Project Notes:

Project Title: Using CNNs and Machine Learning to Diagnose Skin Cancer Moles
Name: Anika Sivasankar

Note Well: There are NO SHORT-CUTS to reading journal articles and taking notes from them. Comprehension is paramount. You will most likely need to read it several times, so set aside enough time in your schedule.

Contents:

Knowledge Gaps:

This list provides a brief overview of the major knowledge gaps for this project, how they were resolved and where to find the information.

Knowledge Gap	Expected Resolved by	Information is located	Date resolved
Figuring out how you can use Python to program a Machine Learning model?	December 2024	Mentors, Online resources like Github	November 29 2024
How can ML models analyze the data using Python?	December 2024	Github, Mentors specialized in ML models	December 2 2024
What kinds of datasets will I set aside to be used in the ML model training process?	November 2024	Online research on image recognition analysis with ML models,	November 20 2024
What kinds of pre-trained models already exist to be used for CNNs?	November 2024	Reading journals that talk about using CNNs with pre-trained models, and seeing how and why they used certain ones over others?	November 30 2024
What kinds of steps need to be considered during the image preprocessing stages?	November 2024	In research articles dedicated to image augmentation and image preprocessing for ML models	November 28 2024
How can you analyze the accuracy and loss of models?	December 2024	Online research and asking mentors	December 8 2024

Literature Search Parameters:

These searches were performed between (Start Date of reading) and XX/XX/2019.
List of keywords and databases used during this project.

Database/search engine	Keywords	Summary of search
Google	Machine Learning Model in Healthcare	Most of the results that came up here shows how ML models were implemented in different aspects of healthcare, ranging from diagnosis to analyzing data.
Google	how to train a ML model image recognition	Most of these results were about you would pick your dataset, then pick the kind of model you would train, and how you can use convolutional neural networks to help in that process
Google	ml model image analysis	Most of these results were about how ML models can analyze images and find patterns and shapes to come up with some quantitative data.

Tags:

Tag Name	
Artificial Intelligence	Machine Learning Model
Disease Diagnosis	AI Trust/Ethical Concerns

Article #Ex. Notes: Title

Article notes should be on separate sheets

KEEP THIS BLANK AND USE AS A TEMPLATE

Source Title	
Source citation (APA Format)	
Original URL	
Source type	
Keywords	
#Tags	
Summary of key points + notes (include methodology)	
Research Question/Problem/ Need	
Important Figures	
VOCAB: (w/definition)	
Cited references to follow up on	
Follow up Questions	

Article #1 Notes: COVID-19 Pandemic Cybersecurity Issues

Article notes should be on separate sheets

Source Title	COVID-19 pandemic cybersecurity issues
Source citation (APA Format)	Pranggono B, Arabo A. 2021 COVID-19 pandemic cybersecurity issues. Internet Technology Letters.;4:e247. https://doi.org/10.1002/itl2.247
Original URL	https://onlinelibrary.wiley.com/doi/10.1002/itl2.247
Source type	Letter/Journal Article
Keywords	Cybersecurity, Covid-19
#Tags	Cyberattacks, Scams, Phishing, Malware
Summary of key points + notes (include methodology)	This paper talks about how the COVID-19 pandemic has led to a rise in cyber-attacks, especially against vulnerable sections like healthcare. It mostly discusses the challenges posed by the shift to start remotely working and suggests ways to strengthen cybersecurity during these uncertain times.
Research Question/Problem/ Need	How has the COVID-19 pandemic worsened cybersecurity threats, due to increased cybercriminal activity through phishing and ransomware, and the challenges posed by the sudden shift to remotely work in quarantine?
Important Figures	n/a
VOCAB: (w/definition)	Cyber Criminals: a person who engages in criminal activity by means of computers or the internet.
Cited references to follow up on	n/a
Follow up Questions	1. How have the healthcare cybersecurity measures during the pandemic helped with cyber-attacks? 2. What long-term cybersecurity issues might come from working remotely and any online tools?

