ARTIFICIAL INTELLIGENCE IN MEDICINE : TECHNICAL BASIS AND CLINICAL APPLICATIONS PDF, EPUB, EBOOK

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Artificial Intelligence in Medicine: Technical Basis and Clinical Applications - Google Books

For instance, ongoing monitoring and privacy violations have the potential to increase stigma around chronically ill or more disadvantaged citizens 48 and possibly penalize those citizens that are unable to adopt new standards of healthy lifestyle, for instance by reducing access to health insurance and care; little to no debate has been focused on these potential and crucial pitfalls in health policy making. In this techno-political framework, the issue of data protection and ownership becomes more and more crucial, although more than two decades old Several attitudes toward data ownership are described in the literature: although some works argue for common ownership of patients data to profit personalized medicine approaches 50 , 51 , consensus is shifting toward patient ownership, as it has positive effects on patient engagement as well as may improve information sharing if a data use agreement between the patient and healthcare professionals is developed Several universities have started to create new medical curriculum, including a doctor-engineering 18 , to answer the need of educating future medical leaders to the challenges of artificial intelligence in medicine Such curricula see a stronger approach to the hard sciences such as physics and mathematics , and the addition of computational sciences, coding, algorithmics, and mechatronic engineering.

Society as well as healthcare institutions could benefit from these professionals as a safety net for any processes including AI in medicine but also as a drive of innovation and research. Aside from basic medical education, there is a need for implementation of ongoing educational programs regarding digital medicine and targeting graduated physicians, so as to allow retraining in this growing field. As reported by several studies 12 , 13 , electronic health records can be an important administrative burden and a source of burnout, phenomenon increasingly present in physicians, both in training and trained. Although artificial intelligence solutions such as Natural Language Processing are becoming more and more capable of helping the physician deliver complete medical records, further solutions are needed to solve the issue of the increasing time allocated to indirect patient care.

Ambient clinical intelligence ACI is understood as a sensitive, adaptive and responsive digital environment surrounding the physician and the patient 54 and capable of, for instance, analyzing the interview and automatically fill the patient's electronic health records. Several projects are underway to develop an ACI, which would be a crucial application of artificial intelligence in medicine and much needed to solve modern problems with the physician workforce.

One of the great barriers to the adoption of intelligent medical technologies in physicians is the fear of a dehumanization of medicine. This is mainly due to the increasing administrative burden 12 imposed on physicians. However, modern technology such as ACI and Natural Language processing are bound to solve the issue of administrative burden and will help clinicians focus more on the patient. As recently discussed in the literature 15 , 16 doctors will most likely not be replaced by artificial intelligence: smart medical technologies exist as such as support to the physician in order to improve patient management.

As recent studies have indicated 45 , however, comparisons frequently occur between artificial intelligence solutions and physicians, as if the two counterparts were in competition. Future studies should focus on the comparison between physicians using artificial intelligence solutions with physicians without the aid of such applications, and extend those comparisons to translational clinical trials; only then will artificial intelligence be accepted as complementary to physicians. Healthcare professionals stand nowadays in a privileged position, to be able to welcome the digital evolution and be the main drivers of change, although a major revision of medical education is needed to provide future leaders with the competences to do so.

The implementation of artificial intelligence in clinical practice is a promising area of development, that rapidly evolves together with the other modern fields of precision medicine, genomics and teleconsultation. While scientific progress should remain rigorous and transparent in developing new solutions to improve modern healthcare, health policies should now be focused on tackling the ethical and financial issues associated with this cornerstone of the evolution of medicine. All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication. The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Potential liability for physicians using artificial intelligence. Briganti G. Le Specialiste. Google Scholar. Rationale and design of a large-scale, app-based study to identify cardiac arrhythmias using a smartwatch: the apple heart study. Ame Heart J. Apple watch, wearables, and heart rhythm: where do we stand? Ann Trans Med. MACE prediction of acute coronary syndrome via boosted resampling classification using electronic medical records. J Biomed Inform.

