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Artificial Intelligence Applications & Venture Funding in Healthcare

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Abstract

Venture Capital (VC) funding raised by companies producing Artificial Intelligence (AI) solutions is on the rise. In healthcare, VC funding is distributed unevenly and certain technologies have attracted significantly more funding than others. The funding decisions made by VC companies also work as a technology driver for the industry. We analyzed a database of 106 Healthcare AI companies collected from open online sources to understand factors affecting VC funding of AI companies operating in different areas of healthcare. Companies acting as R&D catalysts have been most succesful in raising VC funding. The results suggest that there is a significant connection between higher funding and having research organizations and pharmaceutical companies as the customer of the product or service. In addition, focusing on AI solutions that are applied to direct patient care delivery is associated with lower funding. We discuss the implications of our findings on health technology research and development, and on the barriers of platform data markets in healthcare industry.

Tiivistelmä

Tekoälyn sovellukset ja pääomasijoitukset terveydenhuollossa

Tekoälysovelluksia tuottavien terveydenhuoltoalan yritysten keräämä pääomasijoitusten määrä on kasvussa. Terveydenhuollon pääomarahoitus eri yritysten välillä jakautuu varsin epätasaisesti. Pääomarahoituksen jakautumisesta voimme tehdä tulkintoja terveydenhuoltoalan tekoälysovellusten tulevasta kehityksestä. Analysoimme avoimista verkkolähteistä kerätyn 106 terveydenhuoltoalan startup-yrityksen toimintaa ja niiden tekoälyn sovelluksia ymmärtääksemme näitä terveydenhuoltoalan kehitykseen liittyviä eri tekijöitä. Tulokset viittaavat siihen, että korkeampi rahoitus on yhteydessä niihin tuotteisiin ja palveluihin, joiden asiakkaana on tutkimusorganisaatio tai lääkeyhtiö. Suurimmat sovellusalueet yritysten määrässä mitattuna ovat 1) tutkimus-&kehitys-katalyytit; 2) lääketieteellinen kuvantaminen ja analysointi; 3) potilaiden seuranta. Keskustelemme havainnoistamme ja niiden vaikutuksista terveydenhuollon tutkimukseen ja kehitykseen sekä markkinoiden mahdollisista esteistä.

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Keywords: Artificial Intelligence, Capital Funding, Technology

Asiasanat: Tekoäly, Pääomasijoitukset, Teknologia

JEL: G2, G24, I1, I19

Introduction

The number of digital health companies that employ Artificial Intelligence (AI) solutions is growing. Many applications improving quality of care and personalizing the care process have been developed, ranging from Intelligent Patient Flow Management systems [1] to emotionally responsible online roleplay avatars [2]. AI enables machines, software, systems and services to act reasonably according to their task and situation [3,4]. Big amounts of data have become a natural situation in many consumer-driven platform businesses – we have witnessed several new types of uses for Machine learning (ML) algorithms [5]. However, data in healthcare seem to be and act as a different type of a factor of production for ML algorithms - we are observing more industrial types of uses than in other platform businesses.

As with other innovation systems, also AI technology environment in healthcare is highly driven by capital investment decisions [6]. Capital investment decisions affect the companies' research strategies, and VC investors might affect the target markets and development foci of the companies [6]. Also the decision on which companies are funded and which are ignored affects the developmental trends of the whole industry [7,8,9].

According to a recent white paper by Rock Health [10], the venture capital (VC) funding of digital health companies applying AI/ML has grown in a similar way as digital health VC funding overall. The paper states that in the United States, 121 digital health companies leveraging AI/ML have raised a total of $2.7B with 206 deals from 2011 to 2017, which is slightly over 10% of all venture dollars invested in digital health during that period. Funding for AI/ML companies peaked in 2016. [10]. The VC funding of AI Health companies has distributed unevenly and certain technologies have attracted significantly more funding than others. For example, companies functioning as research & development catalysts, including drug discovery and clinical trial management space, have been highly successful in raising VC funding. On the contrary, companies with value propositions focusing on applying AI/ML to direct patient care delivery have been more modest in raising funding. It has been suggested that one of the reasons for the difference in funding amounts is that there are fewer risks in using AI to improve business functions instead of patient treatment [10].

Capital funders disinclination to fund directly patient-oriented solutions is by far not a trivial finding. If we think of digital health startups, practically all companies need some level of external funding to manage their growth and innovation strategy. Already some evidence of unaligned goals between funders and technology developers affecting the state of medical AI solutions has been unveiled: Lehoux et al. [9] stated that *"Current innovation policies should be carefully examined because capital investors' understanding of the world in which they operate largely determines which health technologies make their way into healthcare systems and which may never come into existence."* In a similar vein, Hirsch-Kreinsen [6] expressed worry over technology development: "*Linking of innovation processes in the field of pharmaceuticals to criteria of the financial market leads to a focus of their innovation strategies on products with particularly good prospects, blockbusters, that is, patented key products with a high turnover and profit margin.".* Furthermore, Lehoux et al. [7] have also emphasized that the current institutional arrangements for innovation systems direct public policies towards supporting the development of technologies that capital investors deem valuable. Information on which types of companies attract venture funding is also crucial for public funding agencies determining their own focus areas.

