UNLOCKING

the Value of AI in Life Sciences

Co-created by

Emerj Artificial Intelligence and **Expert.ai**

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The AI Research and Advisory Company

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Introduction

We live in a world brimming with information. The digital universe is growing exponentially, year over year, and the data available to humans today far exceeds their ability to process and act on it before it becomes stale and irrelevant.

Data means everything to leaders and stakeholders in the life sciences industry. How do they navigate these vast stores of data and confront today's health, economic and financial challenges?

> *“Many health researchers assert that 80% of scientific publications contain assumptions that must be verified and cross-checked within the document against real-world evidence.*
>
> *The knowledge included in this data can offer valuable insight for strategic activities like R&D, innovation, competitive intelligence and adverse events monitoring. Thus, an organization can establish a competitive advantage by making data more accessible and actionable. The quantity, variety and complexity of scientific content makes it difficult to find what you need when you need it. In this context, AI-based semantic applications have evolved from a game-changing service to a de-facto requirement for both competition and innovation.”*

Christophe Aubry

Head of Sector Strategy for Life Sciences and Healthcare at expert.ai, a leading company in artificial intelligence applied to text, with more than 20 years of experience in natural language understanding

Unfortunately, researchers constantly **struggle with information overload**, and this challenge is only exacerbated by the nuance of industry-specific terminology. Because few people have the depth of knowledge necessary to understand and process medical concepts, scaling that knowledge is a nearly insurmountable task.

Can artificial intelligence (AI) help? **It can...with the right technology and approach.**

Traditional data mining tools leverage keywords to extract information and are incapable of reading text or understanding language like humans. As a result, they miss critical information that fails to match up perfectly with the user query.

This is particularly applicable to scientific content where the same term may indicate different concepts (e.g., CAT as gene vs. CAT as Computed Axial Tomography) or different terms may indicate the same concept (e.g., REGN-10933 and Casirivimab refer to the same drug).

AI technologies such as machine learning (ML) and natural language understanding (NLU) are truly capable of impacting the ecosystem of modern medicine.

There are a number of reasons why:

- The push for personalized medicine
- The exploration of mRNA and gene therapies in creating new treatments
- The need to find patterns amid terabytes of data
- The pressure to make decisions and adopt solutions

> *"AI must leverage its understanding of language to classify and extract what matters from biomedical content, resulting in actionable insights for informed decision making."*

Christophe Aubry

Head of Sector Strategy for Life Sciences and Healthcare at expert.ai

Whether the focus is on drug discovery, the design of clinical trials or the tracking of adverse effects in the drug safety process, AI stands ready as a worthwhile partner to the industry's subject matter experts.

Here is a glimpse into how AI technologies are helping life sciences companies scale key business processes, overcome operational challenges and realize new opportunities.

Use Cases

Unlocking the Value of AI in Life Sciences

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1. Evidence-Based Knowledge Discovery

Introduction

The drug discovery process, a key application of evidence-based knowledge discovery, costs an immense amount of time, effort and resources. Even as a target passes through the successive phases of the drug discovery process — from hypothesis generation to clinical trials—there's no guarantee that it will become a viable drug.

Today's pharmaceutical companies have turned to AI-enhanced technologies in an effort to speed up the drug discovery process.

In addition to drug discovery, drug repurposing has emerged as a key area that promises both savings and new treatments, on a potentially faster timeline. Because these drugs have already reached the market, how they work and their mechanism of action is already known. As a result, applying AI to researching these existing drugs can save valuable time and expand their reach.

Indeed, the drug discovery and drug repurposing processes have long awaited the capabilities promised by AI and its innovative capabilities.

Actions Taken

To help researchers identify key data amidst massive amounts of scientific literature as well as scale the drug discovery and drug repurposing processes, expert.ai provided clients with its patented technology that enables accurate identification and connection of biomedical information such as diseases, drugs, treatments, symptoms, genes, proteins and other data elements from content—but at rates that far exceeded human capabilities.

In building the logic, expert.ai designed a world-class knowledge graph specialized for life sciences and healthcare. The knowledge graph allows for data standardization and linking, such as grouping conditions into families of diseases or identifying mechanisms of action and drug classes.

> *"There has been immense knowledge available from scientific publications to understand how genes could possibly contribute to a disease. The scientific community is facing a lot of challenges in mining such data sets to associate genetic markers with particular diseases and to develop treatment strategies."*

Preeti Chawla
Senior Clinical Data Analyst at expert.ai

Expert.ai's solution helps researchers identify new data elements to enrich the knowledge graph and helps to keep the graph consistent and current, as changes happen frequently in various therapeutic areas. It also helps researchers monitor multiple data sources (from publications to real-world evidence through clinical data) at rates that far exceed human capabilities.