	3. How well do current cybersecurity training programs prepare employees for working on cybersecurity in a remote setting, and how can they be improved?

Article #2 Notes: Revolutionizing healthcare: the role of artificial intelligence in clinical practice

Article notes should be on separate sheets

Source Title	BMC Medical Education
Source citation (APA Format)	Alowais, S. A., Alghamdi, S. S., Alsuhebany, N., Alqahtani, T., Alshaya, A. I., Almohareb, S. N., Aldairem, A., Alrashed, M., Bin Saleh, K., Badreldin, H. A., Al Yami, M. S., Al Harbi, S., & Albekairy, A. M. (2023, September 22). *Revolutionizing Healthcare: The role of Artificial Intelligence in Clinical Practice - BMC Medical Education*. BioMed Central. https://bmcmededuc.biomedcentral.com/articles/10.1186/s12909-023-04698-z
Original URL	https://bmcmededuc.biomedcentral.com/articles/10.1186/s12909-023-04698-z
Source type	Journal Article
Keywords	AI, Clinical Practice
#Tags	HealthCare, Machine Learning model
Summary of key points + notes (include methodology)	This article talks about how AI is changing healthcare by helping doctors make better decisions with their patient care. The AI can help analyze large quantities of data and help spot any kinds of patterns that it sees, to help with any real-life situations with patients. When doctors are using AI in their clinical practices, there is a chance that the data can be leaked, which is what seeps into the ethical concerns of the patients.
Research Question/Problem/ Need	How can you effectively integrate AI into healthcare, even though you are addressing the ethical concerns.
Important Figures	n/a
VOCAB: (w/definition)	Personalized treatment – treatment that will cater to the person's unique needs.
Cited references to follow up on	n/a
Follow up Questions	How could AI be used in the sense that if the data isn't the best quality, how could you fix that to make sure there are no errors in your treatment plan?

	If some datasets are of better quality than others, can the AI differentiate that? How can we be so sure that users will deliver the best data for the model to interpret?

Article #3 Notes: Machine Learning in Healthcare

Article notes should be on separate sheets

Source Title	National Library of Medicine
Source citation (APA Format)	Habehh, H., & Gohel, S. (2021, December 16). *Machine learning in Healthcare*. Current genomics. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8822225/ https://doi.org/10.2174/1389202922666210705124359.
Original URL	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8822225/
Source type	Journal Article
Keywords	Artificial Intelligence, clinical practice, diagnose
#Tags	Machine Learning, Healthcare
Summary of key points + notes (include methodology)	This article talks about the overall progress of AI and ML in more health emergencies and analyzing any kinds of disease patterns. When the AI analyzes patterns in the diseases, specifically using image recognition, it can help facilitate in the disease diagnosis process, which in the long run, can be something that can make the jobs of doctors much easier. The article also talks about how ML is used in radiology, genetics, and electronic health records. This brings up ethical concerns, like data privacy, and challenges in ML to healthcare are also addressed in this article. How ML can be reinforced in medicine for doctors to help their patients is the main point of this article.
Research Question/Problem/ Need	How can ML models be applied in any kind of healthcare settings in order to effectively assist doctors in doing their jobs?
Important Figures	n/a
VOCAB: (w/definition)	Supervised learning – when the ML model is trained on labeled data to predict an outcome Unsupervised learning – when the ML model doesn't use labels but it can still find patterns.
Cited references to follow up on	n/a
Follow up Questions	How can healthcare professionals be trained to effectively use Machine

	Learning tools? How can we address the ethical concerns that may arise from using AI? Would people be okay with their data being in the hands of AI and the people training it? What security measures could be considered for this to be something people are okay with?