In this study, we aim to understand the factors that influence VC funding of AI companies operating in different areas of healthcare. Our goal in this study is to analyze whether the two already explicated phenomenons concerning funding are visible also in industry data gathered in our research project. Based on the recognized preferences of VC investors in recent years, we study whether the companies the technology of which is used in direct patient care delivery receive less funding than other companies; our second point of interest is whether the companies the technology of which is mainly paid by research organizations and pharmaceutical companies, or healthcare providers and insurers, are likely to receive more funding than mainly patient-paid technologies.

We analyzed a database of 106 healthcare AI companies collected from open online sources. The descriptive statistics and results of a multiple regression analysis characterize the funding decisions. After presenting the results, we discuss the implications of our findings on health technology research and development.

Data and Methods

Dataset and descriptive statistics

Our database consists of funding information of 106 companies found from Crunchbase.com web portal. Crunchbase is a platform for finding business information about private and public companies globally, including information about investments and funding information, founding members, mergers and acquisitions, news, and industry trends. From 3981 companies which listed "Artificial Intelligence" as their technology category, we selected those 1434 that had raised more than 250 000 dollars funding. Out of these, 115 were healthcare companies. We limited out multi-industry companies who had only narrow focus on healthcare. In total, 106 companies were included in the analyses. In total, these companies had raised $1,4B in funding. The data were retrieved in June 2017 and June 2018. For companies that were in the datasets in both years, the 2017 data was used. We used data from 2017 for 39 companies and from 2018 for 67 companies.

The descriptive statistics are described in Table 1. Our main variable of interest is the logarithm of total funding amount raised by companies. In addition to information gathered from the Crunchbase.com database, author AH did online exploration on each of the companies' web page to assess some additional characteristics of the companies. We added information on whether the company's AI solution was used directly in patient care delivery, and whether it employed machine learning, machine vision or natural language processing technologies. We also added the population data of the companies' headquarter cites (on both city, metropolitan area and country level). An open description of each AI solution can be found in an Appendix.

To better understand the multitude of diverse technological innovations included in the dataset, we categorized these into larger groups (Figure 1). Similarly to Rock Health white paper findings, the most common technology category (18% of companies) was research and development catalyst, which raised $316 millions in funding.

Variable	Mean / Percentage	Std. Dev.
Log Total funding amount (MEUR)	1.40	1.61
Applying AI/ML to direct patient care delivery	66 %	0.48
Main Customer		
Healthcare providers and insurers	70 %	0.46
Research organisations and pharmaceutical companies	21 %	0.41
Patient	9 %	0.29
Technology		
Machine Learning	65 %	0.48
Machine Vision	22 %	0.41
Natural Language Processing	28 %	0.45
Continent		
Europe & Israel	37 %	0.48
Northern America	56 %	0.50
Asia & Australia	8 %	0.27
Population		
Log Headquarters city population (millions	-0.33	2.05
Log Headquarters cluster population (millions)	0.75	1.48
Log Headquarters country population (millions)	4.77	1.43
Founding year (median)	2014	
Company Age	3.85	2.63

