Literature summary

Unlocking the Potential of Artificial Intelligence in Medicine: Reducing Human Error, Enhancing Patient Care, and Advancing Early Disease Detection

Bachelor of Science in Applied Artificial Intelligence

Sources used (60 item(s))

Ahmad, S. and Wasim, S. (2023) Prevent Medical Errors through Artificial Intelligence: A Review, Saudi Journal of Medical and Pharmaceutical Sciences, 9(7), pp. 419–423. DOI: https://doi.org/10.36348/sjmps.2023.v09i07.007

Link: https://saudijournals.com/media/articles/SJMPS_97_419-423.pdf

Relevant Key Findings:
- A retrospective study analyzing over 34,000 admissions to a tertiary care hospital found that 17.3% of patients experienced an adverse event related to medical errors, with 2.9% of these events resulting in permanent disability or death (p. 1).
- A retrospective analysis of malpractice claims in the United States found that diagnostic errors were the leading cause of medical malpractice claims, accounting for 28.6% of cases (p. 2).
- A systematic review of studies from various countries estimated that medication errors occur in 7-9% of medication orders, with approximately 1% of these errors resulting in patient harm (p. 2).
- A study examining national malpractice claims in the United States found that surgical errors accounted for 24% of claims and were associated with the highest median indemnity payment (p. 2).
- A review of studies investigating communication failures in healthcare found that communication errors were responsible for 60% of adverse events identified (p. 2).
- A systematic review of interventions to improve handoffs in healthcare settings found that standardized handoff protocols reduced the risk of adverse events by 30% (p. 3).

Andras, I. et al. (2020) Artificial intelligence and robotics: a combination that is changing the operating room, World Journal of Urology, 38(10), pp. 2359-2366. DOI: 10.1007/s00345-019-03037-6

Link: https://postprint.nivel.nl/PPpp7783.pdf

Relevant Key Findings:
- AI systems can entail computers that are trained to solve problems by mimicking human cognition (p. 2)
- Machine learning (ML) and deep learning (DL) models are subfields of artificial intelligence that allow the computer to make predictions based on underlying data patterns (p. 2)
- The interaction between medical professionals and ML algorithms improves the decision-making process by decreasing the error rate (p. 2)
- An ML approach using diagnostic and therapeutic information was able to improve lung

cancer staging compared to a method based solely on clinical guidelines (accuracy of 93% for ML vs. 72% for the clinical approach) (p. 2)
- AI induced reduction of the surgical error rate would increase the surgeon's performance (p. 2)
- With ML algorithms that integrate motion analysis, energy, and force usage, it is possible to obtain an automated, accurate, and quantitative skills assessment (p. 3)

Angelucci, F. et al. (2024) Integrating AI in fighting advancing Alzheimer: diagnosis, prevention, treatment, monitoring, mechanisms, and clinical trials, Current Opinion in Structural Biology, 87, p. 102857. DOI: https://doi.org/10.1016/j.sbi.2024.102857

Link: https://www.sciencedirect.com/science/article/pii/S0959440X24000848

Relevant Key Findings:
- Application of artificial intelligence (AI) in neurology is a growing field offering opportunities to improve accuracy of diagnosis and treatment of complicated neuronal disorders.
- Fostering a deeper understanding of the aetiologies of these diseases through AI-based analyses of large omics data.
- The most common neurodegenerative disease, Alzheimer's disease (AD), is characterized by brain accumulation of specific pathological proteins, accompanied by cognitive impairment.
- Summary of the latest progress on the use of AI in different AD-related fields, such as:
- Analysis of neuroimaging data enabling early and accurate AD diagnosis.
- Prediction of AD progression, identification of patients at higher risk and evaluation of new treatments.
- Improvement of the evaluation of drug response using AI algorithms to analyze patient clinical and neuroimaging data.
- Development of personalized AD therapies.
- Use of AI-based techniques to improve the quality of daily life of AD patients and their caregivers.

Antony, A. et al. (2024) AI-Driven insights in pancreatic cancer imaging: from pre-diagnostic detection to prognostication, Abdominal Radiology, pp. 1-13. DOI: https://doi.org/10.1007/s00261-024-04775-x

Link: https://link.springer.com/article/10.1007/s00261-024-04775-x

Relevant Key Findings:
- Pancreatic ductal adenocarcinoma (PDAC) is the third leading cause of cancer-related deaths in the United States
- Poor five-year survival rate and frequent late-stage diagnosis
- Significant barrier to early detection in high-risk cohorts
- Pancreas often appears morphologically normal during the pre-diagnostic phase
- Disease can progress rapidly from subclinical stages to widespread metastasis
- Artificial intelligence (AI) applied to cross-sectional imaging has significant potential
- Identifying subtle, early-stage changes in pancreatic tissue
- AI-driven imaging aids in the discovery of prognostic and predictive biomarkers
- Essential for personalized treatment planning
- Critical discussion on AI's role in detecting visually occult PDAC on pre-diagnostic imaging
- Addresses challenges of model generalizability
- Emphasizes solutions like standardized datasets and clinical workflows
- Provides a forward-thinking conceptual framework that bridges current gaps in AI-driven PDAC research

Bacha, A., Shah, H.H. and Abid, N. (2025) The role of artificial intelligence in early disease detection: current applications and future prospects, Global Journal of Emerging AI and Computing, 1(1), pp. 1-14. https://media.neliti.com/media/publications/592479-the-role-of-artificial-intelligence-in-e-be5b50bf.pdf

Link:
https://media.neliti.com/media/publications/592479-the-role-of-artificial-intelligence-in-e-be5b50bf.pdf

Relevant Key Findings:
- AI enhances diagnostic precision, customizes treatment, and provides economical solutions to healthcare organizations, but faces drawbacks in data privacy and algorithm bias (p. 1).
- AI technologies exhibit a unique capability to diagnose diseases at an earlier stage, providing opportunity for early interventions and better patient results in diseases like cancer and cardiovascular diseases (p. 1).
- AI systems enhance the analysis of X-rays, CT scans, MRI scans, and mammography, detecting tumors, lesions, and fractures at very initial stages (p. 2).
- AI systems can perform sophisticated analyses in healthcare that would take days using traditional methods, and AI adoption is bound by data privacy guidelines like HIPAA and GDPR (p. 3).
- AI systems can detect signs of cancer unnoticed by the human eye, especially in breast cancer detection, and AI helps diagnose cardiovascular diseases at their early stages (p. 5).
- AI offers benefits like enhanced diagnostic accuracy, faster intervention, cost-effectiveness,

and personalized treatment plans, but faces challenges like data privacy and algorithmic bias (pp. 6-7).

Barioni, C.T.S. et al. (2024) Artificial Intelligence for the Identification of Biomarkers in Cancer Prevention and Diagnosis: Advances and Perspectives, Rev. Bras. Cancerol., 70(2), pp. 1-13. DOI: https://doi.org/10.32635/2176-9745.RBC.2024v70n2.4692

Link: https://www.scielo.br/j/rbcan/a/ZgYY6KTwhdKnhzLF7p5VkSx/?format=pdf&lang=en

Relevant Key Findings:
- AI algorithms can identify data imperceptible to the human eye in radiological and pathological images, leading to a deeper understanding of cancers (p. 2).
- Deep learning techniques have shown potential in the analysis of biomedical images and genetic data to identify early signs of cancer (p. 3).
- Convolutional Neural Networks for mammography analysis achieve significantly higher accuracy in detecting early-stage tumors compared to conventional diagnostic methods (p. 3).
- AI studies utilize deep learning algorithms to analyze genetic patterns and/or mutations in specific genes, providing accurate cancer risk predictions and recommending specific prevention strategies (p. 3).
- AI algorithms achieve a high degree of concordance with clinical gold standards, such as fluorescent in situ hybridization (FISH) for HER2, and can predict Oncotype DX risk categories from the automated detection of tubular nuclei (p. 4).
- An AI model reduced false positive and false negative rates in mammograms, enhancing breast cancer screening and diagnostic accuracy (p. 11).

