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Diagnostics and Drug Development: Is Artificial Intelligence conquering other sectors?

The Artificial Intelligence (AI) wave is sweeping the world and taking over one industry at a time. It is everywhere around us - from suggesting what to view or buy, categorising our photos/emails, even figuring out the fastest route to reach our destination. With the many applications of AI, you can see an increase of applications within the healthcare sector. This can range from accessing medical care virtually to the production of new drug treatments which can then be made more readily available for us.

AI will not replace doctors or researchers in the pharma industry but will increasingly play an important part in healthcare. From determining diagnosis, designing treatment plans to assisting in surgery and post-surgery follow ups. AI can also be used to help with the monitoring and assisting in developing new or personalised drugs.

We have looked at the organisations and technologies dominating this patent landscape and have spotted some interesting trends. We have looked at three key technology areas representing AI in Diagnostics and Drug Development:

- Drug Development
- Medical Imaging
- Diagnostic and Treatment

Key Findings:

The Tech Giants are the major innovators in AI for Diagnostics and Drug Development, rather than Pharma

- Tech organisations are the top innovators in this space, not pharma organisations. This is no surprise as they sit on skills and knowledge in AI, which are necessary to build these types of solutions.
- Surveys show that the majority of organisations within health and pharma want AI to be a core capability. However, typical health and pharma organisations are not protecting inventions to any large extent in these technology areas. This could be due to the fact there is a lack of in-house knowledge and skills.

Medical Imaging is the largest area in AI for Diagnostics and Drug Development

- Organisations typically known for their imaging technologies, such as Canon and Fuji Film are prominent within AI for medical imaging.
- Out of the analysed technologies, Medical Imaging has the largest number of inventions and continues to grow globally. However, activity appears to decrease in Europe and North America. Solutions related to AI supported image diagnostics or enhancements are offered by many organisations today, which could be a reason for the stagnation.
- AI is starting to be used in Drug Development and should be monitored closely. Currently, many inventors in this space are universities, indicating that widespread implementation in industry has not yet occurred.

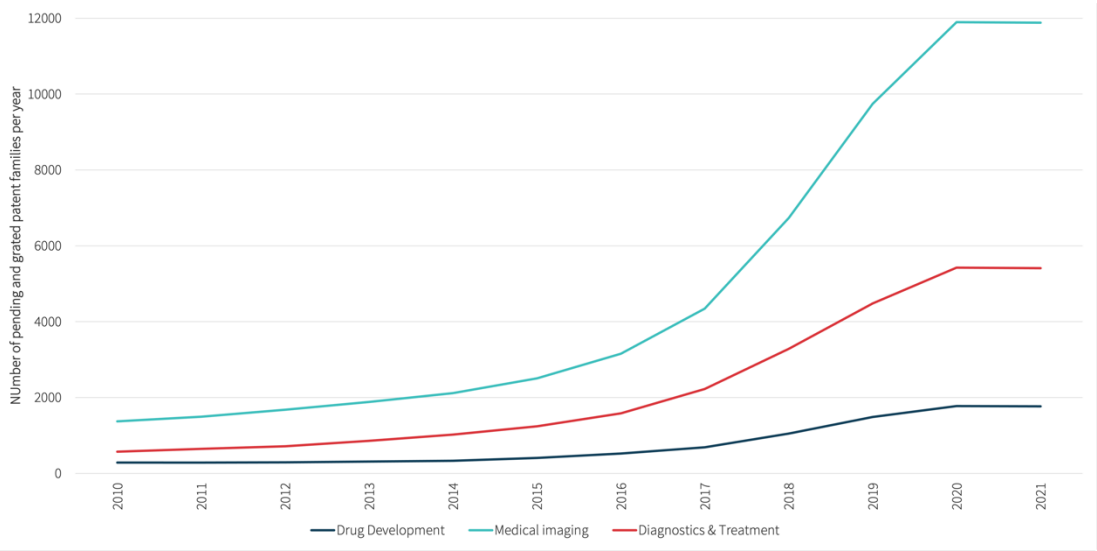
China is leading the way in development of innovation in this space

- China is well on track to become the epicentre of AI in health and pharma, with large organisations such as Tencent and Ping An taking the lead.

AI revolutionising the healthcare industry

Artificial Intelligence has the potential to revolutionise healthcare, and AI inventions in the healthcare and pharma space have increased over 200% in Europe and North America, and over 700% globally over the past 10 years. This growth is particularly strong in the area of diagnostics and treatment. Although medical imaging has the largest number of inventions; diagnostics and treatments have seen the largest increase globally, with a growth of almost 800%.