Article #4 Notes: Artificial Intelligence and Human Trust in Healthcare: Focus on Clinicians

Article notes should be on separate sheets

Source Title	JMIR Publications
Source citation (APA Format)	Asan, O., Bayrak, A. E., Choudhury, A., Enterprises, S. of S. and, & Asan, C. A. (n.d.-b). *Artificial Intelligence and human trust in healthcare: Focus on clinicians*. Journal of Medical Internet Research. https://www.jmir.org/2020/6/e15154/
Original URL	https://www.jmir.org/2020/6/e15154/
Source type	Journal Article
Keywords	Clinicians, AI, Trust
#Tags	Healthcare, Machine Learning, AI
Summary of key points + notes (include methodology)	The overall key point of this article is talking about how trusting clinicians are with AI technology being used in healthcare and it is helping them in making their jobs much easier. It shows how some clinicians don't exactly build trust in AI as easily, and it takes time to build up that trust. AI systems need to be improved, and this will allow for clinicians to have better understandings of AI and how it's being used to help them. The goal of this is to eventually build up the trust that clinicians have in ML models, so that they will be able to solely use it in their everyday jobs and tksts. This was said to also help in improving the decision-making process that healthcare has.
Research Question/Problem/ Need	How can we understand factors that influence clinician's trust in using AI technology to help them in making healthcare decisions?
Important Figures	n/a
VOCAB: (w/definition)	Optimization – making something as efficient as possible Clinical decision making – when people working in healthcare decide on the best course of action for their patients, based on available info
Cited references to follow up on	n/a
Follow up Questions	How does the level of trust in AI tech impact any kinds of patient outcomes?

	How can hospitals measure the level of trust that clinicians have in AI? Can we measure how accurate AI is in diagnosing, so that we can convince clinicians who do not have that must trust in AI to be able to rely on it for their job?

Article #5 Notes: The potential for artificial intelligence to transform healthcare: perspectives from international health leaders

Article notes should be on separate sheets

Source Title	NPJ Digital Medicine
Source citation (APA Format)	Silcox, C., Zimlichmann, E., Huber, K., Rowen, N., Saunders, R., McClellan, M., Kahn, C. N., Salzberg, C. A., & Bates, D. W. (2024, April 9). *The potential for artificial intelligence to Transform Healthcare: Perspectives from International Health Leaders*. Nature News. https://www.nature.com/articles/s41746-024-01097-6
Original URL	https://www.nature.com/articles/s41746-024-01097-6
Source type	Journal Article
Keywords	Ethical Concerns, AI Development
#Tags	Artificial Intelligence, Healthcare
Summary of key points + notes (include methodology)	This article talks about how AI can change healthcare by helping improve on patient care. The outcomes of their health can be drastically improved, although the ethical concerns of patient safety are also an important thing to take note of. There are four main action areas made by the Future of Health (FOH), which are enhancing data quality, creating reliable systems for AI development, promoting data sharing, and offering incentives to speed up the use of AI in healthcare. All of these goals are set to make sure AI is able to meet the requirements needed to be efficiently integrated into a healthcare setting, making doctor's work more accurate.
Research Question/Problem/ Need	How can you effectively use AI in healthcare to improve on the outcomes, but making sure to oversee challenges like the quality of the data?
Important Figures	n/a
VOCAB: (w/definition)	Infrastructure – the basic organizational structure that is needed to perform the given task Incentives – some factors that can motivate an individual to perform a task or action
Cited references to follow up on	n/a

Follow up Questions	When standardizing data to train the AI models, what challenges do healthcare systems face? What are different ways we can enhance the overall quality of the data at hand? If AI changes the way patients are cared for, could it take over the doctor's jobs?

Article #6 Notes: Artificial Intelligence and Healthcare: A Journey through History, Present Innovations, and Future Possibilities