Table 1 – Descriptive statistics

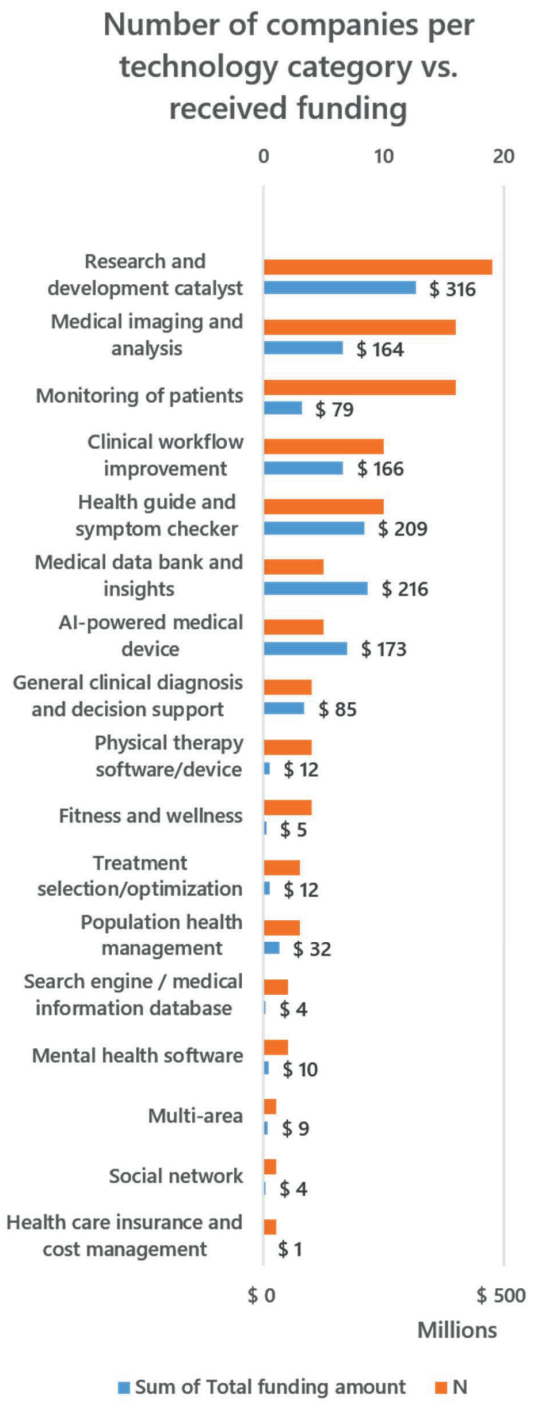

Figure 1 – Technology categories vs. funding raised

Methods and model specifications

We used statistical tests and regression analysis to explore the associations and answer the research questions. As a dependent variable in the OLS regression, we employed the amount of funding raised during the sample year 2017. The amount was retrieved from Crunchbase.com database. We used two different sets of independent variables: Firstly, we did webpage analysis of all the companies and evaluated whether the company's technology was used in any phase of the treatment of the patient. Secondly, we also analyzed via webpage analysis whether the main payer-customer of the AI solution was healthcare provider or insurer, research organization or pharmaceutical company, or patient.

As a control variable, we assessed some technology categories leveraged by companies that have raised substantial VC funding in the past [11]. These AI technologies included Machine Learning (ML), Machine Vision (MV) and Natural Language Processing (NLP). We included all of these in the regressions as dummy variables, as any company could have had any of these technology categories or none of them.

We also controlled for the geographical location of the company headquarters. We used a rough categorization of America, Europe & Israel, and Asia & Australia, as these regions have some shared characteristics, e.g. time zones, but also because there is evidence of differing VC investment patterns between regions (e.g. [12]). From Asia and Australia, most of the companies were China-based. It should be noted that Crunchbase.com site has some geographical bias being mostly focused on North American markets.

As most of the VC is concentrated in cities [13] and there is some evidence of VC companies showing local bias in their funding decisions [14], we also controlled for the headquarter region's size. Also the country size was controlled for as a proxy for capital market size, which may affect the country attractiveness [15]. Furthermore, the company age was controlled for, as startup companies typically have a strong survival bias (e.g. a three-year survival rate of approx. 63% was deemed normal in [16]).

Statistical analysis was performed using STATA 15.

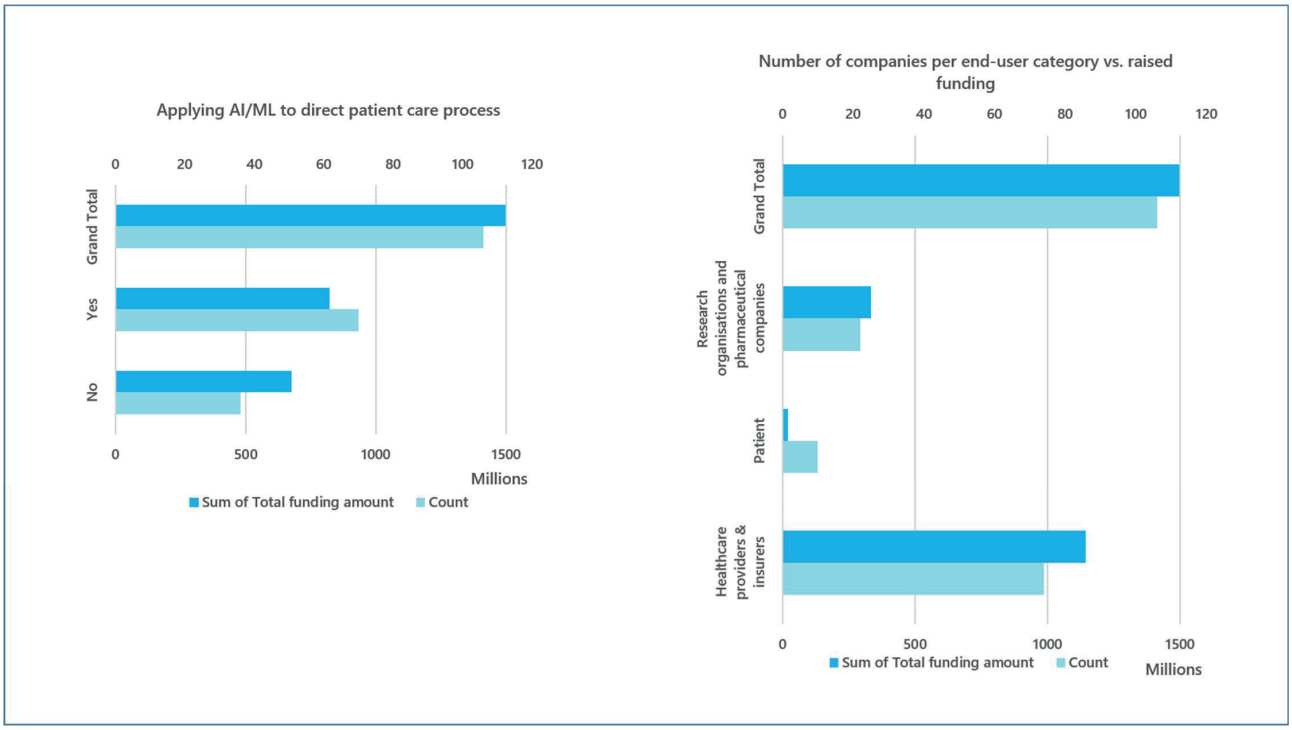

Figure 2 – Number of studied companies vs. funding raised

Results

Initial evidence

Initial descriptive analysis in Figure 2 suggests that those companies who were applying AI/ML technologies to direct patient care delivery seem to raise less funding per company than those who were not (average funding $11.7M vs. $18.7M per company). Second observation is that the companies whose main customer category is patients have raised noticeably less funding than companies having research organizations or healthcare providers as main customers ($1.9M vs. $15.2M and $15.4M, respectively).