Analysis of machine learning techniques for heart failure readmissions. Circ Cardiovasc Qual Outcomes. Applications of artificial intelligence in cardiology. The future is already here. Artificial intelligence outperforms pulmonologists in the interpretation of pulmonary function tests. Eur Respirat J. The wide range of applications and topics addressed by the book could help readers from any field to frame a global perspective on AI in medicine. Released in September , Artificial Intelligence in Medicine provides the best available comprehensive and fundamental volume on the topic. The book highlights a current dichotomy: despite the enormous promise AI holds in medicine, it has yet to show revolutionary clinical benefits, indicating that we may still be at the dawn of a new AI age in medicine.

Written by a large team of influential editors and authors, Artificial Intelligence in Medicine undoubtedly provides a great resource for anyone interested in playing a part in this exciting, upcoming new age. We are always looking for ways to improve customer experience on Elsevier. We would like to ask you for a moment of your time to fill in a short questionnaire, at the end of your visit. If you decide to participate, a new browser tab will open so you can complete the survey after you have completed your visit to this website. Thanks in advance for your time. About Elsevier. Set via JS. However, due to transit disruptions in some geographies, deliveries may be delayed.

View on ScienceDirect. Editors: Lei Xing Maryellen L. Giger James K. Paperback ISBN: Imprint: Academic Press. Published Date: 3rd September Page Count: For regional delivery times, please check When will I receive my book? Sorry, this product is currently out of stock. Flexible - Read on multiple operating systems and devices. Easily read eBooks on smart phones, computers, or any eBook readers, including Kindle. Institutional Subscription. Tax Exempt Orders. Support Center. Free Shipping Free global shipping No minimum order. Provides history and overview of artificial intelligence, as narrated by pioneers in the field Discusses broad and deep background and updates on recent advances in both medicine and artificial intelligence that enabled the application of artificial intelligence Addresses the ever-expanding application of this novel technology and discusses some of the unique challenges associated with such an approach.

Clinicians, medical doctors, bioinformaticians, bioengineers, data scientists. I Introduction 1. Artificial intelligence in medicine: Technical basis and clinical applications II Technical basis 3. Analytics methods and tools for integration of biomedical data in medicine III Clinical applications 8. Uitgebreide beschrijving. Wij vragen wel dat je altijd verwijst naar de brondatabank, je afgeleide producten ook onder ODbL vrijgeeft en geen enkele technologie gebruikt om deze datasets weer gesloten te maken zoals bijv DRM. De datasets zijn ook beschikbaar als een wekelijkse export. NL EN. Meer over Artificial Intelligence Artificial intelligence Medical applications. Giger and James K. Bibliographie: Includes bibliographical references and index. Gennatas and Jonathan H. Poirot, Ramesh Raskar, Daniel L. Lin, William C.

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Lin, William C. Chen and Julian C. Jin, Jayne Seekins and Kristen W. Yin and Jeffery B. Kapp, Maryellen L. Samenvatting: Artificial Intelligence in Medicine: Technical Basis and Clinical Applications presents a comprehensive overview of the field, ranging from its history and technical foundations, to specific clinical applications and finally to prospects. Artificial intelligence AI is expanding across all domains at a breakneck speed. The field of medicine, with its availability of large multidimensional datasets, lends itself to strong potential advancement with the appropriate harnessing of AI. AI also provides the opportunity to improve upon research methodologies beyond what is currently available using traditional statistical approaches. Artificial Intelligence Medicine: Technical Basis and Clinical Applications presents a comprehensive overview of the field, ranging from its history and technical foundations, to specific clinical applications and finally to prospects.

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Artificial Intelligence in Medicine - 1st Edition

Expert systems and artificial intelligence medicine 6. Roles of artificial intelligence in wellness, healthy living, and healthy status sensing 9. Data science for deep genomics and biomedical data analysis cell, genomics, protein-omics Digital and artificial intelligence pathology Deep learning for endoscopy image analysis and disease detection and classification Lessons learnt from the deep learning analysis of retinal fundus images and detection of diabetic retinopathy Chest X-ray and CT image analysis and lung diseases classification AI-assisted breast cancer detection and classification Beyond natural image processing: computer vision for healthcare applications Incorporating artificial intelligence in quantitative imaging and therapeutic outcome prediction Interpretable machine learning for drug delivery and precision medicine Artificial intelligence for radiation oncology applications Applications of AI in the management of cardiovascular diseases Artificial intelligence as applied to clinical neurological conditions A report focused on patient experience, revealed that, in contrast to heart monitoring wearables, patients suffering from epilepsy had no barriers in the adoption of seizure detection devices, and reported high interest in wearable usage Wearable sensors have proven useful to quantitatively assess gait, posture, and tremor in patients with multiple sclerosis, Parkinson disease, Parkinsonism, and Huntington disease These findings support the need of an extensive validation of AI-based technologies through rigorous clinical trials 5.