Article notes should be on separate sheets

Source Title	MDPI
Source citation (APA Format)	Hirani, R., Noruzi, K., Khuram, H., Hussaini, A. S., Aifuwa, E. I., Ely, K. E., Lewis, J. M., Gabr, A. E., Smiley, A., Tiwari, R. K., & Etienne, M. (2024). Artificial Intelligence and Healthcare: A Journey through History, Present Innovations, and Future Possibilities. *Life*, *14*(5), 557. https://doi.org/10.3390/life14050557
Original URL	https://www.mdpi.com/2075-1729/14/5/557
Source type	Journal Article
Keywords	Keywords: Artificial intelligence, ML, telemedicine, chatbots, digital health, personalized medicine, neural networks
#Tags	Artificial Intelligence, Machine Learning, personalized treatment plans
Summary of key points + notes (include methodology)	The article talks about how AI has had major developments in healthcare, starting from the 1960s to some of its current uses, like personalized medicine, robotic surgeries, and drug development. It makes sure to take note of the role of AI during the COVID-19 pandemic, especially in telemedicine and virtual care through chatbots, because patients were not able to come into the doctor's office during the pandemic. The article also talks about some of the ethical challenges, like about the patient's privacy of their health data being in the hand of AI during the training process, that need to be addressed. It makes it clear how there is a need for new guidelines to make sure AI's future use in healthcare is safe, fair, and accessible to everyone, ensuring safety in the patient's data.
Research Question/Problem/ Need	How has the integration of AI evolved in healthcare, and what are some of the current challenges and ethical concerns in its application?
Important Figures	n/a
VOCAB: (w/definition)	Telemedicine: Using technology to provide different kinds of medical care remotely, through video calls or online communication Health Disparities: differences in healthcare access, like race, gender etc.

Cited references to follow up on	n/a
Follow up Questions	1.) How did the COVID-19 pandemic increase the use of AI in healthcare, particularly in telemedicine, and how can that be applied to situations today? 2.) What are some of the main ethical challenges of using AI in healthcare, and how can they be addressed? 3.) How can AI help reduce health disparities, solutions to any of them?

Article #7 Notes: Artificial Intelligence Applications for Biomedical Cancer Research: A Review

Article notes should be on separate sheets

Source Title	National Library of Medicine
Source citation (APA Format)	Weerarathna, I. N., Kamble, A., & Anurag Luharia. (2023). Artificial Intelligence Applications for Biomedical Cancer Research: A Review. *Cureus*, *15*(11). https://doi.org/10.7759/cureus.48307
Original URL	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10697339/
Source type	Journal Article
Keywords	radiodiagnosis, nanotechnology, personalized treatment, diagnostics, precision medicine, cancer research, artificial intelligence
#Tags	Artificial Intelligence, Diagnosing Diseases, Treatment personalization
Summary of key points + notes (include methodology)	The main topic of this article is how AI is changing the way we diagnose and treat cancer, which will make the process faster and more accurate. It helps doctors identify the cancer earlier in the process, avoiding eventual metastasizing, through better image analysis and making treatments like radiotherapy more precise. CNNs can help in this process, with their strong image recognition abilities. AI can also predict how patients might respond to chemotherapy and immunotherapy, which could help make for more personalized treatment plans for those patients. It even plays a role in advanced techniques like nanotechnology for targeted drug delivery. Even though AI has its potential, different challenges like data quality and ethical concerns need to be addressed for it to be fully effective in what we want it to do in healthcare.
Research Question/Problem/ Need	How can AI enhance the cancer care through a more accurate type of diagnosis and personalized treatments, while also addressing challenges like data set quality?
Important Figures	n/a
VOCAB: (w/definition)	Radiodiagnosis: Suing imaging technology like MRIs and CT scans to diagnose diseases. Radiotherapy: Cancer tumor treatment using radiation Nanotechnology - Using very small particles or materials in medicine to target and treat diseases at the molecular level.

Cited references to follow up on	n/a
Follow up Questions	1.) How does AI help doctors find cancer more accurately using images like X-rays or scans? 2.) What challenges does AI face when being used in cancer treatments like radiation or chemotherapy? 3.) How can AI help doctors decide which cancer treatments will work best for different patients?