Bates, D.W. et al. (2021) The potential of artificial intelligence to improve patient safety: a scoping review, npj Digital Medicine, 4, p. 54. DOI: https://doi.org/10.1038/s41746-021-00423-6

Link: https://www.nature.com/articles/s41746-021-00423-6.pdf

Relevant Key Findings:
- AI can improve safety by predicting harms, collecting data including new and already-available data, and as part of quality improvement initiatives. (p. 1)
- Machine learning (ML) algorithms allow simultaneous consideration of multiple data sources to identify predictors and outcomes in healthcare. (p. 1)
- AI techniques can be applied to rapidly detect ventilator-associated pneumonia (AUC=0.98), differentiate between common wound pathogens (accuracy=78%), and classify strains of Clostridium difficile (sensitivities >80%; specificities >73%). (p. 2)

- An artificial neural network (ANN) algorithm was developed to guide safer warfarin dosing, predicting therapeutic dose with 83% accuracy in patients with international normalized ratios (INRs) >3.5. (p. 3)
- An ANN model was developed to guide computed tomography use for diagnosis of PE, achieving an AUC of 0.90 using internal validation and 0.71 using external data. (p. 3)
- AI has been used for early detection of sepsis using novel gene expression biomarkers with AUCs ranging from 0.86 to 0.92 and to predict nocturnal hypoglycemia from midnight to 6 am with an AUC of 0.84 based on continuous glucose monitoring. (p. 5)

Battineni, G. et al. (2020) Applications of machine learning predictive models in the chronic disease diagnosis, Journal of Personalized Medicine, 10(2), pp. 1-11. DOI: 10.3390/jpm10020021

Link: https://www.mdpi.com/2075-4426/10/2/21/pdf

Relevant Key Findings:
- ML predictive models can highlight enhanced rules in the decision-making regarding individual patient care and are capable of autonomous diagnosis of different diseases under clinical regulations (p. 2).
- AI projects coupled with medicine drew in more speculation from the global economy in 2016 than other projects (p. 1).
- ML models can improve the quality of medical data, reduce fluctuations in patient rates, and save on medical costs (p. 2).
- SVM models were used in about 45% of studies, K-Nearest Neighbor (KNN) and Naïve Bayes (NB) models were used in 23% of the studies, LR was applied in 18% of studies, and random forest (RF) models were applied in 14% of studies in the CD diagnosis (p. 6).
- Diabetic predictions show an accuracy of 73.1–91.6%, while in the prediction of liver diseases, NB, RF, KNN, SVM, and NN models produce an accuracy in a range of 78.1–82.7% (p. 6-7).
- With feature extraction techniques, the LR model has identified reasons for depression with accuracy between 72% and 80% (p. 7).

Baurasien, B.K. et al. (2023) Medical Errors and Patient Safety: Strategies for Reducing Errors Using Artificial Intelligence, International Journal of Health Sciences, v7nS1. DOI: 10.53730/ijhs.v7nS1.15143

Link:
https://www.neliti.com/publications/583940/medical-errors-and-patient-safety-strategies-for-reducing-errors-using-artificia

Relevant Key Findings:
- Medical errors remain a significant challenge in healthcare, contributing to adverse patient outcomes, increased costs, and extended hospitalizations.
- These errors encompass diagnostic inaccuracies, medication mistakes, surgical errors, and communication breakdowns.
- The global prevalence of medical errors underscores the urgent need for effective strategies to enhance patient safety.
- This article explores the role of Artificial Intelligence (AI) in reducing medical errors and improving patient safety.
- It aims to evaluate how AI technologies can mitigate various types of medical errors, and the challenges associated with their implementation.
- The study reviews current literature on AI applications in healthcare, focusing on diagnostic support, medication safety, surgical precision, and patient monitoring.
- It analyzes the effectiveness of AI-driven systems in reducing errors across different medical disciplines and examines the integration challenges, including ethical and regulatory concerns.
- AI technologies, including machine learning algorithms and decision support systems, have demonstrated significant potential in enhancing diagnostic accuracy, preventing medication errors, and improving surgical outcomes.
- AI-driven systems have shown promising results in real-time patient monitoring, early detection of adverse events, and optimizing healthcare management.
- However, challenges related to data privacy, algorithm transparency, and integration into clinical workflows persist.

Bhattacharya, S. et al. (2024) Empowering precision medicine: regenerative AI in breast cancer, Frontiers in Oncology, 14, pp. 1-7. DOI: 10.3389/fonc.2024.1465720

Link: https://www.frontiersin.org/journals/oncology/articles/10.3389/fonc.2024.1465720/pdf

Relevant Key Findings:
- In 2022, breast cancer emerged as the most frequently diagnosed cancer globally, with more than 2.3 million new cases and 670 000 deaths globally (p. 1).
- Niramai Health Analytics in Bangalore, India, developed an AI-based, low-cost, non-invasive solution for early breast cancer screening in 2016 using body heat mapping (p. 1).
- AI-driven platforms could significantly enhance the precision of treatment plans by integrating genomic, clinical, and demographic information, resulting in a 20% increase in treatment efficacy and a reduction in adverse effects (p. 3).
- Navican's AI-driven precision oncology solutions can effectively integrate clinical and molecular data to tailor treatment plans, resulting in improved patient outcomes and a 30% increase in therapeutic efficacy compared to standard approaches (p. 3).
- IBM Watson for Genomics AI-powered genomic interpretations led to more accurate and individualized treatment options, improving patient outcomes by 25% compared to traditional

methods (p. 3).
- "MammoAssist" boosts radiologist efficiency and productivity by over 50% (p. 5).

Biswas, M. (2024) AI-Powered nanorobots: a mini review on innovations in healthcare, Journal of Artificial Intelligence and Robotics, 1(2), pp. 1-4. DOI: https://doi.org/10.61577/jaiar.2024.100007

Link:
https://www.reseaprojournals.com/emsystem/uploads/archive_files/AI-Powered%20nanorobots%20a%20mini%20review%20on%20innovations%20in%20healthcare.pdf

Relevant Key Findings:
- AI-powered nanorobots can detect subtle changes in biochemical markers indicative of disease progression, such as cancerous cell growth or metabolic irregularities associated with cardiovascular conditions (p. 1).
- AI algorithms in nanorobots enable the identification of patterns, making predictions, and optimizing actions in real-time, such as recognizing cancer cells by analyzing their unique biomarkers for precise drug targeting (p. 2).
- Nanorobots can utilize magnetic fields, acoustic waves, and chemical gradients for precise navigation and targeting within the bloodstream (p. 2).
- Reinforcement learning allows nanorobots to learn optimal strategies through trial and error, improving their navigation and targeting efficiency over time (p. 2).
- Advanced sensors on nanorobots continuously monitor blood chemistry, detect biomarkers indicative of diseases, and measure vital signs like glucose levels, pH, and oxygen saturation (p. 2).
- AI-powered nanorobots enable early detection of blood diseases by recognizing subtle changes in biomarkers that indicate conditions such as leukemia, lymphoma, and infections (p. 3).

Burti, S., Zotti, A. and Banzato, T. (2024) Role of AI in diagnostic imaging error reduction, Front. Vet. Sci., 11:1437284, pp. 01-04. DOI: https://doi.org/10.3389/fvets.2024.1437284

Link:
https://www.frontiersin.org/journals/veterinary-science/articles/10.3389/fvets.2024.1437284/pdf

Relevant Key Findings:
- AI systems are reported to generate lower error rates (including both false positives and false negatives) than radiologists (p. 2).

- Under-reading accounts for 42% of the total diagnostic errors (p. 2).
- AI systems are not subjected to cognitive biases or environmental contexts (overworking, challenging working environment, distractions, etc.) (p. 2).
- AI systems have a variable reported accuracy in the detection of specific lesions, with accuracy in detecting pleural effusion usually very high, whereas accuracy for pulmonary nodules or masses is significantly lower (p. 2).
- AI algorithms could contribute to reducing radiologists' interpretative error rates by automatically screening the quality of diagnostic images before interpretation (p. 3).
- AI has a variable accuracy for different radiographic findings (p. 3).

Cai, J. and Zychlinski, N. (2024) When AI Is Not Enough: Reducing Diagnostic Errors with Radiologist Oversight. https://papers.ssrn.com/sol3/Delivery.cfm?abstractid=5037549

Link: https://papers.ssrn.com/sol3/Delivery.cfm?abstractid=5037549

Relevant Key Findings:
- Artificial intelligence (AI) is becoming increasingly prevalent, particularly in healthcare, where it is shaping the future of decision-making processes.
- In radiology, AI has revolutionized diagnostics by enabling rapid analysis of patient imaging.
- The consequences of AI misdiagnoses can be significant.
- An incorrect result can unnecessarily flag a healthy patient for treatment.
- A missed detection may fail to identify a serious condition that requires immediate intervention.
- Most diagnostic systems combine AI analysis with radiologist review.
- AI first classifies cases, and then radiologists review and confirm or modify the initial diagnosis of AI.
- Effective radiology scheduling must account for the likelihood and cost of false negatives and false positives, as well as AI characteristics such as sensitivity and specificity.
- We develop a multi-server queuing model with separate queues for suspected-positive and suspected-negative cases.
- Using a fluid approximation, we derive an index-based policy, a modified version of the $c\mu/\theta$ rule, to optimally schedule and allocate resources.
- Our proposed policy incorporates the anchoring effect, causing radiologists to devote more time to misclassified cases.
- The anchoring effect may change the classes' prioritization and significantly influence overall system performance.
- We extend our model to incorporate diagnosis-based service level requirements established by hospitals and regulators.
- Numerical results demonstrate the effectiveness and superiority of our policy compared to a widely used benchmark.

Chang, T.C. et al. (2021) Current trends in artificial intelligence application for endourology and robotic surgery, Urologic Clinics of North America, 48(1), pp. 151-160. DOI: 10.1016/j.ucl.2020.09.004

Link: https://www.urologic.theclinics.com/article/S0094-0143(20)30069-0/abstract

Relevant Key Findings:
- Artificial intelligence (AI) has emerged as a tool to manage complex datasets and deliver data-driven patient care in healthcare over the past 2 decades.
- AI algorithms can extract meaningful signals from complex datasets through an iterative learning process similar to human learning.
- Advancements in deep learning over the past decade have accelerated AI applications in healthcare.
- The article focuses specifically on applications of AI to endourology and robotic surgery in urology.
- AI is being used to process complex medical datasets to develop diagnostic, prognostic and therapeutic tools in urology.
- The advent of electronic medical records and digitalization of healthcare has enabled the use of AI in this field.
- Deep learning innovations have driven recent progress in AI applications for urology.
- The authors explore emerging AI technologies and their development as applied to endourology and robotic urologic surgery.