Regression analysis results

The results of the regression analysis can be found in more detail in a publication by Halminen et al. [18]. The main finding in Model 1 was that the independent variable of direct patient care delivery was linked to 48% decrease in funding. In Model 2, we compared the effect of having research institution or healthcare provider as the main customer to those companies having patients as the main customer. In this model, research organizations and pharmaceutical companies' factor for funding was associated with 290% increase in funding. Company age had a significant association to higher amount of raised funding per year. This can be related to companies growing each year, which causes the funding rounds typically to go up. Other significant and positive control variable was Asia & Australia.

Discussion

The results suggest that employing AI solutions directly in patient care delivery is connected with a decrease in funding compared to other solutions. This could indicate that funders are more cautious for treatment technologies that require higher level of evidence of effectiveness before implementation. Also the technologies mainly paid by research organizations and pharmaceutical companies received remarkably more funding than those paid by patients.

In other words, AI technologies for which the main customer was patient raised significantly less funding than those targeted to research organizations. As VC investments are a key driver of innovation systems, it should be considered whether the uneven funding is hindering the development of patient-focused health technologies. Furthermore, it should be considered whether public funding should have patient-centred AI technologies as a specific target group.

The results suggest that AI solutions with patient-side implementation are seen as less attractive than institution-based solutions. This may well be because technologies implemented in patient care and/or used by patients have to pass, in addition to evidence of effectiveness, many more regulatory approvals and administrative evaluation processes than back-office technologies and research and development operations. However, there are two other possible options that may be present. The results may also be due to differences in the levels of funding needed for technologies paid by different parties – namely that

research institutions and pharmaceutical companies might be more likely to purchase technologies and solutions involving high infrastructure investments compared to patient-customer-side products. The findings might also stem from patient-side technologies requiring lower R&D costs, as they typically do not have to be integrated in other organizational data infrastructures as long as they are interoperable with most mainstream information systems.

In many different fields applying AI, there has been development of platform solutions employing customer data. However, our findings indicate that in healthcare sector technologies paid by patient-customers tend to receive lower funding. A possible explanation to this is that data in health care is a trust service. Additionally, the health care trust service differentiates from the confidence of consumer driven platform trust. This might result in a slower and more challenging development of customer data platform solutions in healthcare field than in other industries.

Moreover, descriptive of health care industry, particularly of AI solutions in healthcare, is the focus on special expertise and highly educated professionals, which could explain the emphasis on research organization funding. For healthcare AI companies, CEOs with PhD level education are almost twice as common than in other digital health industries [17]. Further research is needed to compare the findings of this research with data from other industries to understand whether this phenomenon is unique for healthcare companies.

The dataset suffered from some level of geographical bias, which we tried to control for. It is possible that the dataset was not perfectly representative for some regions, such as Asia, and that only the companies which had raised remarkable amounts of funding were included from certain areas. However, we aimed to control for this variance to minimize its effect on the relation between independent and dependent variables. In future studies, a more compherensive database is needed.

It should be noted that as this was not a controlled study, and there is always the risk of endogenous factors that can explain the variance in the levels of funding, such as several societal, educational, regulatory, and other factors. However, preliminary robustness tests did not indicate any extreme external effects affecting the dataset. Furthermore, the variables were assessed subjectively by author AH during the webpage analysis, which might have affected the qualifiers given for companies. Also the time scale of the study has some limitations, as only one data point per company was included. Longitudinal analysis is needed to better understand the phenomenon.

A possible future research direction would be to examine the interaction effects and study whether the research institutions and pharmaceutical companies as main customers have a moderating effect on the funding of those AI healthcare companies that produce solutions for direct patient care delivery. Another interesting further study could investigate the effect of regulatory environment (for example healthcare related permissions required) on the funding raised. Thirdly, it might be useful to compare AI healthcare related research funding received by research institutions and VC funding raised by AI companies. The data concerning VC funding for companies employing AI technologies in healthcare is still relatively scarce, and will most likely improve in quality and quantity in the coming years.

As future research prospects, we are aiming to expand the dataset with data from 2019 for analyses in panel setting.

Conclusions

The objective of this study was to increase understanding of factors affecting VC funding of healthcare AI companies, in particular how patient-centredness of healthcare AI technology affects the amount of funding raised. The results indicate that companies the technologies of which are employed directly in patient care delivery tend to raise lower amounts of funding. Also the companies whose main customers were research organizations or pharmaceutical companies got significantly more funding than technologies mainly paid by patients.

