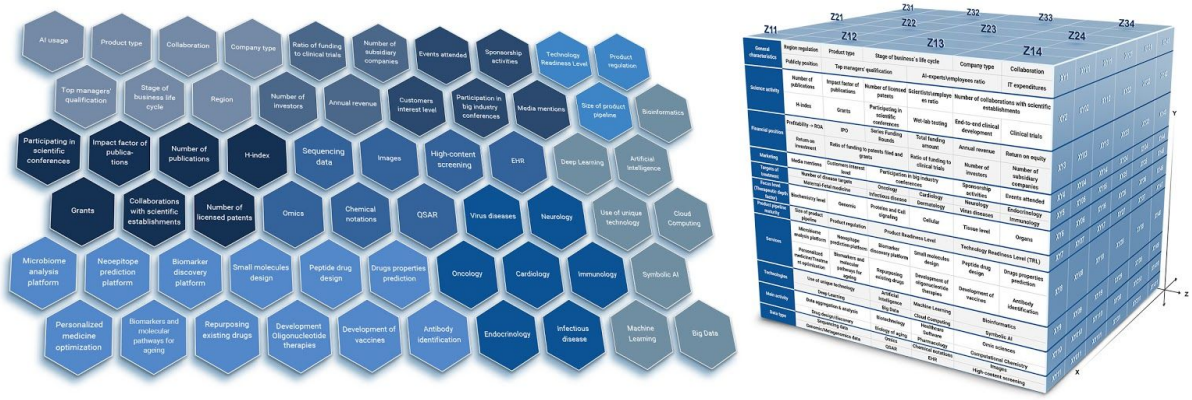
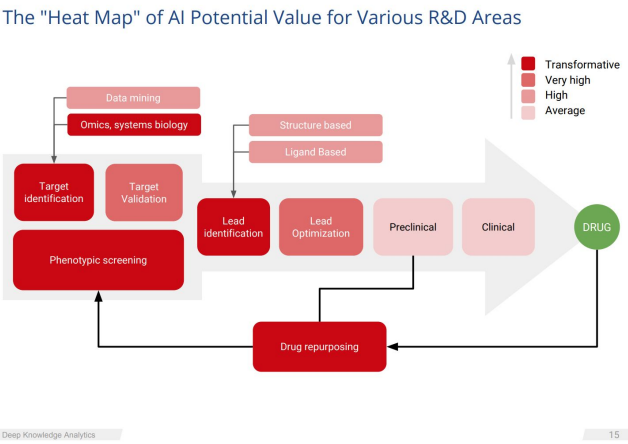


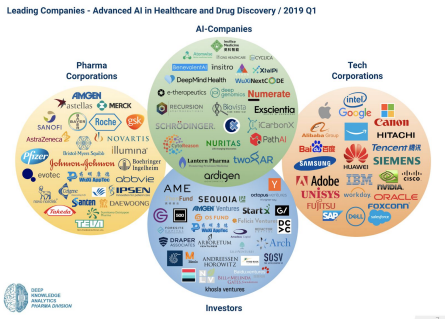
Specialized Metrics To Properly Assess AI-Pharma Startups

The level of sophistication used in due diligence should be on a
par with the level of complexity in a given industry.
AI-Pharma companies are 100x as complex as FinTech companies.
Methodologies used to assess them should be 100x as rigorous.

Discovering new drugs using AI is one of the most challenging areas in biological sciences. Top tier AI for Drug Discovery companies have distinguishing characteristics that include high levels of expertise in biopharmaceutical science, advanced proficiency in AI, very specialized teams, and constantly evolving internal knowledge. Companies in this sector are developing very advanced AI techniques that may enable them to produce the next blockbuster drugs, making them the new unicorns of the Pharma industry.