One of the core challenges of the application of AI in medicine in the next years will be the clinical validation of the core concepts and tools recently developed. Although many studies have already introduced the utility of AI with clear opportunities based on promising results, several well recognized and frequently reported limitations of AI studies are likely to complicate such validation. We will hereby address three of such limitations, as well as provide possible ways to overcome them.

First, the majority of studies comparing efficiency of AI vs. This difficulty could be overcome in the open science era as open data and open methods are bound to receive more and more attention as best practices in research. However, transitioning to open science could prove difficult for medical AI companies that develop software as a core business. Second, studies reporting AI application in clinical practice are known to be limited because of retrospective designs and sample sizes; such designs potentially include selection and spectrum bias, i. Continuous reevaluation and calibration after the adoption of algorithms that are suspected of overfitting should be necessary to adapt software to the fluctuation of patient demographics Furthermore, there is a growing consensus as of the need of development of algorithms designed to fit larger communities while taking into account subgroups Third, only few studies are known to compare AI and clinicians based on same data sets; even in that scenario, critiques have been made pointing at lower diagnostic accuracy rate than expected in specialty doctors.

Opposing AI and clinicians is, although well represented in the scientific literature, probably not the best way to tackle the issue of performance in medical expertise: several studies are now approaching the interaction between clinicians and algorithms 47 as the combination of human and artificial intelligence outperforms either alone. Medical technology is one of the most promising markets of the 21st century, with an estimated market value rapidly approaching a thousand billion dollars in An increasing percentage of the revenue is due to the retail of medical devices such as heart monitoring devices to a younger population, which is not the primary target consumer profile because health problems such as atrial fibrillation are less likely to appear.

Because of this phenomenon, the Internet of Things IoT is redefining the concept of healthy individual as a combination of the quantified self personal indicators coded in the smartphone or wearable and series of lifestyle wearable-provided parameters activity monitoring, weight control, etc. Furthermore, in the last couple of years several wearable companies have been concluding important deals with either insurance companies or governments to organize a large-scale distribution of these products: this kind of initiatives are mainly aimed to induce lifestyle change in large populations.

While western countries are continuing to evolve toward health systems centered around the patient's individual responsibility toward its own health and well-being, the ethical implications of ongoing medical monitoring with medical devices through the Internet of things are frequently discussed. For instance, ongoing monitoring and privacy violations have the potential to increase stigma around chronically ill or more disadvantaged citizens 48 and possibly penalize those citizens that are unable to adopt new standards of healthy lifestyle, for instance by reducing access to health insurance and care; little to no debate has been focused on these potential and crucial pitfalls in health policy making.

In this techno-political framework, the issue of data protection and ownership becomes more and more crucial, although more than two decades old Several attitudes toward data ownership are described in the literature: although some works argue for common ownership of patients data to profit personalized medicine approaches 50 , 51 , consensus is shifting toward patient ownership, as it has positive effects on patient engagement as well as may improve information sharing if a data use agreement between the patient and healthcare professionals is developed Several universities have started to create new medical curriculum, including a doctor-engineering 18 , to answer the need of educating future medical leaders to the challenges of artificial intelligence in medicine Such curricula see a stronger approach to the hard sciences such as physics and mathematics , and the addition of computational sciences, coding, algorithmics, and mechatronic engineering.

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Several projects are underway to develop an ACI, which would be a crucial application of artificial intelligence in medicine and much needed to solve modern problems with the physician workforce. One of the great barriers to the adoption of intelligent medical technologies in physicians is the fear of a dehumanization of medicine. This is mainly due to the increasing administrative burden 12 imposed on physicians. However, modern technology such as ACI and Natural Language processing are bound to solve the issue of administrative burden and will help clinicians focus more on the patient.

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Regulatory, social, ethical, and legal issues of artificial intelligence in medicine Industry perspectives and commercial opportunities of artificial intelligence in medicine Outlook of the future landscape of artificial intelligence in medicine and new challenges. He has made unique and significant contributions to each of the above areas. He has received numerous awards from various societies and organizations for his work in artificial intelligence, medical physics and medical imaging. Maryellen L.

