI-led innovations.

AI is only as good as the innovators behind it, with experts noting that to deliver results, users must ask the right questions and work with clean data. In Verge's case, the company started its work in human rather than animal models, combining its brain sequence database with human genetics, overlaid with human-derived neurons. This let researchers identify gene signatures that appear in patients.

Despite the challenges, the importance of AI in drug development is now well-under-

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Rich Christie, M.D., Ph.D.
Chief Development Officer
AiCure

AI Provides Patient Support

AI-powered solutions are playing a pivotal role to keep patients engaged in their trials, ensure visibility into their well-being, and maintain communication by providing multiple avenues of support. Sponsors of clinical trials and sites need data mining and advanced analytic capabilities to safeguard trials with meaningful insights and limited data variability, especially when supporting trials remotely.



Michelle Marlborough
Chief Product Officer
AiCure

Enhancing the Patient Experience

Partnering with AI vendors that have solutions that truly reach patients where they are, and that use technology already at a patient's disposal to enhance patient engagement will empower study teams at sponsors, sites, and CROs to focus on the patient experience. Furthermore, this focus on partnering with technology vendors will also give study teams the patient data visibility needed via a single dashboard to help them make data-driven decisions that can greatly impact the successful administration of an ongoing study.



Mike Weber
VP of Product Management
Aktana

It's All About Balance

Implementing AI effectively is all about balance. The key is finding an AI partner who excels at integrating all data assets, coordinating all stakeholders and leveraging existing technical and analytics investments. A well-rounded AI implementation that can be deployed quickly, adopted effortlessly and can generate practical suggestions and insights for users allows the organization to focus on agility, continuous improvement and extracting the most value from their AI.

Agility and Vigilance

Production-grade AI models take work to maintain. As markets shift, models drift, especially in the face of unexpected change, like COVID-19. Pharma companies must establish a diligent practice of ingesting recent data, retraining AI models, and regularly evaluating their predictive health to ensure they haven't degraded. Companies must also remember that as AI changes, so do the workflows of its users. This agility requires eternal vigilance, but the competitive advantages that result can be remarkable.



Dinesh Kasthuril
Global Head, Client Relationships and Project Management
Covance Patient Safety

On-Demand Reproducibility

Pharma companies work in a highly regulated environment, and in addition to using AI to drive data insights it is vital to ensure compliance with regulations, especially computer systems validation requirements. For this purpose traceability and reproducibility of data is key. Hence, being able to capture and reproduce on demand a trail of how an AI system predicted an outcome is key. This places an additional onus on implementation and effective use of AI systems.



Jerome Premereur, M.D.
VP, Patient Safety Solutions and Adjudication
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Time, Resources, and Quality

AI is helping a lot in the equation of three variables that safety is dealing with, wondering how we can get balance. The three variables are time, resources, and quality. One cannot be perfect without sacrificing the other two. Time is regulated and cannot be adjusted above the traditional reports of 7/15 days for expedited safety reports (ESR). Resources are very substantial if the quality of the report is at the level expected and on time. AI is fast. A learning machine on natural language processing (NLP) can read hundreds of pages much faster than any physician and can extract the elements that are important in a narrative for the ESR. Therefore, time, resources, and quality are able to achieve a new and better ▶

stood. In the future, some predict that chemists who use AI to support their research will replace traditional ways of working. This was underscored during a 2018 protein folding competition, which attracted scientists glob-

ally to try to predict the 3D shape of proteins in the human body. The contest's winner: DeepMind, which made the predictions using neural networks — the same technology that recognizes photos in Facebook posts.

While AI is just one element in the search for innovative new drugs to address unmet health conditions, increasingly companies large and small recognize that it is a crucial part of the equation. ^{PV}

EXECUTIVE VIEWPOINTS

balance with AI. For these reasons, AI has attracted a lot of attention with regard to facilitating the capture of the adverse events and the traditional pharmacovigilance operations within the pharmaceutical and CRO industry. This scope of the AI development is now very active. In the near future, AI is going to be very efficient on safety signal detection for clinical trial benefit risk evaluation on an ongoing basis — and certainly before the end of the study even if the recruitment is very fast such as vaccination of a large cohort or the seasonal aspect of allergy patient recruitment — as well as postmarketing safety for products on the market.



Claire Bonaci
Senior Director, US
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Microsoft

AI and Clinical Trials

With Covid-19 permeating every aspect of our lives, the pharma industry is no exception. Digitization and AI are uniquely positioned to be front and center to positively affect how clinical trials are executed and how drugs come to market. This will not only benefit biotech companies but also the many patients with unmet medical needs.

Scaling AI Across Pharma

Cross-industry partnerships will be crucial in the journey of implementing AI at scale in pharma. Collaboration between technology companies, biotech startups, and industry leaders have the opportunity to lean in and design ethical and innovative solutions using AI. Leveraging technology companies' AI expertise and pharma companies' deep

industry knowledge will be a force to be reckoned with.



Max Divak
Interactive Group
Supervisor
Ogilvy Health

AI in Diagnostics Gaining Traction

The pharmaceutical industry employs the use of AI across many categories, including epidemic outbreak prediction, drug discovery, diagnostics, improving the quality of treatment, optimizing medical cost, and even sales and marketing. The effectiveness of AI in diagnostics is quickly gaining traction. For example, diagnosing conditions through the analysis of imaging. A trained algorithm can compare scans against massive databases of imaging libraries and diagnose conditions within seconds with a high level of confidence. The AI could also cross reference patient information to rule out certain criteria. Currently, the fate of a patient is not left to autonomous machines. But when healthcare professionals use AI as their helping hand, or even as a second opinion, the effectiveness in diagnostics and quality of treatment drastically improve.



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Partnerships Are Key to AI Implementation

There needs to be alignment and partnerships with everyone. Obviously “big tech” and pharma need to strengthen their trust and relationships to allow

new technologies to replace real-life interactions/decision making. More importantly, patients need to be comfortable with allowing medical decisions to be made based on a program algorithm instead of on thousands of years of medical experience.



Malai Sankarasubbu
VP of AI Research
Saama Technologies

AI and Clinical Trial Data Management

AI is yielding highly valued results for pharma as related to clinical trial data management. Using AI models to predict discrepancies and manage queries results in significant process improvement that reduces time to database lock. Expediting conversion of raw EDC data to analysis-ready SDTM data in near real time is a tremendous win for biopharma from a time perspective and can have positive implications for clinical trial budgets as well.

Walk, Then Run with AI

Managing the pharma industry's expectations of AI is a major challenge. AI can facilitate remarkable achievements, but underlying business processes to support AI implementation must be in place to ensure its success. In order for AI to enable the industry to fly, it must first walk, crawl and then run with AI. This progression can be achieved in rapid succession with a tech partner that can align internal business processes with the right state-of-the-art AI automation platform.

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