The results imply that patient-targeted AI technologies face remarkable challenges in VC funding, and the development of customer data markets might be slower and more difficult in healthcare than in other industries.

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Appendix

Year	Company name	Category	New description
2018	Ada Health	Health guide and symptom checker	A mobile application for self-diagnosis and tracking symptoms. The recommendations/results are personalised based on 1) the user's answers to a set of questions, 2) the user's symptom history and 3) the answers and history of other users. The software uses machine learning to give better recommendations by analysing the users' symptom data.
2018	Aidoc	Medical imaging and analysis	Aidoc helps detect and pinpoint critical anomalies for radiologists through deep learning and AI algorithms that analyze medical images and patient data. Aidoc eases up the work list and frees up time and attention to what matters.
2017	Noomi (Aifloo)	Monitoring of patients	Noomi (previously Aifloo) offers a mobile application and wristband sensor that are used to track the behavioural patterns of elderly people. The machine learning algorithm can notice if something is wrong and can issue warnings.
2017	Analytics 4 Life	Medical imaging and analysis	A radiation-free, Complex Phase Space -based medical imaging techonology combined with machine learning image analysis to enable physicians to make better diagnoses.
2017	Athelas	AI-powered medical device	A blood testing device connected with a mobile application. The software uses machine vision at least to count and classify white blood cells. The machine can be used by doctors, researchers and patients.
2017	Ayasdi	Clinical workflow improvement	A software platform and applications to organizations looking to analyse and build predictive models using big data or highly dimensional data sets. Organizations and governments have deployed Ayasdi's software across a variety of use cases including the development of clinical pathways for hospitals, anti-money laundering, fraud detection, trading strategies, customer segmentation, oil and gas well development, drug development, disease research, information security, anomaly detection, and national security applications.
2018	Babylon Health	Health guide and symptom checker	A mobile application for communicating with GPs, prescription delivery and AI-powered symptom-checking. The software learns from medical data, user data and expert inputs. Also NLP is used to analyse user inputs, clinical reports etc.
2018	BaseHealth	Population health management	A health platform for medical companies and agencies that predicts the probability of different health conditions in populations. The information can be used to make better decisions in health care planning and operations. The platform uses machine learning on large patient data sets.
2018	Bay Labs, Inc.	Medical imaging and analysis	Bay Labs combines deep learning with cardiovascular imaging to help in the diagnosis and management of heart disease.
2018	Behold.ai	Medical imaging and analysis	Cognitive computing / machine vision software that can be to used to analyse radiographic images.
2018	Bigfoot Biomedical	AI-powered medical device	The company is developing an automated insulin delivery system that is connected to a mobile application. The purpose is to easen the life of diabetics by automatically tracking the insulin level in the user's body and by automatically injecting or recommending to inject a right amount of insulin at the right time. Machine learning is used in personalising the therapy.
2018	Biofourmis	Monitoring of patients	Biofourmis gathers patients' vital signs and other medical data (weight, sleep activity etc.) from medical and wearable devices into an online platform and a mobile application, where they can be tracked by the patients and their physicians. Machine learning is applied to produce personalized physiological health models and to notice health problems,such as cardiac arrest, early.
2017	Biofourmis Pte. Ltd.	Monitoring of patients	Biofourmis gathers patients' vital signs and other medical data (weight, sleep activity etc.) from medical and wearable devices into an online platform and a mobile application, where they can be tracked by the patients and their physicians. Machine learning is applied to produce personalized physiological health models and to notice health problems,such as cardiac arrest, early.
2017	BrainQ	Treatment selection/optimization	BrainQ is developing breakthrough technology that utilizes its proprietary AI algorithms to identify high resolution spectral patterns in patient's brain waves (EEG). These patterns are interpreted and then translated into a tailored electromagnetic treatment protocol aimed to treat disabilities following neurodisorders such as stroke and spinal cord injury. These are conditions that globally affect tens of millions of people each year. The company's technology has already been applied in animal studies and early stage human clinical trials which have shown very promising results. The unique AI technology largely stems from developing and owning one of the largest known Brain Computer Interface ("BCI")-based EEG databases for motor tasks.
2017	Buoy Health	Health guide and symptom checker	The company provides a chat bot online and in a mobile application for accurate self-diagnosing and connecting the patient with the right medical professional. The bot has been taught by at least 18 000 scientific articles covering over 5 million patients. Most likely it also learns constantly from patients' answers.