Artificial Intelligence in Medicine Technical Basis and Clinical Applications – elebook

Currently, only very specific settings in clinical practice benefit from the application of artificial intelligence, such as the detection of atrial fibrillation, epilepsy seizures, and hypoglycemia, or the diagnosis of disease based on histopathological examination or medical imaging. The implementation of augmented medicine is long-awaited by patients because it allows for a greater autonomy and a more personalized treatment, however, it is met with resistance from physicians which were not prepared for such an evolution of clinical practice. This phenomenon also creates the need to validate these modern tools with traditional clinical trials, debate the educational upgrade of the medical curriculum in light of digital medicine as well as ethical consideration of the ongoing connected monitoring.

The aim of this paper is to discuss recent scientific literature and provide a perspective on the benefits, future opportunities and risks of established artificial intelligence applications in clinical practice on physicians, healthcare institutions, medical education, and bioethics. While, before the mobile era, medical technologies were mainly known as classic medical devices e. AI has revolutionized medical technologies and can be commonly understood as the part of computer science that is able to deal with complex problems with many applications in areas with huge amount of data but little theory 2. Intelligent medical technologies i. The development of intelligent medical technologies is enabling the development of a new field in medicine: augmented medicine, i. Augmented medicine is not only enabled by AI-based technologies but also several other digital tools, such as surgical navigation systems for computer-assisted surgery 7 , virtuality-reality continuum tools for surgery, pain management and psychiatric disorders 8 — Although the field of augmented medicine seems to encounter success with patients, it can be met with a certain resistance by healthcare professionals, in particular physicians: concerning this phenomenon, four widely discussed reasons should be provided.

First, unpreparedness as to the potential of digital medicine is due to the evident lack of basic and continuing education regarding this discipline Second, the early digitization of healthcare processes, very different from the promise of augmented medicine came with a steep increase of the administrative burden mainly linked to electronic health records 12 , which has come to be known as one of the main components of physician burnout Third, there is increasing fear as to the risk of AI replacing physicians 14 , although the current and mainstream opinion in the literature is that AI will complement physician intelligence in the future 15 , Fourth, the current world-wide lack of a legal framework that defines the concept of liability in the case of adoption or rejection of algorithm recommendations leaves the physician exposed to potential legal outcomes when using

AI As of the lack of education in digital medicine, several private medical schools are preparing their future medical leaders to the challenge of augmented medicine by either associating the medical curriculum with the engineering curriculum or implementing digital health literacy and use in an upgraded curriculum The aim of this paper is to summarize recent developments of AI in medicine, provide the main use-cases where AI-powered medical technologies can already be used in clinical practice, and perspectives on the challenges and risks that healthcare professionals and institutions face while implementing augmented medicine, both in clinical practice and in the education of future medical leaders.

The early detection of atrial fibrillation was one of the first application of AI in medicine. AliveCor received FDA approval in for their mobile application Kardia allowing for a smartphone-based ECG monitoring and detection of atrial fibrillation. Apple also obtained FDA approval for their Apple Watch 4 that allows for easy acquirement of ECG and detection of atrial fibrillation that can be shared with the practitioner of choice through a smartphone Several critiques of wearable and portable ECG technologies have been addressed 21 , highlighting limitations to their use, such as the false positive rate originated from movement artifacts, and barriers in the adoption of wearable technology in the elderly patients that are more likely to suffer from atrial fibrillation.

Applied to electronic patient records, AI has been used to predict the risk of cardiovascular disease, for instance acute coronary syndrome 22 and heart failure 23 better than traditional scales. Recent comprehensive reviews 24 have however reported how results can vary depending on the sample size used in research report.

