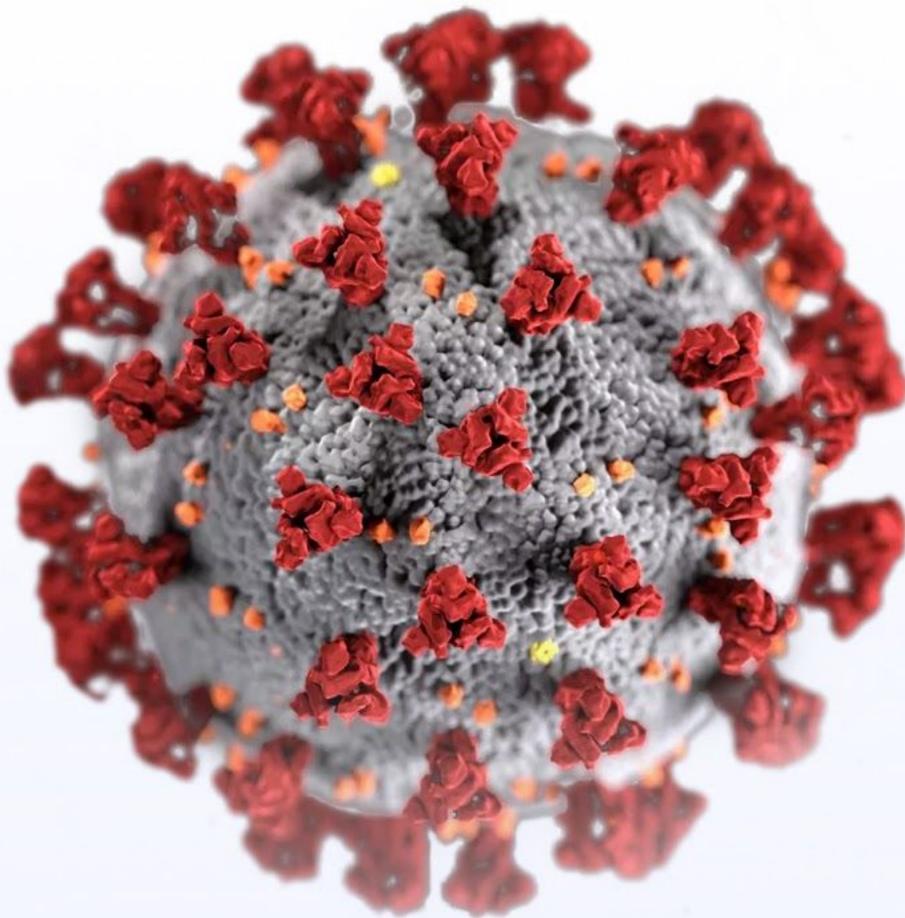# AI Innovation Overview for Pandemic Response

Outbreak Tracking, Drug Development, and Diagnostics

by Daniel Faggella

Research | Strategy | Competitive Intelligence

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Emerj Artificial Intelligence Research

Emerj Artificial Intelligence Research helps global organizations develop AI strategies and initiatives that win in the market. We map the capability-space of AI across major sectors, with a finger on the pulse of academia, Fortune 500s, and the global artificial intelligence startup ecosystem.

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AI and machine learning use cases in pharmaceuticals have attracted more attention since the outbreak of COVID-19. Business leaders in healthcare, life sciences, and those in the public sector are looking for any advantage they can gain over the virus as well as any technology that might help prevent a similar outbreak in the future.

The insights in this brief are a summary of some of the use-case categories from our AI Opportunity Landscape research in life sciences. It is intended to familiarize leaders with the most prominent use-cases and AI vendors that are moving the field forward.

Credit is also due to many of our AI-focused pharmaceuticals experts who joined us on our *AI in Business* podcast to share their insights. I hope you will find this briefing both timely and useful as a quick reference guide for some of the most important AI use-cases for the years ahead.