Chen, C. et al. (2024) Ability of machine-learning based clinical decision support system to reduce alert fatigue, wrong-drug errors, and alert users about look alike, sound alike medication, Computer Methods and Programs in Biomedicine, 243, 107869. DOI: https://doi.org/10.1016/j.cmpb.2023.107869

Link: https://www.sciencedirect.com/science/article/pii/S0169260723005357

Relevant Key Findings:
- The overall benefits of using clinical decision support systems (CDSSs) can be restrained if physicians inadvertently ignore clinically useful alerts due to alert fatigue caused by an excessive number of clinically irrelevant warnings.
- Inappropriate drug errors, look-alike/sound-alike (LASA) drug errors, and problem list documentation are common, costly, and potentially harmful.
- This study sought to evaluate the overall performance of a machine learning-based CDSS (MedGuard) for triggering clinically relevant alerts, acceptance rate, and to intercept inappropriate drug errors as well as LASA drug errors.

Chen, X., Leung, Y.-L. A. and Shen, J. (2022) Artificial intelligence and its application for cardiovascular diseases in Chinese medicine, Digital Chinese Medicine, 5(4), pp. 367-376. DOI: https://doi.org/10.1016/j.dcmed.2022.12.003

Link: http://www.dcmhi.com.cn/en/article/pdf/preview/10.1016/j.dcmed.2022.12.003.pdf

Relevant Key Findings:
- Cardiovascular diseases (CVDs) cause approximately 17.9 million deaths annually worldwide (p. 1).
- Recent progress in artificial intelligence (AI) technology has allowed challenges in CVD diagnosis and treatment to be resolved (p. 1).
- In 2016, Alpha Go Lee defeated the world Go master Lee Sedol, thus extending the capability of AI to a new level (p. 2).
- In a study of heart failure with preserved ejection fraction, multiple tensor factorization identified the subtyping by integrating deep phenotypic measurements, trans-omics modalities of data, and interactions between genetic variants (p. 3).
- In a recent study, the classification rates were 99.1% and 97.4% for the training and testing processes, respectively, for the three basic pulse patterns of TCM doctors (p. 5).
- The average accuracy of a DL model focusing on core symptoms in diagnosing CHD syndrome elements was 96.46% ± 8.957% when the specialist's diagnosis was regarded as the gold standard (p. 6).

Ciampi, M. et al. (2022) An intelligent environment for preventing medication errors in home treatment, Expert Systems with Applications, 193. DOI: https://doi.org/10.1016/j.eswa.2021.116434

Link: https://www.sciencedirect.com/science/article/pii/S0957417421017218

Relevant Key Findings:
- Assistance system based on home sensors, Ambient Intelligence, and Artificial Intelligence to help the elderly during medical treatment to reduce medication errors
- Addresses medication errors such as medication omission, wrong dosage or timing, and drug-drug interactions
- Provides advanced features of self-adaptation to accommodate physical and/or cognitive disabilities
- Utilizes cutting-edge Artificial Intelligence technologies including Reinforcement Learning, Deep Learning, and Natural Language Processing (NLP)
- Functions include:
- Personalised reminders via an intelligent agent called Tutor that self-learns the best communication methods with the patient

- Feedback about medication through an intelligent agent named Checker that identifies the pillbox before taking the pill using Deep Neural Network, Optical Character Recognition, and Barcode Reading
- Alerts for known drug-drug interactions through an intelligent service called Advisor that searches for active principles of medications and known interactions using NLP and Unified Medical Language System (UMLS) RxNorm resources
- Final objective to effectively remind patients of when and what medication to take, check if the correct medication is being taken, and alert for possible drug-drug interactions, with remote reporting on adherence and anomalies to caregivers and/or doctors
- Experimental evaluations show encouraging results in drug recognition and drug-drug interactions identification

Denecke, K. and Baudoin, C.R. (2022) A Review of Artificial Intelligence and Robotics in Transformed Health Ecosystems, Frontiers in Medicine, 9, pp. 1-13. DOI: https://doi.org/10.3389/fmed.2022.795957

Link: https://www.frontiersin.org/journals/medicine/articles/10.3389/fmed.2022.795957/pdf

Relevant Key Findings:
- AI systems can predict disease recurrence and progression (p. 1).
- AI enables analysis of individual patient data to derive recommendations for diagnosis and treatment (p. 2).
- AI can facilitate telemedicine support, including triage, diagnosis, treatment, and monitoring (p. 5).
- AI integration in CDSS (Clinical Decision Support Systems) can provide differential diagnoses and recognize early warning signs (p. 5).
- AI improves tumor detection from image analysis, enhancing reliability by pinpointing areas radiologists might overlook (p. 7).
- AI applications can predict cardiovascular risk factors from retinal fundus photographs, achieving accuracy comparable to traditional blood tests (p. 8).

Deo, N. and Anjankar, A. (2023) Artificial Intelligence With Robotics in Healthcare: A Narrative Review of Its Viability in India, Cureus, 15(5), pp. 1-9. DOI: https://doi.org/10.7759/cureus.39416

Link:
https://www.cureus.com/articles/116306-artificial-intelligence-with-robotics-in-healthcare-a-narrative-review-of-its-viability-in-india.pdf

Relevant Key Findings:

- By 2035, AI would be able to enhance the economy of India by adding 957 billion USD. (p. 1)
- Approximately 74% of the graduate doctors in India work in urban areas which cater to only about one-fourth of the population. (p. 2)
- India will need 2.3 million doctors by 2030 to reach the minimum doctor-patient ratio of 1:1000, which the World Health Organization recommends. (p. 2)
- Till July 2019 there were 66 centers and more than 500 skilled robotic surgeons in India who had successfully performed more than 12,800 surgeries with the assistance of robots. (p. 3)
- Before the year 2000, the success rate of completing the clinical trials via all three stages, for the candidates was only 13.8%. (p. 5)
- Reports say that about 80,000 people die every year due to wrong diagnoses of illnesses. (p. 5)

ECDC (2024) Improving Patient Safety with Machine Learning and AI. https://salute.regione.emilia-romagna.it/normativa-e-documentazione/convegni-e-seminari/improving-diagnosis-for-patient-safety-2024/2_dambrosio.pdf/@@download/file/2_D'Ambrosio.pdf

Link: https://salute.regione.emilia-romagna.it/normativa-e-documentazione/convegni-e-seminari/improving-diagnosis-for-patient-safety-2024/2_dambrosio.pdf/@@download/file/2_D'Ambrosio.pdf

Relevant Key Findings:
- AI models can rapidly analyze vast troves of medical data to uncover patterns and anomalies that would be impossible for humans to detect (p. 2).
- AI-powered systems can streamline repetitive tasks, freeing up clinicians to focus on delivering personalized, high-quality care (p. 2).
- By learning from historical data, AI can forecast risks and complications, allowing healthcare teams to intervene proactively (p. 2).
- A hybrid AI approach reduced false alerts in prescription analysis by 26% compared to traditional methods, while still catching 74% of prescriptions that required intervention (p. 12).
- AI has the potential to reduce medication errors and improve patient safety (p. 21).
- AI can generate high-quality, standardized summaries of patient data (p. 23).

Eggleton, A. (2023) Dr Robot: robotics and AI in healthcare. DOI: https://doi.org/10.4337/9781802207064.000026

Link:
https://www.elgaronline.com/downloadpdf/edcollchap/book/9781802207064/chapter21.pdf

Relevant Key Findings:
- This chapter reflects on the socio-ethical implications of AI technology adoption.
- Focusing on the UK experience, it illustrates how the UK government's 'regulator focused' approach has failed to capture the nuances in technological developments due to the lack of a comprehensive statutory framework.
- A re-conceptualisation of AI adoption is called for to ensure that the balance between regulation and risk is proportionate within the context of patient care.
- The chapter goes on to provide a framework to highlight the impact of innovative integration within the context of AI adoption.

Ely, J.W., Graber, M.L. and Croskerry, P. (2009) Checklists to reduce diagnostic errors, Quality Improvement, p. 8. https://www.ajustnhs.com/wp-content/uploads/2012/10/Smart-Paper-CHFG-Oct-2012p.pdf

Link:
https://www.ajustnhs.com/wp-content/uploads/2012/10/Smart-Paper-CHFG-Oct-2012p.pdf

Relevant Key Findings:
- Diagnostic errors can often be traced to physicians' cognitive biases and failed heuristics (mental shortcuts) (p. 8).
- Faulty thinking plagues other high-risk, high-reliability professions, such as airline pilots and nuclear plant operators, but these professions have reduced errors by using checklists (p. 8).
- The article extends the checklist concept to diagnosis and describes three types of checklists: (1) a general checklist that prompts physicians to optimize their cognitive approach, (2) a differential diagnosis checklist to help physicians avoid the most common cause of diagnostic error—failure to consider the correct diagnosis as a possibility, and (3) a checklist of common pitfalls and cognitive forcing functions to improve evaluation of selected diseases (p. 8).
- Checklists provide an alternative to reliance on intuition and memory in clinical problem solving (p. 8).
- This solution is demanded by the complexity of diagnostic reasoning, which often involves sense-making under conditions of great uncertainty and limited time (p. 8).
- Checklists have gained acceptance in medical settings, such as operating rooms and intensive care units (p. 8).