Chart 1: Pace of Innovation globally

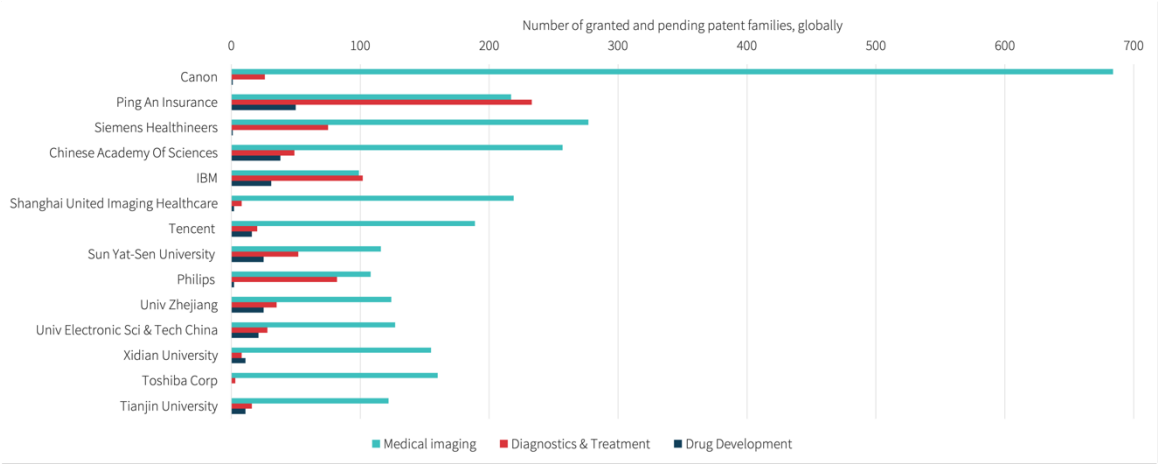


Source: Cipher

The pace at which inventions are filed is no surprise considering the potential of artificial intelligence in the healthcare sector. AI in drug development is, according to GlobalData, expected to not only reduce the time and cost of taking a drug to market but may also improve the likelihood of a drug receiving the necessary approvals. There are however hurdles to overcome in the healthcare industry to fully utilise AI. According to GlobalData and ITProPortal, one major challenge is the lack of expertise in AI and accessibility of data within the life science/healthcare industry.

These two key challenges are part of the reason why many organisations choose to collaborate with large tech organisations with AI expertise. Google collaborating with Sanofi and Microsoft joining forces with Novartis are examples of tech giants agreeing to lend their expertise to solve problems faced by the pharma industry.
This is reflected in the patent data, where the top inventors are indeed large tech organisations.

Chart 2: Top patent owning organisations globally



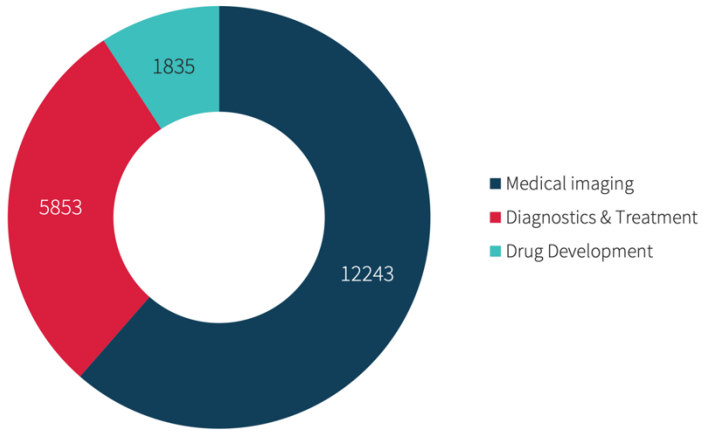
Source: Cipher

Several big players can be seen among the top owners across these three AI applications such as IBM, Tencent and Ping An Insurance, as well as organisations more known for their imaging technologies such as Canon and Fuji Film. Organisations we are used to seeing in healthcare are not completely absent, for example Siemens Healthineers and Philips are both among the top 15 global patent owners across these three technology spaces.

The presence of tech giants, imaging organisations as well as companies more common in medtech is no surprise. Imaging organisations have deep knowledge in technologies needed in medical imaging as well as AI and have long been providers of x-ray/imaging equipment used in the healthcare sector. Tech giants have access to data as well as the skills and knowledge relating to AI. Both Philips and Siemens Healthineers are large organisations with a range of capabilities within the respective organisations.

Chart 3: Number of active patent families by technology, globally

Medical diagnostics is a great application for AI. This is reflected in the large number of innovations in medical imaging, diagnostics and treatment areas.