2017 CardioCube	Monitoring of patients	CardioCube is a voice assistant (currently based on Amazon Alexa) used to manage chronic heart diseases. The patient can freely talk about their health and everyday life to the voice assistant, which will pick up and track any factors regarding their health. The voice assistant can also ask questions from the patient and have a conversation with them. The collected data can be followed by the doctor who can use it to make decisions about the patient's treatment.
2018 CARMAT	AI-powered medical device	Carmat offers an bioprosthetic heart for people with end-stage heart failure. The heart replaces the failing heart of the patient and can even be powered by carriable batteries. Intelligent sensors (maybe using machine learning) automatically adjust the heart's function to patient's physiological needs.
2018 Caspar Health	Physical therapy software/device	Caspar provides an platform for patient physiotherapy, occupational therapy, speech therapy, sports therapy as well as nutrition advice and psychology. The patient follows the therapy instructed on the platform, which contains many exercise and educational videos. The platform can also be used to communicate with doctors. Big data and machine learning are claimed to be used to improve the therapies.
2018 CloudMedx Inc	Clinical workflow improvement	CloudMedX is an artificial intelligence platform meant for tracking and improving patient journeys. The platform provides a clear overview of patients, their health problems and estimated risk factors. The platform also provides an access for patients to their own data. Also insurance companies can use the platform to track what is going on in the platform.
2017 CTAdventure	Medical imaging and analysis	The company applies machine learning in order to improve and automate research in the field of medical imaging. These solutions are applicable whenever image analysis (either pictures or video) could improve the speed or quality of performed services. CTA is also pioneers in Augmented Reality and Virtual Reality. One real life case where their technology has been applied was finding and tagging anomalies in endoscopy images.
2018 Curai	General clinical diagnosis and decision support	Curai, helps patients deliver the right information to doctors to help medical professionals figure out the best diagnosis — and reduce the overhead for doctors so they can work with more patients without the grunt work. Patients can send photos of rashes, describe their symptoms, or MRI results and help navigate those results to come to the best conclusion with doctors and have more readily available access. And the hope is that Curai will also develop into a system that can detect potential problems from symptoms that a patient might not even realize are relevant.
2018 Cydar Medical	Medical imaging and analysis	Cydar is a machine vision techonology that can create automated 3D overlays of organs and other body parts using x-ray imaging. The imaging can be used for example to support surgeries by constantly tracking the appearance and position of organs.
2018 DeepRadiology	Medical imaging and analysis	DeepRadiology has a range of customized solutions applying the latest imaging analytic deep learning algorithm capability for all imaging modalities such as CT scans. Their CT system is claimed to able to detect clinically significant pathologies in CT scans of the head with error rates better than published error rates for radiologists.
2017 DEONTICS	Clinical workflow improvement	Deontics provides Clinical Pathways and Clinical Decision Support Systems (CDSS) software with the goal of improving healthcare outcomes and patient safety. Their CDSS platform can for example used to track patients and to use their data to match them with personalised treatment recommendations. The platform can also be used by patients to understand the clinical decisions made about their treatment. Access can also be given to insurance companies to treatments and manage costs.
2018 diafyt	Monitoring of patients	The Diafyt app monitors patients' diabetes and notifies them if they have to intervene. The system measures blood sugar, steps and transmits the data wirelessly to patients' Smartwatch. This works even while jogging or sleeping. Artificial intelligence helps in the background and detects deviations in advance and can alert you in time.
2018 Digitize.AI	Health care insurance and cost management	Digitize.AI helps healthcare finance leaders reduce revenue cycle costs, increase labor productivity, and speed up pre-certifications by combining A.I. and intelligent automation. Their AI assistant automates, accelerates and priotizes pre-certification tasks.
2017 Enlitic, Inc.	General clinical diagnosis and decision support	Enlitic has medical deep learning algorithms that improve healthcare diagnoses' speed and accuracy. The solution can for example prioritize patients, screen for common population health problems, like breast cancer, analyse x-ray images or measure clinics performance.
2018 Gyant	Health guide and symptom checker	GYANT is a chatbot designed to collect important medical information around the patient's illness or ailment. This information is instantly organized and presented to a licensed medical providers to review and provide a diagnosis.
2017 Huiyi Hui Ying	Medical imaging and analysis	Huiyi Hui Ying has a cloud based digital medical imaging and tumor radiotherapy platform. The system is for example applied to the diagnosis of tumor, cardiovascular, and abdomen diseases.