Fitzgerald, R.C. et al. (2022) The future of early cancer detection, Nature Medicine, 28, pp. 666–677. DOI:

https://doi.org/10.1038/s41591-022-01746-x

Link: https://www.nature.com/articles/s41591-022-01746-x

Relevant Key Findings:
- A proactive approach to detecting cancer at an early stage can make treatments more effective, with fewer side effects and improved long-term survival.
- As detection methods become increasingly sensitive, it can be difficult to distinguish inconsequential changes from lesions that will lead to life-threatening cancer.
- Progress relies on a detailed understanding of individualized risk, clear delineation of cancer development stages, a range of testing methods with optimal performance characteristics, and robust evaluation of the implications for individuals and society.
- Advances in sensors, contrast agents, molecular methods, and artificial intelligence will help detect cancer-specific signals in real time.
- To reduce the burden of cancer on society, risk-based detection and prevention needs to be cost effective and widely accessible.

García-Pola, M. et al. (2021) Role of Artificial Intelligence in the Early Diagnosis of Oral Cancer. A Scoping Review, Cancers, 13(18), p. 4600. DOI: https://doi.org/10.3390/cancers13184600

Link: https://www.mdpi.com/2072-6694/13/18/4600

Relevant Key Findings:
- The review aimed to synthesize evidence on applying AI to early oral cancer diagnosis.
- A search was conducted in PubMed, Web of Science, Embase and Google Scholar databases from January 2000 to December 2020.
- 36 studies were included that focused on early non-invasive diagnosis of oral cancer using AI applied to screening.
- The studies used AI models to analyze images, including photographs (optical imaging and enhancement technology) and cytology.
- The included studies were heterogeneous in nature, each using different AI algorithms.
- There was potential for training data bias and limited comparative data for AI interpretation across studies.
- AI showed promise for precisely predicting oral cancer development.
- However, methodological issues need to be addressed alongside advances in AI techniques to enable large-scale transfer to population-based detection protocols.
- The review highlights the potential of AI to improve early oral cancer diagnosis, but also identifies limitations in the current research that need to be overcome.

Ghanem, M., Ghaith, A.K. and Bydon, M. (2024) Artificial

intelligence and personalized medicine: transforming patient care, in The New Era of Precision Medicine. Academic Press, pp. 131-142. DOI: https://doi.org/10.1016/B978-0-443-13963-5.00012-1

Link: https://www.sciencedirect.com/science/article/pii/B9780443139635000121

Relevant Key Findings:
- Artificial Intelligence and Personalized Medicine: Transforming Patient Care
- Applications of artificial intelligence (AI) in personalized medicine
- Foundations of AI technologies and techniques
- Machine learning, deep learning, and natural language processing
- AI-driven diagnostic tools and applications
- Medical imaging analysis
- Genomic data interpretation
- Biomarker identification
- AI's role in personalized drug therapy
- Pharmacogenomics and precision dosing
- Use of AI in disease prediction and prevention
- AI-powered risk assessment and lifestyle recommendations
- AI and patient-centered care
- Personalized patient engagement
- Enhancing patient-provider communication
- Ethical and legal considerations
- Ensuring data privacy and security
- Addressing algorithmic bias and fairness
- Regulatory landscape and guidelines
- Future directions and challenges in the field
- AI-driven innovations in personalized medicine
- Overcoming technical, clinical, and societal barriers
- Valuable resource for understanding AI in patient care
- Current state of the field and future directions and challenges
- Essential read for researchers and practitioners in personalized medicine

Gordo, C., Núñez-Córdoba, J.M. and Mateo, R. (2021) Root causes of adverse drug events in hospitals and artificial intelligence capabilities for prevention, Journal of Advanced Nursing, 77(7), pp. 3168-3175. DOI: https://doi.org/10.1111/jan.14779

Link: https://onlinelibrary.wiley.com/doi/abs/10.1111/jan.14779

Relevant Key Findings:
- The main root cause of ADEs was a lack of adherence to safety protocols (64.8%)
- Identification errors (57.4%)

- Fragile and polymedicated patients (44.4%)
- Identification and reading are two potentially useful AI capabilities to prevent ADEs

Goyal, A., Chadha, N. and Riggs, J. (2018) APPLICATION OF MACHINE LEARNING TECHNIQUES IN EARLY DISEASE DETECTION: A REVIEW. https://www.ispor.org/docs/default-source/euro2019/ai-in-early-disease-detection-ispor-poster-v7-pdf.pdf?sfvrsn=ff1a021d_0

Link: https://www.ispor.org/docs/default-source/euro2019/ai-in-early-disease-detection-ispor-poster-v7-pdf.pdf?sfvrsn=ff1a021d_0

Relevant Key Findings:
- Machine learning (ML) can automatically learn and improve from experience, aiding in early disease diagnosis based on patient data, leading to better treatment and outcomes (p. 1)
- Out of 267 studies, 152 met the inclusion criteria for analyzing ML techniques in early disease detection/diagnosis using clinical or real-world datasets (p. 1)
- The top disease areas where ML is used in early diagnosis include neurological disorders (n=48), cancer (n=39), and cardiological disorders (n=16) (p. 1)
- Support Vector Machines (SVM) were deployed in 57 studies, while neural networks were used in 42, and other methods (random forest, logistic regression, deep learning) in 35 (p. 1)
- ML algorithms have outperformed human counterparts in terms of accuracy in certain studies, improving early diagnosis (p. 1)
- Future roadmap includes adoption of ML through hybrid models, data consolidation via data sharing, and integration of ML assisted diagnosis into healthcare delivery (p. 1)

Greco, E. et al. (2024) AI-Enhanced tools and strategies for airborne disease prevention in cultural heritage sites, Epidemiologia, 5(2), pp. 267-274. DOI: https://doi.org/10.3390/epidemiologia5020018

Link: https://www.mdpi.com/2673-3986/5/2/18/pdf

Relevant Key Findings:
- Poor ventilation can significantly increase the risk of airborne transmission in densely populated indoor settings (p. 2).
- AI-driven models have been used to simulate the spread of airborne pathogens in enclosed spaces, informing ventilation improvements and crowd management (p. 2).
- Smart HVAC systems equipped with AI can optimize air filtration and circulation, reducing the risk of airborne diseases (p. 2).

- AI systems can monitor crowd density in real-time using video analytics and IoT sensors, triggering alerts when social distancing thresholds are breached (p. 2).
- Real-time PCR and spectroscopic analysis can detect the presence of pathogens, aiding in early detection and swift implementation of quarantine and sanitation measures (p. 3).
- Internet of Things (IoT) technologies can monitor compliance with preventive measures such as mask-wearing and hand hygiene using cameras and smart sensors (p. 4).

Harada, Y. et al. (2021) Effects of a Differential Diagnosis List of Artificial Intelligence on Differential Diagnoses by Physicians: An Exploratory Analysis of Data from a Randomized Controlled Study, International Journal of Environmental Research and Public Health, 18(11), pp. 1-7. DOI: https://doi.org/10.3390/ijerph18115562

Link: https://www.mdpi.com/1660-4601/18/11/5562

Relevant Key Findings:
- The prevalence of physician diagnosis identical with the differential diagnosis of AI was significantly higher in the intervention group than in the control group (70.2% vs. 55.1%, $p < 0.001$).
- The primary outcome was significantly >10% higher in the intervention group than in the control group, except for attending physicians and physicians who did not trust AI.
- This study suggests that at least 15% of physicians' differential diagnoses were affected by the differential diagnosis list in the AI-driven DDSS.

Howard, K.L. et al. (2022) Artificial Intelligence in Health Care: Benefits and Challenges of Machine Learning Technologies for Medical Diagnostics. Washington, DC: National Academy of Medicine. https://www.gao.gov/assets/gao-22-104629.pdf

Link: https://www.gao.gov/assets/gao-22-104629.pdf

Relevant Key Findings:
- Diagnostic errors affect more than 12 million Americans each year, with aggregate costs likely exceeding $100 billion (p. 1).
- Six in 10 Americans live with at least 1 chronic condition, such as cancer, diabetes, Alzheimer's disease or heart disease (p. 5).
- Chronic diseases represent seven of the 10 causes of death in the U.S., are the leading causes of disability, and are leading drivers of health care spending (p. 5).
- The National Institutes of Health (NIH) estimated that more than 6 million Americans had Alzheimer's disease as of 2021 (p. 6).

- Heart disease cost the U.S. about $363 billion each year from 2016 to 2017, according to the Centers for Disease Control and Prevention (CDC) (p. 6).
- At the beginning of January 2022, the U.S. had about 56 million reported cases of COVID-19 and over 830,000 reported deaths, according to CDC (p. 6).