Identification of patterns in, for example, medical records to predict outcomes or make decisions regarding most appropriate next steps in a treatment plan is well suited for the capabilities of AI. As is for example supervised machine learning for identification of abnormalities in medical images such as CT scans. This may have contributed to the vast number of inventions which may result in this space being highly competitive.

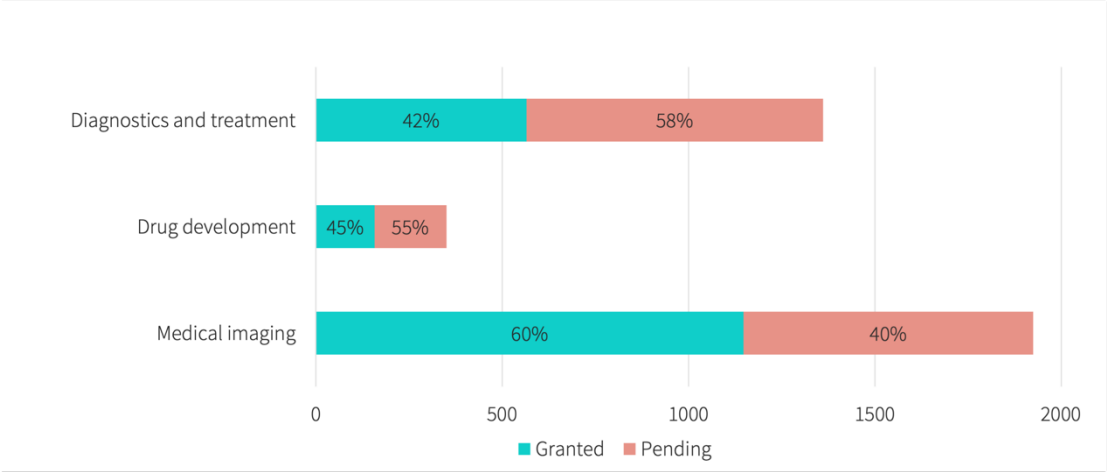
Source: Cipher

AI driven solutions already in play

There are many examples of solutions where AI is applied to medical diagnostics which are readily available to the healthcare sector. For example, Canon offers AI solutions which range from optimising workflows, tailoring treatments and improving imaging quality through AI-driven image reconstruction in their advanced intelligent Clear-IQ Engine (AiCE). Similarly, Ping An Insurance offers an intelligent image analysis system which shortens the time it takes to diagnose a patient. According to Ping An, their 'AskBob Doctor's smart imaging model' for diagnosing pelvic and hip injuries is the first solution to accurately detect all kinds of trauma-related findings at the same time in x-ray images. Typically, AI solutions like these can only detect individual fractures. Ping An also offers AI driven solutions for managing type 2 diabetes which is currently serving more than 100,000 patients in China. Siemens is yet another example of an organisation offering AI driven support for image diagnostics.

All technology areas investigated here are growing in size globally and have fewer granted than pending patent families indicating a large pipeline of inventions. An increase in activity is therefore to be expected in the foreseeable future. There are however geographical differences which can be seen. Medical imaging now has fewer pending than granted patent families in Europe and North America auguring a decline in activity for this technology area.

Chart 4: Current number of inventions, North America and Europe

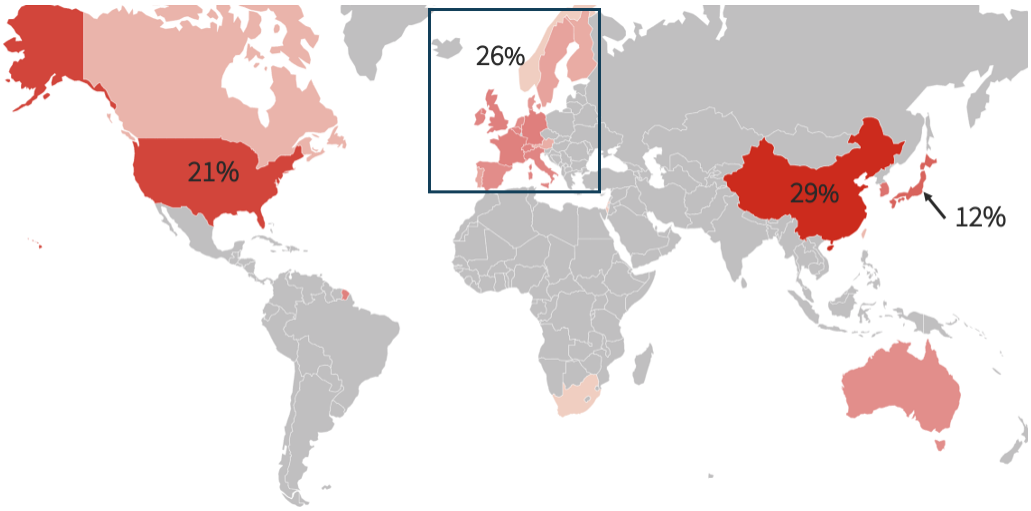


Source: Cipher

This may suggest medical imaging will reach a phase where the pace of innovation will stagnate due to saturation or a decreasing interest in this market in these geographies.