2017	iCarbonX	Medical data bank and insights	iCarbonX provides a health information platform Meum that helps people to create a digital profile of their lives, so they can understand and monitor their present health status, predict trends, and improve their future. The idea seems to be that several health supporting applications can be built around the platform, for example regarding fitness, nutrition etc. The data on the platform can also be used for research purposes.
2018	Implantable Artificial Kidney	AI-powered medical device	The company was developing an artificial kidney but now seems to have shut down. The research might continue in universities however.
2017	Infermedica	Health guide and symptom checker	Infermedica provides preliminary medical diagnoses based on user's answers to questions and large medical datasets. Thanks to the software's API, the AI can be integrated into 3rd party software and customised in many ways.
2018	Janasense	Monitoring of patients	A software for elderly care that monitors them using sensors and gives information about their health. The software also comes up with personalised advice for keeping the elderly active and warns if their health deteriorates.
2018	KenSci	Population health management	KenSci offers a machine learning powered cloud platform that measures and predicts population health conditions, healthcare costs and operational KPIs.
2018	Koning	Medical imaging and analysis	Koning is developing a device for creating images of the breast with good spatial resolution, no painful compression, in a rapid 10-second exposure, at radiation levels in the range of diagnostic mammograms. Future versions of our technology are expected to optimise early disease detection, diagnosis, intervention and treatment in numerous areas of the body.
2017	Life365	Monitoring of patients	Life365 offers a variety of tools to connect care providers with patients who can benefit from managing their health at home. The tools provide timely insights into a patient's health, enabling early intervention and helping to reduce avoidable and expensive hospitalizations. The solutions are customised according to the needs of the customer organisation. The role of machine learning is unclear but most likely it used to notice problems early and to fine-tune the service.
2018	Lifespeed	Medical data bank and insights	A mobile application to which a user can upload their own medical data or sync them from various healthcare providers, pharmacies etc. The user can then give another healthcare provider an access to their whole medical history to support their treatment. The role of machine learning is left unclear.
2017	Lytics	General clinical diagnosis and decision support	The company offers a variety of AI tools designed for collecting data, noticing patterns, making predictions, treatment and medical dosage optimisation, research etc. that can be applied for example in the treatment of end-stage renal diseases or cardiac disorders.
2017	MDOPS Corporation	Clinical workflow improvement	MDOPS offers a bunch of technologies to improve clinical workflow. Mili, a clinical assistant, is a voice-controlled assistant can complete complex tasks in behalf of medical staff. MDLog is a mobile phone application for clinical documentation dictation. Finally, the company provides a whole EMR application.
2018	Medial EarlySign	Monitoring of patients	Medial EarlySign creates AI-powered software tools that give health professionals robust risk predictors that enhance care management opportunities by helping identify patients with life-altering medical conditions as early as possible, sometimes even before they appear symptomatic. Their tools are hosted on a single operating system that constantly keeps track of individual patients' risk factors.
2018	Medius Health	Health guide and symptom checker	An AI-powered self-diagnosis application that gives treatment recommendations for mild conditions and directs patients to a hospital in more concerning cases.
2018	MedLab Media Group	Search engine / medical information database	The company provides a semantics-based search engine for medical content called DeepAIMed that can be used find reliable medical information sources. The company also has an application that can be used by physicians across the world to share knowledge and to collaborate.
2017	Medopad	Multi-area	Medopad offers a wide range of healthcare technologies. Their initial product was a mobile platform onto which all patient data could be pooled and viewed by medical professionals. At the same time, the platform could be used to monitor patients and their treatment. Later they have developed similar technologies for medical trials, population health management, insurance support and sport injury prevention. They are also developing an AI technology to spot Parkinsson's disease early.
2017	MedWhat	Health guide and symptom checker	The company is developing an AI virtual medical assistant can answer medical questions of both doctors and patients. The patients can access and chat with the assistant through a free mobile application while medical professional can have to pay for an access to a personalised application. The idea is to give people access to relevant medical information easily and to support doctors' work.
2018	MST Medical Surgery Technologies	AI-powered medical device	The company is focusing on medical robotics and computer-assisted surgery. Their core technology is a software-based image analytics information platform powered by advanced visualization, scene recognition, artificial intelligence, machine learning and data analytics. They also have one ready product, AUTOLAP, which is a image-guided laparoscope position system used in robot-assited minimally invasive surgery.

2018	Mujo Mechanics	Physical therapy software/device	MUJO provides a range of technologies for treating shoulder problems. They have devices that can be used for shoulder exercises and an application that instructs and monitors the patients during the exercises. In addition, they have a platform onto which the data are collected and where the doctors can monitor their patients. Machine learning is used to predict what treatment would work the best for the patient.
2018	MVision AI	Medical imaging and analysis	MVision seeks to improve medical diagnoses, especially in countries where people don't have access to high quality healthcare. Their idea is to collect high quality data, especially related to medical imaging, from developed countries and to use that to support diagnoses through an online service, for example by identifying cancers from x-ray images. They are currently pushing a prostate cancer diagnosis product to the market.
2017	NarrativeDx	Clinical workflow improvement	NarrativeDx is a smart platform for collecting experience and feedback data from patients. The platform can also analyse the data through AI and NLP and give direct insights why patients are feeling the way the do and what can be done to improve patient satisfaction.
2018	Notable	Clinical workflow improvement	Notable offers a voice controlled system integrated into doctors' smart watch to make clinical administration tasks easier and faster, e.g. patient notes, prescriptions, updating of medical records etc.
2018	Nucleai	Medical imaging and analysis	Nucleai aims to Improve cancer diagnostics making it accurate, effective, accessible and efficient in order to treat patients better by using Machine Learning, Deep Learning, and Machine Vision technology.
2017	Odeza	Clinical workflow improvement	Odeza has a cloud-based automated concierge platform that can be used for communicating with the patient and automating various tasks such as appointment booking and billing.
2018	Orbita	Monitoring of patients	Orbita provides software to improve patient engagement in digital healthcare through voice-controlled and conversational AI solutions. The software can be for example used to track treatments, medication adherence and post-discharge monitoring.
2017	Pager	Health guide and symptom checker	Pager is a mobile application where patients can self-diagnose symptoms with a chat bot, talk with doctors or find a suitable one and stay on top of their health, e.g. schedule vaccinations, physicals etc.
2018	Paige.AI	Medical imaging and analysis	Paige AI is an artificial intelligence tool that helps doctors in diagnosing cancers from medical images and predicting treatment response and survival.
2018	Pieces Tech	Clinical workflow improvement	PiecesTech has a platform that interprets patient data in real-time and can predict and warn about problems and improve clinical workflow, bringing large saving to healthcare providers and improved care for patients.
2017	Pintrack Ltd	Monitoring of patients	Outminder is designed to support people with long term care needs through reminders and alarms set on their smartphone or tablet. The company's website however is no longer in existance and no new information about the company can be found after 2012.
2017	Potbotics	Treatment selection/optimization	Potbotics offers a platform for patients and doctors for optimising cannabis treatment. For example, the platform helps patients to find the right cannabis strain for their ailment and keeps track of their response. The platform has used AI to read large amount of cannabis research to optimise it recommendations.
2018	Really	Monitoring of patients	Really is developing a technology to detect, monitor, and assess the daily function of individuals' over time to earlier detect and measure preclinical symptoms of neuropsychiatric and neuropsychological disorders (especially Alzheimer's), from their everyday use of language, and other digital data sources. The information can be used to start the treatment early and to support research in the field.
2018	Shenzhen Rui Medical (Deep Core)	Medical imaging and analysis	The company focuses on the development of clinical imaging diagnosis system for early-stage detection of cancer. Its services covers breast cancer, prostate cancer, and chest radiograph.
2018	Smart Reporting GmbH	Clinical workflow improvement	Smart Reporting offers a digital health solution for structured medical reporting. Instead of writing reports in free-text format, the Smart Reporting platform offers a standardized way of making medical reports, which improves data quality and process efficiency. Currently the platform is available only for radiologist and the idea is to integrate AI to the workflow by automating medical image analysis.
2017	snap40	Monitoring of patients	Snap40 provides continuous automated risk analysis so health services can identify people at high risk of deterioration. They offer a device that monitors users via its single wearable device, worn on the upper arm. This includes relative changes in systolic blood pressure, respiratory rate, heart rate, mobility, blood oxygen saturation, and temperature, as well as perspiration and movement levels. AI is used to predict patient deterioration and warn about health problems.
2018	Sophia Genetics	General clinical diagnosis and decision support	Sophia Genetics has developed an AI that supports doctors in diagnoses by easily providing insights about patients' genomic data. SOPHiA AI continuously learns from thousands of patients' genomic profiles and experts' knowledge to improve patients' diagnostics and treatment options.