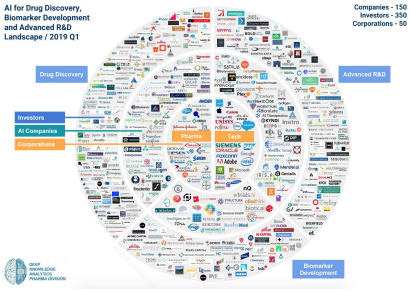


Due to the complexity, companies in this sector sometimes appear to be enigmatic black boxes to investors. Since most investment funds have not developed sufficiently robust methods to evaluate AI for Drug Discovery companies, they erroneously treat these companies as traditional biotech companies. There *could be* and *should be* better assessment methods for evaluating these companies. Even the most advanced companies should be scrutinized, and many parameters should be taken into account. Very few investment firms are capable of applying efficient due diligence to assess investment targets in this sector because they fail to use approaches that match the sophistication of the sector.

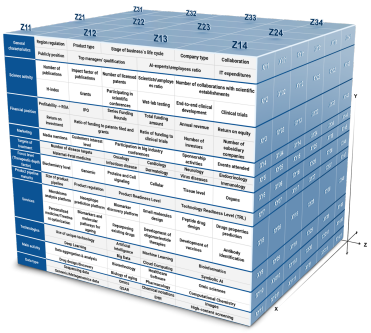


The Drug Discovery Environment

The drug discovery environment is big. It includes advanced AI for drug discovery teams, startups, pharma companies, venture investors, healthcare providers, and governments. Interactions in this environment are extremely inefficient. There are very few examples of high functioning relationships between AI startups, pharma companies and healthcare systems. Most of the venture investors are profiting on disproportions and inconsistencies in the sector, rather than through proactive adoption and use of the most advanced technologies available. This is why venture capital firms can generate profits without being sophisticated investors in this area. This scenario is far from ideal.

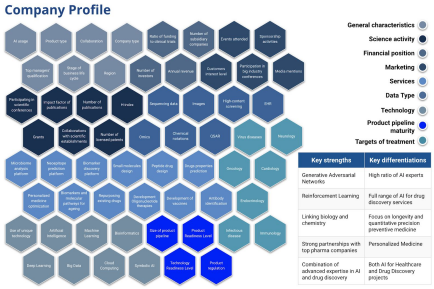


The pace of innovation in AI for Drug Discovery is unprecedented. These companies are using *fundamentally different* techniques than those used as standard practice 20 years ago. At the same time, the majority of investment funds are still using the *same* techniques that were used 20 years ago. The venture investment industry is not evolving at the pace required to match the rate of progress in DeepTech. The pace of progress in the investment technology industry (InvestTech) must keep up with the pace of progress in advanced science and technology. Investment funds that leverage progressive techniques to update their business models, exit strategies, and underlying assessment methodologies, will have a big advantage over funds that don't.



Specialized Metrics for Valuation and Forecasting

Although there are about 150 AI companies in the Drug Discovery space, very few of them are capable of building end-to-end solutions. Companies such as WuXi NextCODE, BenevolentAI, DeepMind Health, and Insilico Medicine are leaders in this area. Insilico Medicine was the first company to apply generative adversarial networks for generating new molecular structures with specified parameters and published a seminal peer-reviewed paper submitted in June 2016. Deep Knowledge Ventures invested in Insilico Medicine in 2014, years before the AI for Drug Discovery sector rose to prominence. In 2018, Deep Knowledge Ventures' analytical subsidiary, Deep Knowledge Analytics, developed *industry-specific due diligence methods* to determine which AI for Drug Discovery companies are overvalued, balanced (from a technological and financial perspective) and undervalued (where technology significantly exceeds financials).



Deep Comparative Analysis

Early stage startups are assessed using 100 parameters.
Advanced stage companies are assessed using more than 300 parameters.

Deep Knowledge Analytics uses multiple parameters and applies quantified metrics to perform deep comparative analysis to differentiate levels of maturity, business development, scientific advantages, and technological levels in a very objective way.