Considering AI based solutions for assisting with image diagnostics, reconstruction and analysis are widely available from several organisations such as Ping An/Siemens. In combination with a relatively crowded and potentially competitive innovation landscape, it is perhaps no surprise we are approaching a phase with less activity. The increasing trend we see globally is largely due to the high number of patents stemming from China, where the activity seems to be never-ending. China has its goals set on being the AI leader of the world, and they are no doubt on track to achieve this.

Chart 5: Percentage of granted patents by geography



Source: Cipher

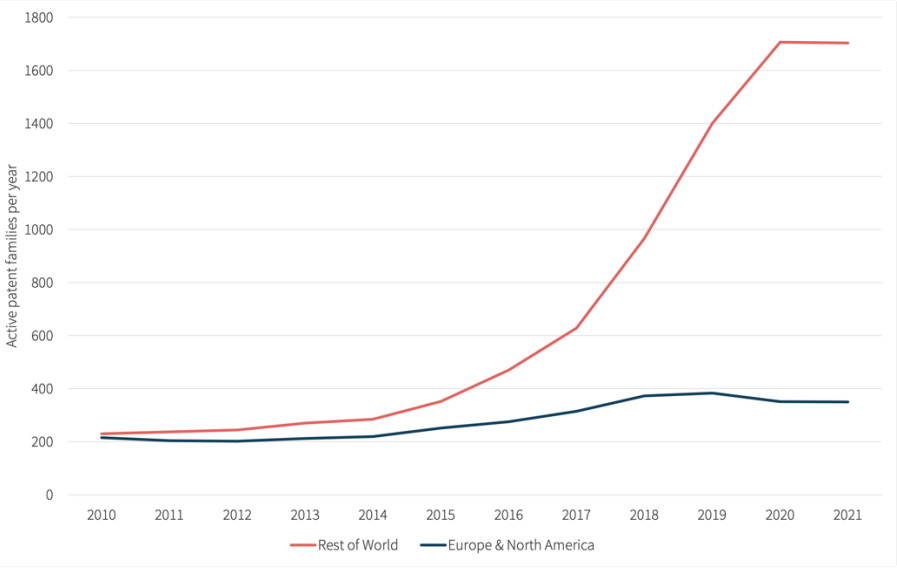
There are not nearly as many patented inventions relating to AI for drug development as there are for medical imaging and diagnostics and treatment, but the area has seen an over 500% global increase over the past 10 years. AI is expected to have a major impact on the drug development industry.

AI as the future of pharma

AI has had notable impact on areas like diagnostics/image recognition, but the pace of innovation and implementation in drug discovery and development has been slower. According to a survey conducted by BenchSci in 2018, only 41% of the over 300 researchers asked were familiar with the uses of AI for drug discovery. The same survey also found that whilst 59% of participants expect an increased use of AI within their organisations, only 16% anticipate a substantial increase. According to the same survey, lack of knowledge as well as concerns regarding safety and costs are stated as barriers for a higher implementation of AI for drug discovery. Therefore, it appears one reason for the low number of applications could be that many researchers are unaware of the potential capabilities of AI. However, considering that the drug development process can take 10 to 20 years and often comes with a price tag of $500 million to $2.6 billion, solutions to shorten and make this process cheaper should be of major interest to drug companies, investors and patients.

When investigating the pace of innovation for this technology, we see a noticeable global increase from 2016, indicating a recent increase in interest in these types of applications. Most of these innovations stem from China, and the increase in Europe and North America has been comparatively modest but still present. 33% of all granted individual patents are Chinese, followed by the US with 16% of all granted individual patents.