Daniel Faggella

CEO and Head of Research, Emerj

1. Outbreak Tracking

Capabilities

Outbreak Prediction

Global population growth and continued interaction with animals creates more opportunities for some diseases to spread across species and affect humans. Both the U.S. and West Africa have seen this in recent years due to the SARS, MERS, and Ebola outbreaks. Researchers are now using AI to help predict hotspots where new diseases might arise.

This type of application would leverage data about local animal populations, known viruses, human demographics, and cultural practices in different areas of the world to predict an outbreak. Government officials can also use these results to be more proactive about preparing for or preventing outbreaks.

Disease Detection

When a human first contracts a previously unknown virus, government and public health officials cannot waste any time in coming up with an immediate response and searching for a cure. AI applications can help these kinds of organizations detect an outbreak and respond to it as fast as possible.

Some may choose to use natural language processing-based (NLP) text mining applications to recognize indicators of unknown or underreported symptoms. This can include public social media data, emergency services and ambulance data so they may detect any anomalies or new developments as patients continue visiting hospitals.

Example Vendor

BlueDot is one example of an AI vendor that offers an outbreak tracking solution to its clients. The company claims to have been the first to detect the COVID-19 outbreak on December 31st, 2019. The software can scan news articles in foreign languages, animal and plant disease data, and government proclamations to warn clients of dangerous areas.

BlueDot claims to use NLP for various languages in order to track global news, and then sends the resulting data to human epidemiologists who use it to determine the nature of a potential outbreak.

2. Drug Development

Capabilities

Drug Discovery

NLP software may help pharmaceutical companies enrich their drug research with an enterprise search application for finding helpful information for current and future drug testing. NLP can comb through a database for information that is relevant to a given search query, and this includes information from an unstructured source such as an image scan of a paper document. Some pharmaceutical companies may find this particularly helpful if they have large stores of data that are digitized but still unstructured such as lab notes from previous experiments.

Optimizing Manufacturing

Determining the physical properties of a drug molecule or compound is an important step in figuring out how a drug can be mass produced. These properties include the compound's solubility in water and other liquids, the shape of its solid crystalline form, and the stability of that structure once it is formed. Salt and polymorph screening helps to determine the best physical form to use for mass production. This also helps researchers find out how long the drug can sit before it expires.

A predictive analytics application may help researchers identify any existing data on crystalline structures of drug molecules so they can get an idea of how their current drug might respond to being pressed into pills.

For example, the application might show the top 10 most similar crystalline structures to the one being tested. The researcher may then be able to infer that if 10 similar drugs responded well to being pressed in the form of a pill, their current project might benefit from the same approach.

Additionally, a data scientist may be able to predict the results of a polymorph screening using this technology. They could then talk to their team about augmenting the drug before the screening begins in order to rule out any perceived variables.

Predicting Drug Molecule Reactions

Some companies use predictive analytics to isolate a specific drug molecule and test how effective it is at treating illnesses and diseases they are focused on. As a result, companies can use their previous clinical testing data for past drugs to discern the right molecules to use and how to structure them. Researchers are likely to find more relevant insights about previous

testing using this method because a predictive analytics application would be able to find more granular similarities between molecules.

Example Vendor

In order to make AI useful for pharmaceutical researchers working at the molecular level, other technologies are necessary for data collection. Xtalpi is one AI vendor attempting to solve this issue with a solution that consists of predictive analytics combined with cloud-based high process computing. They call this technique "crystal structure prediction" because it can report on how likely a drug is to form a certain type of crystalline structure when molecules are combined.

The company claims their solution helps researchers identify the optimal form in which to deliver their drugs, such as an inhaler or eye drops. This is purportedly helpful in late stage drug development where companies need to decide on a strategy for mass production and packaging.

3. Diagnostics

Capabilities

Health Tracking

Patients can use machine learning to track their own health and alert them of irregularities such as increased blood pressure or heart rate. This can be combined with Internet of Things (IoT) devices including smartphones, watches, and other products.

For example, a patient that has noticed a sudden rise in heart rate or change in mood after eating something that affects their blood pressure might check this type of device to stay aware of their heart murmur. These products use sensors on the patient's body to track changes in body temperature, pulse, and other vital signs. The IoT device usually corresponds with a smartphone app that can alert the patient of an irregularity they may not notice and might recommend something the patient can do to treat it.