The interpretation of pulmonary function tests has been reported as a promising field for the development of AI applications in pulmonary medicine. A recent study 25 reported how AI-based software provides more accurate interpretation and serves as a decision support tool in the case on interpreting results from pulmonary function tests. The study received several critiques, one of which 26 reported how the rate of accurate diagnosis in the pulmonologists participating in the study was considerably lower than the country average. Continuous glucose monitoring enables patients with diabetes to view real-time interstitial glucose readings and provides information on the direction and rate of change of blood glucose levels 27 Medtronic received FDA approval for their Guardian system for glucose monitoring, which is smartphone-paired IQ system to help their customers better prevent hypoglycemic episodes based on repeated measurement. Continuous blood glucose monitoring can enable patients to optimize their blood glucose control and reduce stigma associated with hypoglycemic episodes; however, a study focusing on patient experience with glucose monitoring reported that participants, while expressing confidence in the notifications, also declared feelings of personal failure to regulate glucose level Artificial intelligence has been applied in several settings in clinical nephrology.

For instance, it has been proven useful for the prediction of the decline of glomerular filtration rate in patients with polycystic kidney disease 29 , and for establishing risk for progressive IgA nephropathy However, a recent review reporters how at this moment research is limited by sample size necessary for inference The specialty of gastroenterology benefits from wide range of AI applications in clinical settings. Gastroenterologists made use of convolutional neural networks among other deep learning models in order to process images from endoscopy and ultrasound 32 and detect abnormal structures such as colonic polyps Artificial neural networks have also been used to diagnose gastroesophageal reflux disease 34 and atrophic gastritis 35 , as well as to predict outcomes in gastrointestinal bleeding 36 , survival of esophageal cancer 37 , inflammatory bowel disease 38 , and metastasis in colorectal cancer 39 and esophageal squamous cell carcinoma Intelligent seizure detection devices are promising technologies that have the potential to improve seizure management through permanent ambulatory monitoring.

Empatica received FDA approval in for their wearable Embrace, which associated with electrodermal captors can detect generalized epilepsy seizures and report to a mobile application that is able to alert close relatives and trusted physician with complementary information about patient localization A report focused on patient experience, revealed that, in contrast to heart monitoring wearables, patients suffering from epilepsy had no barriers in the adoption of seizure detection devices, and reported high interest in wearable usage Wearable sensors have proven useful to quantitatively assess gait, posture, and tremor in patients with multiple sclerosis, Parkinson disease, Parkinsonism, and Huntington disease These findings support the need of an extensive validation of AI-based technologies through rigorous clinical trials 5.

One of the core challenges of the application of AI in medicine in the next years will be the clinical validation of the core concepts and tools recently developed. Although many studies have already introduced the utility of AI with clear opportunities based on promising results, several well recognized and frequently reported limitations of AI studies are likely to complicate such validation. We will hereby address three of such limitations, as well as provide possible ways to overcome them.

First, the majority of studies comparing efficiency of AI vs. This difficulty could be overcome in the open science era as open data and open methods are bound to receive more and more attention as best practices in research. However, transitioning to open science could prove difficult for medical AI companies that develop software as a core business.

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The integration of AI can occur throughout the continuum of medicine: from basic laboratory discovery to clinical application and healthcare delivery. Integrating AI within medicine has been met with both excitement and scepticism. By understanding how AI works, and developing an appreciation for both limitations and strengths, clinicians can harness its computational power to streamline workflow and improve patient care. It also provides the opportunity to improve upon research methodologies beyond what is currently available using traditional statistical approaches.

On the other hand, computers scientists and data analysts can provide solutions, but often lack easy access to clinical insight that may help focus their efforts. This book provides vital background knowledge to help bring these two groups together, and to engage in more streamlined dialogue to yield productive collaborative solutions in the field of medicine. Additional Product Features Table of Content. Part I: Introduction 1. Past and present of artificial intelligence medicine: From digital medicine to AI healthcare 2. A primer of neural networks and deep learning for artificial

intelligence medicine 4. Biomedical imaging and image analysis in the era of deep learning 5. Expert systems and artificial intelligence medicine 6. Roles of artificial intelligence in wellness, healthy living, and healthy status sensing 9. Data science for deep genomics and biomedical data analysis cell, genomics, protein-omics Digital and artificial intelligence pathology Deep learning for endoscopy image analysis and disease detection and classification Lessons learnt from the deep learning analysis of retinal fundus images and detection of diabetic retinopathy Chest X-ray and CT image analysis and lung diseases classification AI-assisted breast cancer detection and classification Beyond natural image processing: computer vision for healthcare applications Incorporating artificial intelligence in quantitative imaging and therapeutic outcome prediction

Conversation in the Cathedral