Ibrahim, S.A. and Pronovost, P.J. (2021) Diagnostic errors, health disparities, and artificial intelligence: A combination for health or harm?, JAMA Health Forum, 2(9), pp. 1-6. DOI: 10.1001/jamahealthforum.2021.2430

Link: https://jamanetwork.com/journals/jama-health-forum/fullarticle/2784385

Relevant Key Findings:
- The study examines the intersection of artificial intelligence (AI), diagnostic errors, and health disparities in healthcare.
- AI and big data methods provide opportunities to address diagnostic errors and health disparities, which are major challenges in healthcare.
- Computer decision support using AI has been associated with reduced inequities in some areas, like prevention of deep vein thrombosis.
- AI has potential to support clinical trials at multiple stages, including enrollment, adherence monitoring, and patient-centric issues.
- A recent study used machine learning to develop a new algorithm for measuring knee osteoarthritis severity based on radiologic data. This AI-driven measure improved predictive performance and reduced racial disparities in patient-reported pain compared to standard measures.
- The authors argue it is important to ensure AI development incorporates diverse perspectives, uses training data from diverse populations, and identifies potential unintended negative consequences.
- They emphasize the need for transparency about who benefits and who may be harmed by including race/ethnicity in AI models.
- The authors conclude that AI innovations should be embraced and explicitly used to improve care and advance health equity, rather than shunned.
- However, they caution that careful implementation is needed to ensure AI reduces rather than increases inequities in healthcare.

Intel Corporation (2017) Predictive Analytics In Healthcare. https://www.intel.com/content/dam/www/public/us/en/documents/white-papers/gmc-analytics-healthcare-whitepaper.pdf

Link:
https://www.intel.com/content/dam/www/public/us/en/documents/white-papers/gmc-analytics

-healthcare-whitepaper.pdf

Relevant Key Findings:
- Over 85 percent of healthcare organizations in the US have now adopted an Electronic Medical Record (EMR) system (p. 2)
- Penn Medicine estimates that using traditional methods of diagnosis, between 20 and 30 percent of heart failure patients had not been properly identified, but with the predictive model it was able to identify these patients (p. 2)
- Penn Medicine identified about 85 percent of sepsis cases with the algorithm, up from 50 percent, and 30 hours before the onset of septic shock (p. 2)
- The top 10 percent of performers in healthcare analytics have a significantly higher level of executive support and engagement than other organizations (p. 5)
- Montefiore Health System used predictive analytics algorithms to achieve an accurate prediction rate of more than 70 percent in identifying patients at risk of death or in need of intubation (p. 4)
- Sharp HealthCare's predictive model was 80 percent accurate in predicting the likelihood of a rapid response team event within the next hour (p. 7)

Jia, Y. et al. (2019) A Framework for Assurance of Medication Safety using Machine Learning. https://arxiv.org/pdf/2101.05620

Link: https://arxiv.org/pdf/2101.05620

Relevant Key Findings:
- Analyses of quantitative risk assessment (QRA) show that analyses even of technical systems are rarely accurate (p. 1).
- In a study, the AI Clinician uses reinforcement learning to devise effective treatment strategies for sepsis, which is the third leading cause of death in hospitals (p. 3).
- Failure to administer beta-blockers (BBs) to patients following a thoracic operation would cause an 11% increase in the likelihood of AF post-operation (p. 9).
- Giving BBs after surgery reduces the probability of developing AF from 60% to 49%, in medical terms this is referred to as an 11% absolute risk reduction (p. 15).
- Presenting hypotension decreases the probability of getting Post_beta from 45% to 24% (p. 15).
- In 88 out of 141 cases, patients will present hypotension after epidural, this means epidural can cause hypotension, which is consistent with clinical knowledge (p. 14).

Johns, E. et al. (2023) Using machine learning or deep learning models in a hospital setting to detect inappropriate prescriptions: A systematic review. https://www.medrxiv.org/content/10.1101/2023.06.01.23290818.full.p

df

Link: https://www.medrxiv.org/content/10.1101/2023.06.01.23290818.full.pdf

Relevant Key Findings:
- Artificial intelligence (AI) can help pharmacists prioritize medication order reviews for high-risk patients, facilitate decision-making in drug selection, and predict drug dosage, drug-drug interactions, or adverse drug reactions (p. 3).
- AI models for pharmacists are at their beginning, and pharmacists need to stay up-to-date and show interest in developing such tools (p. 2).
- Machine learning techniques have higher performances than conventional statistical methods, especially random forest and Adaboost models, in the prediction of high-risk QTc prolongation related to drug-drug interactions (p. 7).
- With proper tuning, models like XGBoost can significantly improve the workloads on pharmacists in predicting orders requiring intervention from the provider (p. 8).
- GBDT model has the best performance in the identification of factors associated with order errors and medication orders in a high-risk context (p. 9).
- The use of a hybrid system (algorithms + rule-based data) could help identify critical medical errors and reduce the number of false alerts (p. 18).

Kanan, M. et al. (2024) AI-Driven Models for Diagnosing and Predicting Outcomes in Lung Cancer: A Systematic Review and Meta-Analysis, Cancers, 16(3), pp. 1-18. DOI: https://doi.org/10.3390/cancers16030674

Link: https://www.mdpi.com/2072-6694/16/3/674/pdf

Relevant Key Findings:
- AI systems can analyze vast datasets of medical images, patient records, and genetic information to identify patterns and abnormalities that may elude human perception, enabling lung cancer detection at earlier stages and assisting in risk assessment and treatment planning (p. 2).
- AI systems can enhance the effectiveness of current methods by providing more precise and efficient analysis, reducing false positives and false negatives in lung cancer screening (p. 2).
- A study in China using 3D deep learning technology on CT scans achieved a sensitivity of 75% and specificity of 82%, resulting in an overall accuracy of 88.8% (p. 4).
- An AI model from the USA using Support Vector Machine (SVM) and LASSO on LIDC-IDRI data achieved an accuracy of 84.6%, which was 12.4% higher than the accuracy for Lung-RADS (p. 4).
- A Chinese study employing a 3D CMixNet model on LUNA-16 and LIDC-IDRI datasets achieved a sensitivity of 94.0% and specificity of 91.0% (p. 4).
- Pooled sensitivity and specificity of AI models for early lung cancer diagnosis were 0.87

(95% CI: 0.82–0.90) and 0.87 (95% CI: 0.80–0.91), respectively (p. 13).

Kaur, C. and Garg, U. (2023) Artificial intelligence techniques for cancer detection in medical image processing: A review, Materials Today: Proceedings, 81(Part 2), pp. 806-809. DOI: https://doi.org/10.1016/j.matpr.2021.04.241

Link: https://www.sciencedirect.com/science/article/pii/S2214785321031618

Relevant Key Findings:
- Cancer is the uncontrolled growth of abnormal cells in any part of a body.
- Cancer is a broad term for a group of diseases caused when abnormal cells grow in different body parts.
- There are more than a hundred types of cancer such as Lung cancer, Breast cancer, Skin cancer, Oral cancer, Colon cancer, and Prostate cancer.
- Delay in treatment can cause serious health issues, even loss of life.
- This paper reviews methods of detection of lung cancer, brain cancer, and liver cancer using image processing.
- The methods used for detection are Automated and computer-aided detection systems (CAD) with artificial intelligence.
- These methods are good for processing large datasets to provide accurate and efficient results in the detection of cancer.
- However, these processing systems face many challenges to implement on a large scale, including image acquisition, pre-processing, segmentation, data management, and classification strategies to be compatible with AI.
- This paper reviews various image acquisition and segmentation techniques.
- These techniques are essential to cater to the growing patient population and improve the healthcare system.

Kaur, J. (2024) FutureCare: AI Robots Revolutionizing Health and Healing, in Revolutionizing the Healthcare Sector with AI. Hershey, Pennsylvania: IGI Global, p. 30. DOI: https://doi.org/10.4018/979-8-3693-3731-8.ch016

Link: https://www.igi-global.com/chapter/futurecare/352293

Relevant Key Findings:
- FutureCare represents a fundamental change in the way healthcare is provided
- AI robots are transforming the field of health and recovery
- Success relies on the incorporation of artificial intelligence (AI) and robots to increase the

capacities of healthcare professionals
- Improve patient results and optimize the allocation of resources
- Revolution encompasses key buzzwords: AI-enabled healthcare, precision diagnostics, individualized therapies, robotic surgeries, rehabilitative care, remote monitoring, and operational efficiency
- Several problems need to be addressed to fully harness AI-powered medical robots' potential
- Challenges include regulatory constraints, ethical considerations, and accessibility barriers
- FutureCare offers extensive options to revolutionize healthcare delivery, enhance patient experiences, and advance health equity worldwide

Kawamura, R. et al. (2022) Incidence of Diagnostic Errors Among Unexpectedly Hospitalized Patients Using an Automated Medical History-Taking System With a Differential Diagnosis Generator: Retrospective Observational Study, JMIR Medical Informatics, 10(1), pp. 1-13. DOI: https://doi.org/10.2196/35225

Link: https://medinform.jmir.org/2022/1/e35225/

Relevant Key Findings:
- Automated medical history-taking systems that generate differential diagnosis lists have been suggested to contribute to improved diagnostic accuracy.
- The effect of these systems on diagnostic errors in clinical practice remains unknown.
- The study aimed to assess the incidence of diagnostic errors in an outpatient department with an AI-driven automated medical history-taking system.
- A retrospective observational study was conducted using data from a community hospital in Japan.
- Patients aged 20 years and older who used the AI-driven system in the outpatient department of internal medicine from July 1, 2019, to June 30, 2020, were included.
- The primary endpoint was the incidence of diagnostic errors detected using the Revised Safer Dx Instrument by at least two independent reviewers.
- The incidence of diagnostic errors was compared between groups where the AI system generated the final diagnosis and where it did not, using the Fisher exact test.
- A total of 146 patients were analyzed, with a final diagnosis confirmed for 138 patients.
- Diagnostic errors occurred in 16 out of 146 patients (11.0%, 95% CI 6.4%-17.2%).
- The incidence of diagnostic errors was lower when the final diagnosis was included in the differential diagnosis list (7.2% vs 15.9%, P=.18).