This type of technology may be particularly beneficial during the pandemic because of the high number of patients that are currently seeking medical attention. Those with preexisting conditions may use an IoT device in order to better track their health to stay on top of their health and keep themselves out of the hospital during the pandemic.

Chatbots for Diagnostics

While chatbots have myriad use-cases across industries, the pandemic highlights their utility as social distancing becomes the norm. Chatbots use natural language processing (NLP) technology to recognize a patient's responses to diagnostic questions and deliver an accurate response based on medical data regarding past diagnoses.

Additionally, some medical chatbots can serve as guides to explain to patients how to administer a self test for various conditions. For example, Healthy.io offers an FDA-approved home testing urine analysis kit that uses computer vision to scan and compare the colors of a test strip to a result pad. This requires the patient to use a smart device with a camera so that the software can scan the test strips. The chatbot explains each step of the testing process to the patient, and can answer any questions they type in the interface.

Machine Vision for Medical Imaging

Some AI diagnostic applications use machine vision to help doctors diagnose physical abnormalities in the bodies or signs of diseases. This has been seen in both oncology and radiology prior to COVID-19. When using these techniques, endoscopic cameras are equipped

with a machine vision system that is trained to detect shapes and colors of both healthy and unhealthy body structures. Alternatively, this type of machine vision can also detect abnormalities within CT scans.

As the camera pans around the inside of the patient's body, the machine vision system would be able to detect any damage or abnormalities. Machine vision-powered radiology may be helpful to some healthcare companies looking for a more accurate way of discerning how much damage a condition has done to a patient's organs. In the case of COVID-19 patients, this would be helpful in diagnosing lung damage or other conditions.

Example Vendor

Aidence is one AI vendor that offers machine vision-based radiology software. They claim their Veye Chest solution helps radiologists report on pulmonary nodules which are small growths in the lungs. They also claim the solution can be integrated into a hospital's existing EMR/EHR database.

Veye Chest is made to detect the presence or warning signs of pulmonary nodules in lung CT scans. Radiologists can use the software to help discern whether the nodules are malignant or otherwise a threat to the patient's health. The software purportedly provides an annotated image of the CT scan along with a text description of any findings.

Top Interviews

Learn from some of Emerj's best podcast interviews about the fundamentals of AI in life sciences. Before piloting any logistics AI solution, we recommend these interviews:

- [The Future of Drug Discovery and AI -The Role of Man and Machine](#) - Amir Saffari of Benevolent AI discusses how machine learning currently facilitates the drug discovery process and what kind of role it might play in the future.
- [Modeling Biology with Artificial Intelligence](#) - Dr. Kristóf Zsolt Szalay of Turbine explores the possibilities of using artificial intelligence to model biology in how it responds to chemicals and drugs.
- [What's Possible for AI in Drug Discovery](#) - Murali Aravamudan of Qrativ shares his insights on the requirements for AI drug discovery projects and the possibilities for the pharmaceutical companies that attempt them.
- [Overcoming the Data and Talent Challenges of AI in Life Sciences](#) - Gunjan Bhardwaj of Innoplexus highlights the biggest hurdles for life sciences companies in terms of gathering the right data and hiring the best talent for AI and machine learning projects.
- [Overcoming Data Challenges for AI in the Healthcare Industry](#) - Zhigang Chen of Tencent explores what aspects of the AI landscape are currently working for china and how these differ from the particular AI opportunity of the U.S.A.

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What to Do About It

• Building and Validating an AI Strategy
• Determining a High-ROI AI Initiative
• Matching AI Capabilities to Business Goals

TRENDS
What's Changing

• Business Functions Undergoing Evolution
• Applications Enabling New Strategic Advantages
• Shifting Power Dynamics Due to New AI Capabilities

IMPLICATIONS AND APPLICATIONS
What's Working and What's Possible

• Landscape of AI Strartup Innovation
• Landscape of Enterprise AI Adoption and Development
• Evidence of ROI (Cost Savings, Growth, Revenues)
• Evidence of Enterprise Adoption

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