2018	Spring Health	Mental health software	Spring Health has an online wellness platform designed for company employees to connect with mental healthcare services. The platform is also supposed to have a predictive AI that can for example predict what anti-depressant might work best for the patient.
2018	Suki	Clinical workflow improvement	Suki is a smart digital voice assistant for doctors that makes clinical adminstrative work easier.
2018	SWORD Health	Physical therapy software/device	SWORD Health has a digital therapy platform that uses AI and motion tracking to understand the performance of each patient, providing real-time feedback during treatment, under remote guidance from clinical teams.
2017	Symptify	Health guide and symptom checker	Symptify offers a mobile app that helps bring down healthcare costs by allowing users to evaluate their symptoms at their convenience, find the nearest suitable health care provider and to check into them.
2018	Taliaz	Treatment selection/optimization	Taliaz has developed Predictix, a highly-accurate decision support tool, that can help clinicians find their patients the right treatment sooner. The software reads patients' genetic data, their clinical history and demographic data and recommends the most effective treatment and medicine with least side effects. Currently, the software is used to treat at least depression.
2017	Thalman Health	Monitoring of patients	The company has a wireless sensor that continuously and non-invasively measures the body temperature from the patient's skin. Machine learning is supposedly used to identify problems such as infection early by analysing the body temperature over time.
2018	uCare.ai	Population health management	uCare has a predictive AI that allows patients to obtain a personalized understanding of their lifetime risks for health preservation and disease prevention. At the same time, providers can focus on those who need their expertise urgently with our insights and augmenting capabilities while payers can provide enhanced coverage without increasing premiums by reducing costs.
2017	Viz	Medical imaging and analysis	The company is developing techonologies to automatically identify and triage suspected large vessel occlusion strokes and to create rapid perfusion analyses of CT imaging.
2018	WebMicroscope	Medical imaging and analysis	WebMicroscope is a platform designed to handle large, gigapixel size, digitized whole slide images of scanned tissues and biopsies. The user can upload their own images to the service and even easily create an algorirthm themselves to analyse them. The platform also has ready algorithms for counting, segmenting and identifying objects from the images. WebMicroscope can also be connected with large interactive multitouch displays for fast and easy viewing of virtual slides.
2018	Woebot Labs	Mental health software	Woebot is an automated conversational agent (chatbot) who helps users' to monitor their mood and learn about themselves. Drawing from a therapeutic framework known as Cognitive Behaviour Therapy, Woebot asks people how they're feeling and what is going on in their lives in the format of brief daily conversations. Woebot also talks to users' about mental health and wellness and sends them videos and other useful tools depending on their mood and needs at that moment.
2017	Your.MD	Health guide and symptom checker	Your.MD is a free chat bot service that uses AI to help users find safe health information so they can make the best choices for their health.
2018	Zebra Medical Vision Ltd	Medical imaging and analysis	Zebra-med has a AI-powered medical imaging analytics platform that uncovers important insights and risk factors from medical images at a cost of $1 per scan.

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