Khan, M. et al. (2024) Ai-powered Healthcare Revolution: an Extensive Examination of Innovative Methods in Cancer Treatment, Jurnal Multidisiplin Ilmu, pp. 1-2.

https://www.neliti.com/publications/592335/ai-powered-healthcare-revolution-an-extensive-examination-of-innovative-methods

Link: https://www.neliti.com/publications/592335/ai-powered-healthcare-revolution-an-extensive-examination-of-innovative-methods

Relevant Key Findings:
- Artificial intelligence (AI) in cancer medicine
- Innovative techniques and advances in healthcare
- AI's role in diagnostic imaging
- Accuracy in identifying anomalies in MRIs, CT scans, and mammograms
- Targeted therapies and minimizing side effects in precision oncology
- AI-powered clinical decision support systems
- Insights into disease development and therapeutic responses
- Survival prognostication and identification of high-risk patients
- Improvement of clinical trials and drug research and development
- Changes in pathology and histology analysis for precise cancer diagnosis

Kumar, K.S. et al. (2023) Artificial Intelligence in Clinical Oncology: From Data to Digital Pathology and Treatment, American Society of Clinical Oncology Educational Book, 43, p. e390084. DOI: 10.1200/EDBK_390084

Link: https://ascopubs.org/doi/pdf/10.1200/EDBK_390084

Relevant Key Findings:
- The article discusses artificial intelligence (AI) applications in clinical oncology, focusing on digital pathology, biomarker development, and treatment.
- In digital pathology, AI is being used to extract new information from standard histology to guide treatment selection and biomarker development.
- For biomarker development, AI is being applied to predict treatment selection and response.
- In therapeutics, AI is being used for drug target discovery, drug design and repurposing, combination regimen optimization, and modulated dosing.
- The authors recommend developing workflows that integrate various AI innovations to comprehensively augment diagnostic and interventional capabilities in clinical oncology.
- Challenges remain in the ideation, validation, and deployment of AI in clinical oncology. The paper provides recommendations to address these from clinical, engineering, implementation, and health economics perspectives.
- The overall goal is to propose frameworks that can integrate AI domains for sustainable adoption of practice-changing AI in clinical oncology to improve patient outcomes.
- The article is published in the 2023 American Society of Clinical Oncology Educational

Book, Volume 43.

Li, H. et al. (2024) Application of artificial intelligence (AI)-enhanced biochemical sensing in molecular diagnosis and imaging analysis: Advancing and challenges, TrAC Trends in Analytical Chemistry, 174, p. 117700. DOI: https://doi.org/10.1016/j.trac.2024.117700

Link: https://www.sciencedirect.com/science/article/pii/S0165993624001821

Relevant Key Findings:
- Biochemical sensing plays a vital role in the research of life and natural science.
- Traditional sensors cannot meet the needs of accurate and efficient analysis of numerous data.
- The emergence of AI provides a new strategy for overcoming challenges in biochemical sensing.
- Focus on how AI reinforces biochemical sensing in accuracy, sensitivity, specificity, and efficiency.
- Review of AI applications in material synthesis, molecular diagnosis, and imaging analysis in the past three years.
- Discussion of characteristics and performance evaluation methods of the algorithms.
- Challenges of AI biochemical sensing in application include database construction, reasonable selection of algorithms, and data reliability verification.
- Clarification of advancements needed and future development prospects.

Miller, D.D. and Brown, E.W. (2018) Artificial Intelligence in Medical Practice: The Question to the Answer?, The American Journal of Medicine, 131(2), pp. 129–133. DOI: https://doi.org/10.1016/j.amjmed.2017.10.035

Link: https://web2.augusta.edu/mcg/medicine/documents/dougmillerartiintelligence.pdf

Relevant Key Findings:
- AI medical image analysis achieves diagnostic speed exceeding, and accuracy paralleling, experts (p. 2).
- AI will impact medical practice by applying natural language processing to "read" the expanding scientific literature and collate diverse electronic medical records (p. 2).
- Machines learning directly from medical data could avert clinical errors due to human cognitive biases, positively impacting patient care (p. 2).
- Deep learning addresses the clinical utility reduction of gene chips by reducing data diversity and applying layered auto-encoding analyses to train artificial neural networks to

achieve more accurate cancer detection and classification (p. 3).
- Convolutional neural networks outperformed 21 dermatologists at keratinocyte carcinoma and melanoma detection by classifying 129,450 images of 2032 malignant and benign skin diseases using multiple layered algorithms trained to identify common deadly skin cancers (p. 3).
- Two deep learning systems trained to detect and grade diabetic retinopathy and macular edema achieved high specificities (98%) and sensitivities (87%-90%) for detecting moderately severe retinopathy and macular edema, compared with 54 ophthalmologists and senior residents (p. 3).

Modi, K., Singh, I. and Kumar, Y. (2023) A comprehensive analysis of artificial intelligence techniques for the prediction and prognosis of lifestyle diseases, Archives of Computational Methods in Engineering, 30, pp. 4733–4756. DOI: https://doi.org/10.1007/s11831-023-09957-2

Link: https://link.springer.com/article/10.1007/s11831-023-09957-2

Relevant Key Findings:
- Artificial intelligence is the fastest growing data-driven technology and is currently used in all major fields and reduces the work of humans.
- Artificial intelligence can analyse extensive data from Electronic Health Records, clinical trials, patient's medical history, X-rays, CT scans and contribute to the healthcare field by explicitly detecting and predicting lifestyle diseases such as Alzheimer, Arthritis, Asthma, Atherosclerosis, COPD, Depression, Obesity, Osteoporosis, Metabolic Syndrome and PCOS.
- Lifestyle diseases are diseases related to the daily habits or routines of individuals such as smoking, excessive consumption of alcohol, physical inactivity, overeating etc.
- Common techniques used by AI to diagnose these diseases are Decision Tree, Random Forest, ANN, SVM, Regression, Naïve Bayes and deep learning models such as Convolutional Neural Network, Recurrent Neural Network, and Natural Language Processing.
- A common framework is presented in this paper to carry forward the research to add significant value.
- This paper presents an extensive overview of the diseases, their symptoms and associated illnesses, risk factors, datasets suitable for developing predictive models, challenges encountered by researchers, and significant contributions made in this area.

Mukherjee, D., Roy, D. and Thakur, S. (2025) Transforming Cancer Care: The Impact of AI-driven Strategies, Current Cancer Drug Targets, 25(2), pp. 204-207. DOI:

https://doi.org/10.2174/0115680096323564240703102748

Link: https://www.benthamdirect.com/content/journals/ccdt/10.2174/0115680096323564240703102748

Relevant Key Findings:
- AI is a critical component in healthcare, especially in the application of precision medicine where patients' characteristics, including genetic makeup, determine the treatment options that should be implemented.
- AI sorts big data, predicting people's reactions to specific treatments, the right combinations of drugs, and possible side effects, therefore increasing the efficiency of the treatment process and decreasing negative outcomes.
- This article briefly presents the ethical issues and concerns that might arise due to the integration of AI in society, such as the privacy of data, the issues of bias in the algorithms, and the issues of interpretability of the AI systems.
- There is no doubt that AI can bring qualitative changes in cancer care based on its potential to enhance patient prognosis and reduce health care costs, as well as become a defining feature of the standard of care.

Naeem, M. and Coronato, A. (2022) An AI-Empowered Home-Infrastructure to Minimize Medication Errors, Journal of Sensor and Actuator Networks, 11(1), pp. 1-14. DOI: https://doi.org/10.3390/jsan11010013

Link: https://www.mdpi.com/2224-2708/11/1/13/pdf

Relevant Key Findings:
- Medication errors affect 150,000 people yearly and 7000 patients die every year in the USA (p. 1).
- The cost of hospitalization due to failure in adherence to medication therapy is around USD 13.35 billion annually in the USA alone (p. 1).
- In Europe, the expense of medication errors ranges from €4.5 billion to €21.8 billion annually (p. 2).
- A study monitoring 256 residents in 55 care homes observed that 69.5% (178) had one or more medication errors, with a mean of 1.9 errors per resident (p. 2).
- AlexNet model was able to minimize the error rate to 16% in 2012, reduced from 25% in 2011 (p. 5).
- A DL classifier achieved 98.00% accuracy with a loss of 0.0583 on the testing data-set for drug identification (p. 10).