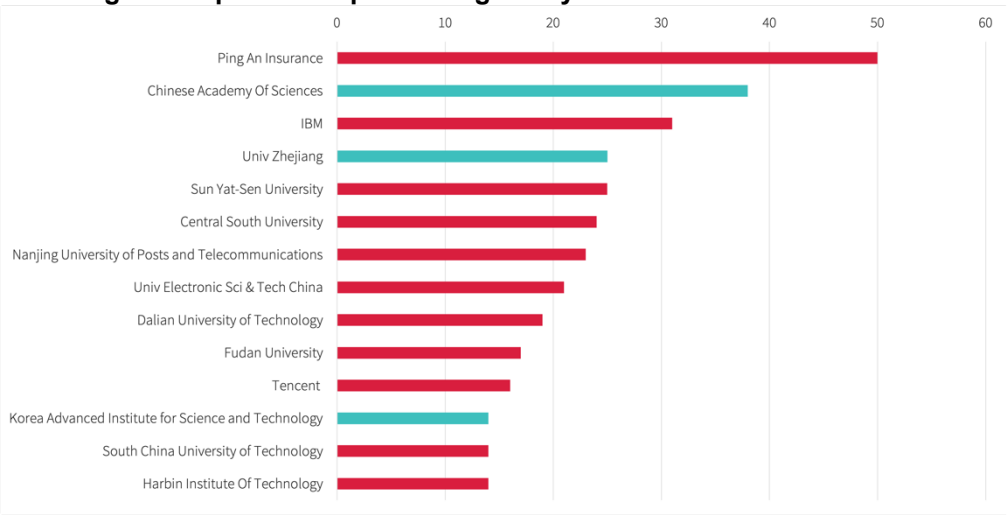
Chart 6: Drug Development - Pace of Invention by geography



Source: Cipher

Owners in this technology space are primarily universities and research institutions, with a few noteworthy exceptions such as Ping An insurance, Tencent and IBM. In 2020 Tencent announced they had launched a drug discovery platform, iDrug, driven by AI technologies. Currently, Tencent has patented 16 inventions in this space, all but one of them were filed in the past 3 years. Tencent has previously dabbled in healthcare in relation to telesurgery, for example, but this is a new direction for them to take.

Chart 7: Drug Development – top owners globally



Source: Cipher

Baidu is also looking to enter the space and was last year reported to be scouting for a $2 billion investment to put towards a biotech start-up with an AI focus. Baidu are not unfamiliar with the biotech space; they have previously invested in AI start-ups such as Atomwise and Insilico.

Not only do we see large organisations entering this space, but big money is spent investing in smaller companies with a focus on AI driven drug development further indicating this space should be monitored closely as it will be of great importance in the future. In 2019 Insilico Medicine signed a dual-programme discovery collaboration with Jiangsu Chia Tai Fenghai Pharmaceutical worth up to $200 million. In March this year, AI drug discovery start-up Insitro secured $400 million Series C investments and Cardiff based biotech company Antiverse raised £1.4m to put towards their AI antibody drug discovery platform. So far, primarily universities appear as top innovators in this space, indicating that wide implementation and maturity has not yet been reached for the use of AI in drug development.

We expect the growing interest in AI for drug development to persist. Increased activity in inventions within this space as well as large amounts of investments being made into it are both indicators of future growth. Time is of the essence in drug discovery and development and AI holds tremendous potential in speeding up the process of developing and approving new drugs. Time will tell if AI for diagnostic purposes, and especially diagnostics of medical imaging will see the same growth going forward that we have seen historically. Common for all AI applications investigated here is that China is emerging as the epicentre. China is the market to watch, and Europe and North America are lagging in comparison.

Technology Scopes

The technology scopes are what defines what is included in the patent landscapes above.

Diagnostics and treatment

Artificial intelligence (AI) and machine learning (ML) used for determining appropriate treatment for patients, diagnosing a patient or figuring out how a patient would react to a drug. This includes drug disease matching, support in medical treatment decision-making, predicting prognosis of disease and identifying drug-to-drug interactions in medical content among other things. AI and ML for medical image diagnostics not included here.

Drug Development

Artificial intelligence (AI) and machine learning (ML) used in the drug development process. This includes finding new drugs, new targets for existing drugs, investigating drug actions, adverse effects of drugs, drug safety, estimating drug efficacy among other things. It does not include applications like determining appropriate treatment for a specific patient or diagnosing a patient or figuring out how a specific patient would react to a drug.

Medical imaging

Artificial intelligence (AI) and machine learning (ML) used to diagnose or assist in diagnosis of a patient by medical images such as x-rays, ultrasound or CT images. Image recognition of body parts (e.g. hands or ears) and identification of disease in plants are not included.

For more information on who owns what and where in the Diagnostics and Drug Development space, access Cipher via your subscription or if you'd like to understand more about the Life Sciences taxonomy used to run this report in Cipher, contact us directly at info@cipher.ai .

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