Results

Between years of experience in the life sciences industry and collaboration with subject matter experts, expert.ai specialized its innovative AI technology to help researchers scale the drug discovery process. This technology is fueled by a unique knowledge graph that contains more than 2 million concepts and 6 million relations across 12 different languages.

Within that, you can find more than:

100,000 diseases	**450,000** drugs and chemicals	**115,000** symptoms or findings
86,000 genes and proteins	**65,000** geographic locations	

The depth and breadth of the knowledge graph enables extraordinary precision, coverage and granularity when categorizing documents, extracting meaningful data and connecting information in scientific content or medical notes across any therapeutic area.

With scientific literature as the primary source of data on target association with disease, **expert.ai mines publications daily and structures drugs, diseases, targets or biomarkers to create a knowledge synthesis centered on a disease area.** This allows for quick insights to discover causal relationships between targets and diseases, potential treatments and risk factors.

Expert.ai technology brings human-like comprehension of language to the drug discovery process by enabling researchers to speed up their research and data analysis. Additionally, it also supports the identification of potential new applications for existing drugs, in an effort to repurpose treatments in other disease areas.

2. Clinical Trial Design

Introduction

Drug development is a long and expensive process. It takes on average 10–15 years and USD $1.5–2.0 billion to bring a new drug to market. Approximately half of this time and investment is consumed during the clinical trial phases of the drug development cycle.
Reference

Given recent events (e.g., COVID-19), it has become imperative that the development timeline be shortened for new treatments. As the world raced to develop a vaccine that could win the war against the pandemic, we saw a surge in the number of clinical trials being conducted as experimental treatments started to emerge. The clinical landscape of who was doing what, where and when rapidly evolved. By monitoring clinical trial data and learning from previous outcomes (i.e., what went well, what went wrong), researchers can, in turn, design better clinical trials.

What was emphasized during the COVID-19 outbreak is an ongoing **need that spans numerous therapeutic areas and rare diseases.** Creating a clinical landscape for drug development requires capturing, mining and linking clinical trials around the world, extracting key data points from semi-structured to unstructured data and presenting them in an easy-to-use manner for informed decision making.

> *"Clinical trials allow us to tap into the potential of AI throughout the drug development life cycle, starting with design and planning, identifying principal investigators & site locations, enrolling patients and monitoring adverse events."*

Archna Bhandari
Executive VP, Data and Analytics, at expert.ai

Actions Taken

Expert.ai's technology mines data from more than 700,000 clinical trials worldwide. This includes clinical trial registries such as clinicaltrials.gov, EUDRA, EUPAS, Japanese registries, Australian registries and others. Their AI platform takes care of data mapping, deduplication and linking across registries to make it easy for researchers to consume data.

By incorporating cutting-edge NLU and ML technologies combined with standard and custom taxonomies, **expert.ai can understand and link important terms like "coronavirus," "COVID-19," and "SARS-CoV-2"** so that researchers can identify and target the data most likely to help them accelerate the design and development of their clinical trials.

> One of the important criteria for clinical trial design and success is related to patient recruitment. Such information is described under the eligibility criteria of the trial, which is detailed in an unstructured data field.

Inclusion criteria lists the key features that the targeted patient population must qualify for, such as:

demographics	clinical characteristics	duration of disease	severity of disease

Exclusion criteria list the additional key features that could interfere with the study or increase the risk for an unfavorable outcome or adverse events. For instance, the presence of comorbidities must be avoided for a patient to qualify for a recruitment in clinical trials.

Actions Taken

Expert.ai technology makes it possible to convert this unstructured data to structured information and create key attributes for a patient profile. These patient profiles can then be used as a screening tool to identify patient populations from real-world data such as Electronic Health Records (EHRs). In addition, this analysis is further expanded from one single trial to a set of related trials, thus allowing the use of this information for cohort design for new trials.

Expert.ai technology also facilitates retrospective analysis for new trial design by tracking data points such as change in enrollment numbers and time taken in moving from one recruitment status to another during the length of the clinical study.

Results

Expert.ai technology allows centralized access to all clinical trials around the world. It provides the most up-to-date and comprehensive data landscape by disease, drug, mechanisms of action, organization or geography. Not only can researchers find related trials, they can also access related publications, news, study results and principal investigators all in one place.

Thanks to deep natural language understanding capabilities, **key data elements are accurately identified from trials and standardized to offer data analytics capabilities that go way beyond keyword search.** Reporting features include drill-down and filtering that help researchers find site-level information, research facilities, lead researchers and networks of collaborators.