10 Fundamental Parameters used by Deep Knowledge Analytics

1.Team Structure

The number of specialists and balance in the company's team structure. Generally the best structure is 1/3 biochemistry specialists, 1/3 AI specialists, and 1/3 business development and investment relations experts, including former Pharma executives to assist in establishing contact and cooperation with Pharma companies. In practice what constitutes a *sufficient number* depends on the scope of the company's target applications. As a general rule, the number of specialists should be more than 10. Top tier companies typically have a significant number of employees with expertise in AI/ML/DL, which allows generating unique know-how and intellectual property. These companies have strong interdisciplinary teams enabling collaboration between AI and life science experts.

2. Independent Scientific Validation

Evidence of independent scientific validation including a significant number of peer-reviewed papers in the domain of pharmaceutical research published in high-impact journals. Companies in this category demonstrate significant advances in the application of AI to drug discovery, which is reflected in a high number of research publications, public presentations, press-releases, and patents.

3. Active Participation in Conferences and Events

Companies in this category are typically participate actively in high profile public events, discussions and forums; they appear in news and media regularly. They contribute significantly to promoting AI-driven approaches to drug discovery and basic biology, educating the public by specific use cases, and establishing best AI adoption practices. They usually have strong expertise both in drug discovery and development and in theoretical and practical aspects of AI technology, and have visibility within the scientific community through frequent presentations at scientific and technology conferences.

4. Direct Collaboration with Pharma and Tech Companies

The company should have direct collaboration with Pharma and Tech companies. This serves as additional validation that the company has something practical and tangible in its pipeline. The company should have official research collaborations with top 30 Pharma and Tech companies, where the company provides advanced know-how in AI-driven drug discovery.

5. AI Strength

There must be evidence that the company uses state-of-the-art AI techniques and consistently absorbs ongoing innovation in novel AI technologies and methodologies. If the company claims that it is an AI company, then it should be particularly strong in AI.

6. Investors

The company should have world-class investment funds as investors in their Series A or B rounds. There are fewer than 20 world-class investment funds recognized as being top funds globally by the entire investment community.

7. Target Molecules and Target Applications

The company should have a large number of target molecules discovered, and a sufficient number of molecules currently in clinical trials. Also taken into consideration is the number of target applications the company of pursuing (e.g. drug discovery, biomarker development, toxicity and ADME prediction, compound generation, compound binding, etc.).

8. Technology Development Scope

Whether the company is developing an end-to-end clinical pipeline, or focusing on just one particular segment in the overall drug discovery and development process.

9. R&D Depth

The proportion of the company's funds dedicated to its R&D activities, as opposed to completing the development of products near the end of their development cycle. A high proportion of funds devoted to R&D indicates proactive innovation and new technology adoption.

10. Ratio of Investment to IP Produced

The ratio of the amount of money invested in the company to the amount of IP produced by the company. This is indicative of the performance of the company's R&D activities and the company's future prospects, and reflects how intelligently and efficiently the company has utilized its funding to date.

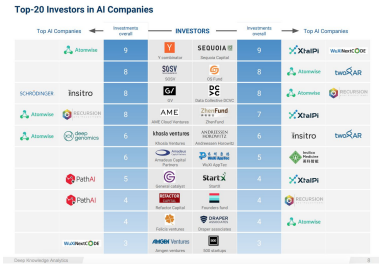
Progressive InvestTech

The business model traditionally used by venture funds has stagnated and will be ineffective going forward. To achieve success, investment firms operating in DeepTech industries will need advanced science and technology assessment capabilities and new approaches to venture capital business models and exit strategies. Deep Knowledge Ventures is developing a novel InvestTech solution which will be particularly relevant for the AI for Drug Discovery sector. The thematic Pharma AI investment fund is designed with one purpose - to invest in the best AI for Drug Discovery companies. The Pharma AI - Index Hedge Fund will use hybrid investment technologies that combine the profitability of venture funds with the liquidity of hedge funds, significantly de-risking the interests of LPs and simultaneously providing the most promising AI companies with a significant amount of investment.