Namaganda, G. (2024) The Role of AI in Early Disease Detection and Diagnostics, J Biochem Biotech, 7(6), p. 239. DOI: https://doi.org/10.35841/aabb-7.6.239

Link:
https://www.alliedacademies.org/articles/the-role-of-ai-in-early-disease-detection-and-diagnostics.pdf

Relevant Key Findings:
- AI systems can detect abnormalities in medical images, such as X-rays, MRIs, and CT scans, that may be missed by the human eye, enabling earlier diagnosis of conditions like cancer (p. 1).
- AI tools have been trained to recognize subtle changes in mammograms that indicate the presence of tumors, sometimes years before they become detectable through traditional screening methods, allowing for less invasive treatments and improved patient outcomes in breast cancer (p. 1).
- Machine learning models can predict the likelihood of a heart attack or stroke by detecting early signs such as arterial blockages, abnormal heart rhythms, or high cholesterol levels (p. 1).
- AI algorithms can detect early signs of Alzheimer's disease by analyzing brain atrophy patterns in MRI scans or identifying changes in speech patterns that indicate cognitive decline, improving quality of life through early interventions (p. 1).
- During the COVID-19 pandemic, AI systems were employed to track the spread of the virus, predict outbreaks, and identify individuals at high risk by analyzing real-time data from various sources (p. 1).
- AI tools can analyze genetic sequences to detect BRCA mutations, which are associated with a higher risk of breast and ovarian cancer, enabling individuals to take preventive measures such as increased screening or prophylactic surgeries (p. 1).

Nassif, A.B., Talib, M.A., Nasir, Q., Afadar, Y. and Elgendy, O. (2022) Breast cancer detection using artificial intelligence techniques: A systematic literature review, Artificial Intelligence in Medicine, 127, pp. 1-20. https://arxiv.org/pdf/2203.04308

Link: https://arxiv.org/pdf/2203.04308

Relevant Key Findings:
- In 2020, over 276,000 new cases of invasive breast cancer and more than 48,000 non-invasive cases were diagnosed in the US, with early diagnosis leading to a 99% chance of survival for 64% of these cases (p. 1).
- Breast cancer can be detected using methods like X-ray mammography, ultrasound, Computed Tomography, Portion Emission Tomography, and Magnetic Resonance Imaging, but the golden standard is a pathological diagnosis (p. 1).

- Deep CNNs (Convolutional Neural Networks) have been shown to be quite effective for early detection and diagnosis of breast cancer, leading to more successful treatment (p. 3).
- Research indicates that the use of binary classification (whether or not breast cancer is present) results in the highest accuracy compared to multiclass classification in breast cancer detection (p. 11).
- CNN (Convolutional Neural Network) models are frequently used for both binary and multiclass classification in breast cancer studies (p. 11).
- For multiclass differentiation or breast cancer subtype classification, the highest accuracy obtained using imaging data was 90% in a study utilizing machine learning (p. 11).

Nawrat, Z. (2023) Introduction to AI-driven surgical robots, Art Int Surg, 3, pp. 90-97. DOI: 10.20517/ais.2023.14

Link: https://www.oaepublish.com/articles/ais.2023.14

Relevant Key Findings:
- The article discusses the introduction of AI-driven surgical robots and their impact on healthcare.
- AI is seen as an integral part of medical robots, enhancing their capabilities beyond just physical tasks.
- The author argues that AI and robotics represent a new paradigm of work in healthcare, potentially allowing human workers to focus more on patient care.
- Key benefits of AI-powered medical robots include:
- Improved precision and accuracy
- Faster and more efficient procedures
- Reduced recovery time
- Decreased risk of complications
- AI allows robots to operate autonomously, learn from experience, and adapt to new situations, making them more versatile.
- AI-powered robots use advanced sensors and imaging devices to collect and process large amounts of data in real-time.
- The integration of AI and robotics in surgery can provide surgeons with real-time information and feedback, enhance surgical planning and decision-making, and reduce risks.
- The author sees this technology as a way to improve surgical outcomes and potentially expand access to high-quality healthcare.
- However, the article also notes this shift will require expanding the professional teams responsible for patient care to include more engineering support.

Nimkar, P., Kanyal, D. and Sabale, S.R. (2024) Increasing trends of artificial intelligence with robotic process automation in health care: A narrative review, Cureus, 16(9), p. e69680. DOI:

https://doi.org/10.7759/cureus.69680

Link: https://www.cureus.com/articles/285919-increasing-trends-of-artificial-intelligence-with-robotic-process-automation-in-health-care-a-narrative-review.pdf

Relevant Key Findings:
- AI and RPA improve diagnostic precision, accelerate administrative tasks, reduce operation timing, and improve patient care in healthcare (p. 1).
- RPA bots automate manual processes in healthcare, allowing employees to dedicate more time to decision-making (p. 1).
- AI reduces the workload for doctors, nurses, and other healthcare professionals and saves significant time (p. 2).
- AI and RPA span appointment scheduling, robotic-assisted surgery, administrative data entry, telehealth monitoring, claim management, EHR, medical billing, patient and staff boarding (p. 3).
- RPA mitigates burnout and enhances overall job contentment by alleviating employees from repetitive duties (p. 5).
- Surgical robotics allows surgeons to make more accurate cuts and have supported the creation of new minimally invasive techniques (p. 6).

O'Sullivan, S. et al. (2019) Legal, regulatory, and ethical frameworks for development of standards in artificial intelligence (AI) and autonomous robotic surgery, The International Journal of Medical Robotics and Computer Assisted Surgery, 15(1), pp. 1-6. DOI: https://doi.org/10.1002/rcs.1968

Link: https://onlinelibrary.wiley.com/doi/abs/10.1002/rcs.1968

Relevant Key Findings:
- Accountability
- Liability
- Culpability
- p. 1
- p. 2
- p. 3

Olawade, D.B. et al. (2023) Using artificial intelligence to improve public health: a narrative review, Frontiers in Public Health, 11, pp. 1-9. DOI: 10.3389/fpubh.2023.1196397

Link:
https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2023.1196397/pdf

Relevant Key Findings:
- AI can aid public health delivery via spatial modeling, risk prediction, misinformation control, public health surveillance, disease forecasting, and health diagnosis (p. 1).
- AI was integral to forecasting COVID-19 spread, contact tracing, pharmacovigilance, and rapid testing and detection during the pandemic (p. 1).
- AI algorithms have been used to forecast the spread of infectious diseases like COVID-19 or influenza, enabling public health officials to take preventive measures (p. 2).
- AI algorithms can examine a variety of data sources, including social media and electronic health records, to find patterns and forecast the spread of diseases (p. 3).
- Machine learning algorithms can examine and integrate massive volumes of data, including laboratory test results and medical imaging, to find patterns and forecast disease (p. 5).
- CNNs enable the identification of patterns, anomalies, and abnormalities in X-rays, CT scans, and MRIs by automatically learning hierarchical features from images (p. 6).

Parmar, U.P.S. et al. (2024) Artificial Intelligence (AI) for Early Diagnosis of Retinal Diseases, Medicina, 60(4), pp. 1-15. DOI: https://doi.org/10.3390/medicina60040527

Link: https://www.mdpi.com/1648-9144/60/4/527/pdf

Relevant Key Findings:
- Artificial intelligence (AI) has emerged as a transformative tool in ophthalmology, revolutionizing disease diagnosis and management (p. 1).
- AI systems utilize algorithms to detect early signs of diabetic retinopathy (DR) from color fundus photography, including microaneurysms, red lesions, hemorrhages, and blood vessel segmentation (p. 3).
- The EyeArt system has a sensitivity and specificity of 91.7% and 91.5%, respectively, for determining the necessity of referral for diabetic retinopathy (p. 3).
- Deep learning CNNs analyzing fundus photographs for automated age-related macular degeneration (AMD) severity grading achieved accuracy values of 79.4%, 81.5%, and 93.4% in classifying different classes of AMD (p. 4).
- Wang et al.'s DeepROP system achieved high sensitivity (99.62% for Id-Net and 88.46% for Gr-net) and specificity (99.32% for Id-net and 92.31% for Gr-net) in facilitating early detection of retinopathy of prematurity (ROP) using retinal fundus photographs (p. 7).
- Abbas et al.’s algorithm using DenseNet reported a sensitivity and specificity of 90.5% and 91.5% in classifying hypertensive retinopathy (HR) using 1400 fundus photographs (p. 9).