3. Drug Safety: Reporting Adverse Events

Introduction

After a drug is approved, an increasing number of patients begin using it and side effects emerge. These adverse events, or AEs, can be reported directly by physicians, or they can be identified by healthcare organizations or via post-authorization studies. Increasingly, AEs surface through direct patient feedback on social media.

That's what makes drug safety so critical in the pharmaceutical industry. **AI can help monitor adverse events with the goal to improve patient care and reduce the risk of side effects.** For instance, AI can enable researchers to constantly look at different data sources, including social media networks increasingly used by patients. That presents new challenges: the data, its semantics and syntax are different and not presented in typical physician language.

Few industries face such a challenge. As such, pharma companies continuously improve their systems designed to monitor and report on the safety of their products. However, the sheer volume of information produced by patients — and the platforms they use to share it — increases every year.

How, then, do life sciences companies collect this feedback and report it to the Food & Drug Administration or other regulatory agencies, to comply with drug safety regulations? And, how do pharma companies move forward into the digital age?

Actions Taken

Expert.ai was selected by a European consortium of governments and industries to identify adverse drug reactions from patient reporting in social media (later named ADR-PRISM). This project set out to make drug safety monitoring easier for the life sciences industry. During the project, expert.ai leveraged its NLU technology and knowledge graph expertise to build a solution that could identify adverse events as reported in five patient forums with 21 million posts.

In mining social media content, **expert.ai addressed key challenges coming from the differences in the way people use language in social media** — differences in semantics, syntax and terminology. The teams involved in the project trained AI models to understand the language of the patient and connect identified data (adverse reactions, conditions, drugs, symptoms) to standard medical nomenclatures.

Indeed, the words people use on social media, the format they use to structure their post as well as the volume of public posts presented unique challenges for the ADR-PRISM team. Expert.ai was uniquely positioned to identify adverse events through its AI approach.

Expert.ai's solution provides full comprehension of text at scale and extracts actionable drug safety information for evaluation and regulatory reporting. Using its AI-based natural language understanding software that models human knowledge, expert.ai offers categorization across languages, entity and relationship extraction, and text analytics that detect information once locked away in medical notes, EHRs, social media posts and others.

Results

Through the ADR-Prism project, expert.ai brought natural language understanding to the drug safety process. Pharmaceutical companies can mine social media posts, healthcare reports and clinical studies to identify adverse effects from medications. **Ultimately, they can now determine an AE's criticality as well as link the textual content to a product and even a patient's demographic information.**

In the end, expert.ai created a solution that sheds light on a source of knowledge rarely available to drug safety teams. By unlocking the power of public, patient-generated communication, expert.ai can identify potential concerns about adverse reactions that were not easily accessible or captured by drug companies.

This delivers key insights into:

potential drug side effects	demographic data of patients	non-medical preferences about a drug (e.g., its shape, color, taste, etc.)	marketing efforts of a drug

> *"The ADR-PRISM project won't replace structured data. It does, however, bring more structured data from social media to the monitoring process. Pharmaceutical companies can leverage the data and present it to the right people to take action."*

Christophe Aubry
Head of Sector Strategy for Life Sciences and Healthcare at expert.ai

Conclusion

In the life sciences and pharma industries, advanced natural language understanding capabilities are transforming vast stores of unused data into valuable information that improves R&D, informs clinical trial design and enhances drug safety efforts.

From innovation to regulation to patient engagement, expert.ai helps life sciences and pharmaceutical organizations get the most out of all their information assets through unique and innovative applications of its hybrid AI technology.

Make the most of your data by transforming it into knowledge and insights.

About Expert.ai:

Expert.ai is the premier artificial intelligence platform for language understanding. Its unique hybrid approach to NL combines symbolic human-like comprehension and machine learning to transform language-intensive processes into practical knowledge, providing the insight required to improve decision making throughout organizations.

By offering a full range of on-premise, private and public cloud offerings, expert.ai augments business operations, accelerates and scales data science capabilities and simplifies AI adoption across a vast range of industries including Insurance, Banking & Finance, Publishing & Media, Defence & Intelligence, Life Science & Pharma, Oil Gas & Energy, and more.

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About Emerj Artificial Intelligence Research:

Emerj Artificial Intelligence Research is a market research and advisory company focused exclusively on the business impact of AI.

Companies that thrive in AI disruption run on more than just ideas. They leverage data and research on the AI applications delivering return in their industry today and the AI capabilities that unlock true competitive advantage into the future - and that's the focus of Emerj's research services.

Leaders in finance, government, and global industries trust Emerj to cut through the artificial intelligence hype, leverage proven best-practices, and make data-backed decisions about mission-critical priorities.

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