Article #8. Notes: Applications of Artificial Intelligence (AI) in healthcare

Article notes should be on separate sheets

Source Title	scienceOPEN
Source citation (APA Format)	Shaheen, M. Y. (2021). Applications of Artificial Intelligence (AI) in healthcare: A review. *ScienceOpen Preprints*, *1*(1). https://doi.org/10.14293/s2199-1006.1.sor-.ppvry8k.v1
Original URL	https://www.scienceopen.com/hosted-document?doi=10.14293/S2199-1006.1.SOR-.PPVRY8K.v1
Source type	Journal Article
Keywords	Clinical Trials, AI, COVID-19, Drug Discovery
#Tags	AI, ML Models, Healthcare
Summary of key points + notes (include methodology)	This article is looking at how AI is changing healthcare, focusing on three key areas: drug discovery, clinical trials, and patient care. AI helps speed up the discovery of new drugs and medicines by helping with the analyzing of complex data. It is also used in clinical trials to manage large amounts of information, making the process faster and more accurate. AI analyzes patient data to give ideas and treatment plans that can improve the quality of care for the patient. The study also talks about some of the challenges, such as high costs and the effects of the COVID-19 pandemic, showing how AI could help solve these issues.
Research Question/Problem/ Need	How can AI transform and address any key challenges in modern healthcare, such as drug discovery, clinical trials, and patient care?
Important Figures	n/a
VOCAB: (w/definition)	Clinical Trials: research studies conducted for patients
Cited references to follow up on	n/a
Follow up Questions	1.) How does AI improve the efficiency of drug discovery compared to already existing traditional methods? 2.) What role did AI play in handling data and patient care during the COVID-19 pandemic that might not have been addressed in this article?

	3.) What are some of the biggest challenges that come from integrating AI into clinical trials and patient care?

Article #9. Notes: Artificial intelligence (AI) in healthcare and research

Article notes should be on separate sheets

Source Title	Bioethics Briefing Note
Source citation (APA Format)	Berg, R. S. (2018, May 15). *Artificial intelligence (AI) in healthcare and research*. Nuffield Bioethics. https://healthcare.report/Resources/Whitepapers/31b40935-fca9-4018-b44b-1c08034d11c4_Artificial-Intelligence-AI-in-healthcare-and-research.pdf
Original URL	https://healthcare.report/Resources/Whitepapers/31b40935-fca9-4018-b44b-1c08034d11c4_Artificial-Intelligence-AI-in-healthcare-and-research.pdf
Source type	Article/Policy Brief
Keywords	AI, Drug Discovery, Medical Imaging, Echocardiography
#Tags	AI, ML, Personalized treatments
Summary of key points + notes (include methodology)	The article discusses how AI is being used in various areas of healthcare, such as disease detection, chronic condition management, drug discovery, and improving patient experiences. It mentions how AI has a very good ability to analyze large datasets, especially with images (using Convolutional Neural Networks), speeding up medical research, and helping in clinical tasks like medical imaging and surgeries. It focuses on using AI tools to analyze large datasets, such as medical images and genetic data, to make faster and more accurate predictions. There are some ethical concerns, like data privacy, bias, and accountability for the AI-based decisions in clinical practice. There's some potential of AI in improving healthcare efficiency, overall patient outcomes, and reducing costs.
Research Question/Problem/ Need	How can AI improve healthcare practices like detecting diseases and drug discovery to create new medicines, while simultaneously addressing ethical challenges?
Important Figures	n/a
VOCAB: (w/definition)	Chronic Condition Management: Using AI to help manage chronic health conditions, which will improve patient care. Telemedicine: healthcare that is provided online, through virtual

	consultations.
Cited references to follow up on	n/a
Follow up Questions	1.) How can we make sure the ethical concerns are addressed so people can trust using AI? 2.) Can there be other models used to analyze images that aren't CNNs? 3.) How can we make drug discovery the most accurate, using AI?