Shen, R. (2024) The Transformative Impact of Artificial Intelligence in Healthcare: innovations, applications, and future prospects, SHS Web of Conferences, 207, p. 03018. DOI: 10.1051/shsconf/202420703018

Link:
https://www.shs-conferences.org/articles/shsconf/pdf/2024/27/shsconf_icdeba2024_03018.pdf

Relevant Key Findings:
- AI enhances diagnostic processes by spotting early-stage lung cancer on CT scans more reliably than human radiologists (p. 3).
- AI-driven systems like IBM Watson for Oncology review medical records and cross-reference cases to present oncologists with evidence-based treatment options (p. 3).
- AI-based personalized medicine uses genomic data to identify specific cancer treatments based on a patient's tumor genetic signature (p. 3).
- AI algorithms can detect diabetic retinopathy with accuracy approaching that of ophthalmologists, enabling timely treatment and averting blindness (p. 4).
- AI-powered robots like ReWalk provide physical therapy to patients recovering from spinal cord injuries by helping them regain mobility (p. 4).
- AI algorithms can analyze remotely collected patient data to provide real-time insights and early warnings of potential health problems (p. 6).

Singh, Y., Hathaway, Q.A. and Erickson, B.J. (2024) Generative AI in oncological imaging: Revolutionizing cancer detection and diagnosis, Oncotarget, 15, pp. 607-608. https://www.oncotarget.com/article/28640/pdf/

Link: https://www.oncotarget.com/article/28640/pdf/

Relevant Key Findings:
- Generative AI can generate synthetic medical images, enhance image quality, and predict future progression of tumors (p. 1).
- Generative AI can expand datasets for training diagnostic algorithms by generating synthetic images of rare cancer types or early-stage tumors (p. 1).
- Generative AI can denoise low-dose CT scans, improve the spatial resolution of MRI images, and reconstruct missing data in partial scans (p. 1).
- AI models can predict likely tumor growth patterns and treatment responses by analyzing current imaging data and generating potential future scenarios (p. 1).
- AI systems could analyze an individual's digital twin to determine the optimal screening schedule and modality, moving beyond the one-size-fits-all approach (p. 1).
- Generative AI could simulate potential growth patterns of lesions, allowing oncologists to

tailor treatment plans with precision and improve outcomes (p. 2).

Sugimoto, M. et al. (2023) Machine learning techniques for breast cancer diagnosis and treatment: a narrative review, Annals of Breast Surgery, 7, p. 7. DOI: 10.21037/abs-21-63

Link: https://abs.amegroups.org/article/view/7085/html

Relevant Key Findings:
- The review examines studies using machine learning and deep learning techniques for breast cancer classification and diagnosis across five medical imaging modalities: mammography, ultrasound, MRI, histology, and thermography.
- It discusses five popular machine learning techniques: Nearest Neighbor, SVM, Naive Bayesian Network, Decision Trees, and Artificial Neural Networks, as well as deep learning architectures and convolutional neural networks.
- Machine learning and deep learning techniques have achieved high accuracy rates in breast cancer classification and diagnosis across various imaging modalities.
- These techniques have potential to improve clinical decision-making and lead to better patient outcomes.
- The review finds that machine learning can help exploit clinical utility and understand tumorigenesis/progression of breast cancer from big data sources.
- Approximately 3,000 papers on this topic were published from 2015-2019, aided by publicly available databases like the Wisconsin Breast Cancer Database.
- Image processing using machine learning is currently a major focus area for breast cancer diagnosis.
- The review also covers applications of machine learning to other data types beyond imaging, especially clinical-pathological features and quantitative molecular profiles.
- Machine learning models have been developed to predict response to neoadjuvant chemotherapy and axillary lymph node metastasis in breast cancer patients.

Terry, N. (2019) Of Regulating Healthcare AI and Robots, Yale Journal of Health Policy, Law, and Ethics, 18(3), pp. 1-52. https://scholarworks.indianapolis.iu.edu/bitstreams/90b5fba8-4f1f-4228-abbb-fc29e7031572/download

Link:
https://scholarworks.indianapolis.iu.edu/bitstreams/90b5fba8-4f1f-4228-abbb-fc29e7031572/download

Relevant Key Findings:
- The American Medical Association (AMA) preferred the phrase "augmented intelligence" in

its 2018 policy recommendations, rather than "artificial intelligence." (p. 4)
- 75% of all medical communications still rely on facsimile machines. (p. 6)
- Healthcare professionals have a relatively low potential for substitution by AI. (p. 7)
- CMS Administrator Seema Verma stated that "Healthcare remains in a 1990s time warp." (p. 7)
- AI imaging is estimated to be a $2 billion business by 2023. (p. 11)
- Diagnostic errors affect 5% of U.S. outpatients annually, accounting for 6-17% of adverse events. (p. 12)

Wang, H-Y. et al. (2024) Integrating Artificial Intelligence for Advancing Multiple-Cancer Early Detection via Serum Biomarkers: A Narrative Review, Cancers, 16(5), p. 862. DOI: https://doi.org/10.3390/cancers16050862

Link: https://www.mdpi.com/2685940?trk=public_post_comment-text

Relevant Key Findings:
- The concept and policies of multicancer early detection (MCED) have gained significant attention from governments worldwide in recent years.
- The integration of MCED with AI has become a prevailing trend, giving rise to a plethora of MCED AI products.
- The overall diversity of MCED AI products remains considerable.
- The types of detection targets encompass protein biomarkers, cell-free DNA, or combinations of these biomarkers.
- Different model training approaches are employed, including datasets of case-control studies or real-world cancer screening datasets.
- Various validation techniques, such as cross-validation, location-wise validation, and time-wise validation, are used.
- All of the factors show significant impacts on the predictive efficacy of MCED AIs.
- Deploying the MCED AIs in clinical practice presents numerous challenges, including presenting the predictive reports, identifying the potential locations and types of tumors, and addressing cancer-related information, such as clinical follow-up and treatment.
- This study reviews several mature MCED AI products currently available in the market.
- This review illuminates the challenges encountered by existing MCED AI products across these stages, offering insights into the continued development and obstacles within the field of MCED AI.

Yilmaz, R. and Yağın, F.H. (2022) Early Detection of Coronary Heart Disease Based on Machine Learning Methods, Med Records, 4(1), pp. 1-6. DOI: https://doi.org/10.37990/medr.1011924

Link: https://dergipark.org.tr/en/download/article-file/2035220

Relevant Key Findings:
- Random Forest (RF) model classified coronary heart disease with 92.9% accuracy, outperforming Support Vector Machine (SVM) at 89.7% and Logistic Regression (LR) at 86.1% (p. 1).
- The RF model achieved a Specificity of 92.9%, Sensitivity of 92.8%, F1-score of 92.8%, Negative Predictive Value of 92.9%, and Positive Predictive Value of 92.8% in classifying coronary heart disease (p. 1).
- The SVM model showed a higher Sensitivity value compared to the RF model (p. 1).
- In a dataset of 1190 patients expanded to 1258 via SVM-SMOTE (629 in each class), RF, SVM, and LR algorithms were used for coronary heart disease classification (p. 4).
- Grid Search with 3 repeats and 10-fold Repeated k-Fold Cross-Validation was used to determine the optimal hyperparameters for each model (p. 4).
- The values of Accuracy, Specificity, F1-score, Sensitivity, Negative predictive value, and Positive predictive value criteria obtained from the SVM model were calculated as 0.897, 0.844, 0.887, 0.971, 0.976, and 0.816 respectively (p. 4).

Zaslavsky, M.E. et al. (2023) Disease diagnostics using machine learning of immune receptors, bioRxiv. DOI: 10.1101/2022.04.26.489314

Link: https://med.stanford.edu/content/dam/sm/utzlab/documents/Zaslavsky%20BioRxiv%202023.pdf

Relevant Key Findings:
- MAchine Learning for Immunological Diagnosis (Mal-ID) screens for multiple illnesses simultaneously by analyzing receptor sequence datasets with machine learning representations of immune receptor repertoires (p. 2).
- Many features of immune receptor sequences, when modeled using machine learning, can independently recapitulate known biology of responses to infections like SARS-CoV-2 and HIV (p. 2).
- MAchine Learning for Immunological Diagnosis (Mal-ID) approach is effective in identifying a variety of disease states, including acute and chronic infections and autoimmune disorders, even with differences between pediatric and adult patient groups (p. 2).
- Mal-ID uses three models per gene locus to identify disease states and receptor sequences of disease-related antigens: variable gene segment frequencies, similar sequences across individuals, and protein language modeling (p. 3).
- The combined B cell receptor (BCR) + T cell receptor (TCR) metamodel in Mal-ID outperforms BCR-only or TCR-only versions, demonstrating the benefit of integrating signals from both B cell and T cell populations (p. 9).
- Applying machine learning to immune repertoires can reveal common features of autoreactive immune receptor repertoires, enabling new immunological knowledge discovery

and contributing to disease diagnostics (p. 2). Mal-ID is able to distinguish disease and healthy states with an AUC score of 0.98 (p. 9).

Zhang, G.Y. and Gross, C.P. (2024) Protecting Patients by Reducing Diagnostic Error, JAMA Intern Med, 184(2), p. 173. DOI: https://doi.org/10.1001/jamainternmed.2023.7334

Link: https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2813859

Relevant Key Findings:
- 23% of hospitalized patients experienced a diagnostic error
- 17% of patients experienced harm or death as a result
- Study involved 2428 patient records across 29 academic medical centers in the US