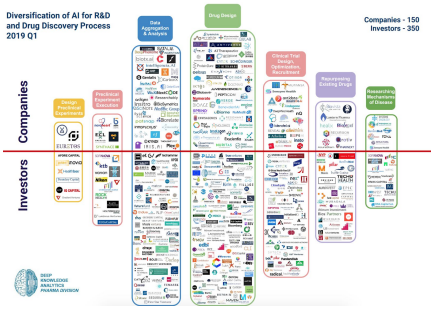
Deep Knowledge Analytics, a subsidiary of Deep Knowledge Ventures, regularly produces comprehensive quarterly reports on multiple topics including DeepTech, AI, Longevity, and AI for Drug Discovery. On April 12, 2019 Deep Knowledge Analytics published a new open-access quarterly report on the AI for Drug Discovery Industry. This 108 page report provides a comprehensive overview of the AI Pharma landscape through Q1 2019. This report features analysis of 350 investors, 50 corporations and 150 companies active in the sector, and features a list of 30 leading R&D centers that provide important research in this area. The report also covers the most important events that took place in the industry in Q1 2019.

Q1 2019 Report Highlights

- Investment in AI for Drug Discovery startups increased from $200 million in 2015 to over $700 million in 2018.
- The number of AI for Drug Discovery companies increased by 20 companies.
- The report shows 350 investors identified in Q1 2019, which is 30 more investors than Q4 2018.



- There are 350 investment funds investing in the sector including Google Ventures, Tencent, Wuxi, Andreessen Horowitz, Khosla Ventures, and Sequoia Ventures.
- Although there is no consensus so far among analysts regarding the expected valuation of the industry, estimates range from $5 billion to $20 billion by 2024.
- Cost of R&D per drug is growing exponentially, but sales per asset are definitely not increasing.



- An additional 10 new research centers were recorded since Q4 2018.
- Regional proportion remained almost the same, despite an increased number of entities and a growing interest from China.
- Declining R&D efficiency of Biopharma Companies remains a major concern among all parties in the industry with a continuous decline recorded during the last 8 years.
- Demand for AI technologies and AI talent is growing in the Pharma and healthcare industries and driving the formation of a new interdisciplinary field — data-driven drug discovery/healthcare.

Proprietary Report Series

Deep Knowledge Analytics Pharma Division publishes highly specialized proprietary reports to provide accurate, relevant, and up-to-date information about this sector. Proprietary reports are designed to provide deep analysis and tangible forecasts to facilitate strategic decision-making for M&A, and to help companies optimize strategic agendas, navigate challenges, and maximize opportunities. These proprietary case studies provide comprehensive information and practical insights to help biopharma companies and other entities optimize short and long-term strategies. Updated editions of each report will be released each quarter, incrementally increasing the precision, practicality and actionability of the analysis. Updated editions also provide identification and analysis of successful business strategies in the industry.

Deep Knowledge Ventures is a leading investment fund focused on the synergetic convergence of DeepTech verticals, frontier technologies and technological mega-trends. Deep Knowledge Ventures is known for its use of sophisticated analytical systems for investment target identification and due-diligence. Major investment sectors include AI, Precision Medicine, Longevity, Blockchain and InvestTech. @DeepTech_VC

Deep Knowledge Analytics is the DeepTech analytical arm of Deep Knowledge Ventures, specializing conducting special case studies, and producing advanced industry analytical reports. DKA's Pharma Division is the leading analytical entity specifically focused on the Pharma and AI for Drug Discovery sectors, and is the source of market intelligence and analytics for AI-Pharma, a specialized hybrid hedge fund. @DK_Analytics

This article was written by Margaretta Colangelo and Dmitry Kaminskiy.

Margaretta Colangelo, Managing Partner at Deep Knowledge Ventures, is based in San Francisco. Margaretta serves on the Advisory Board of the AI Precision Health Institute at the University of Hawai'i Cancer Center.

Dmitry Kaminskiy, General Partner at Deep Knowledge Ventures, is based in London. Dmitry is Head of International Development of the Secretariat for the All Party Parliamentary Group for Longevity and Managing Trustee of the Biogerontology Research Foundation.