Article #10. Notes: What Artificial Intelligence Means for Health Care

Article notes should be on separate sheets

Source Title	Jama Health Forum
Source citation (APA Format)	Cutler, D. M. (2023, July 6). *What Artificial Intelligence Means for Health Care*. Jama Network. https://jamanetwork.com/journals/jama-health-forum/fullarticle/2807176
Original URL	https://jamanetwork.com/journals/jama-health-forum/fullarticle/2807176
Source type	Article
Keywords	AI, Automation Clinical Decision Making, Bias
#Tags	AI, Clinical help, Assist doctors
Summary of key points + notes (include methodology)	The article talks about how AI is changing healthcare, focusing on its strengths and challenges. AI is expected to automate some routine tasks like billing and scheduling, which can save almost billions of dollars for hospitals. This is one of the benefits, cutting down costs. But this may also reduce some administrative jobs. In clinical settings, AI is more likely to help doctors instead of replace the doctors, and they would help with tasks like analyzing lab results and monitoring patients remotely, but also using image recognition to help diagnose, helping doctors quite a bit in that field. The article also talks about how AI should aim to improve human decision-making and avoid replicating biases. AI integration in healthcare will require thoughtful planning and high-quality data, but this will end in AI being implemented successfully.
Research Question/Problem/ Need	How can AI improve healthcare efficiency and support clinical care while also addressing challenges like bias and data quality?
Important Figures	n/a
VOCAB: (w/definition)	Clinical Care: Using AI to support doctors in analyzing medical data and aiding in diagnosis and treatment. Remote Monitoring: AI tools that track patients' health from home, reducing the amount of hospital visits.
Cited references to follow up on	n/a

Follow up Questions	1.) How can AI help reduce the costs of healthcare while maintaining the same level of quality of patient care? 2.) What are some of the potential risks that doctors and patients might face when relying on AI for clinical decision-making? 3.) How can AI developers address bias in data to make sure there are only fair outcomes?

Article #11. Notes: Artificial Intelligence in Skin Cancer Diagnosis: A Reality Check

Article notes should be on separate sheets

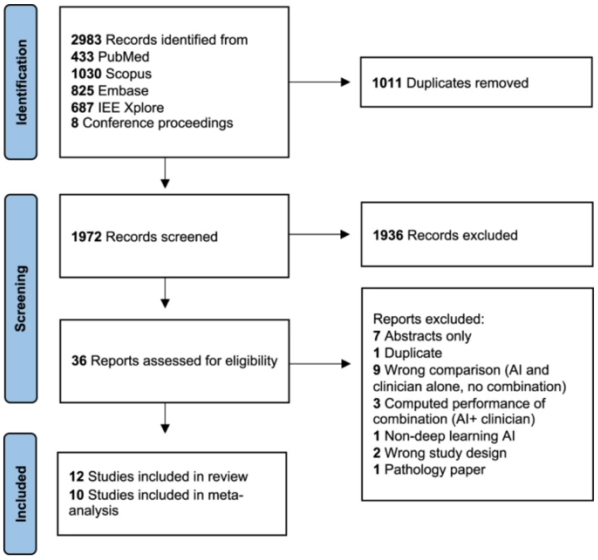
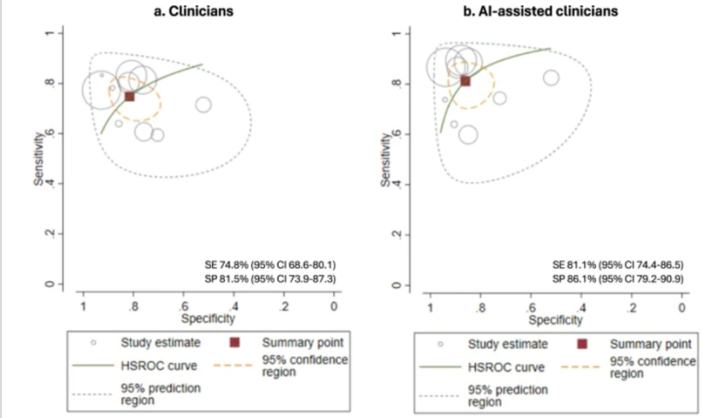
Source Title	ScienceDirect
Source citation (APA Format)	Brancaccio, G., Balato, A., Malvehy, J., Puig, S., Argenziano, G., & Kittler, H. (2023). Artificial Intelligence in Skin Cancer Diagnosis: A Reality Check. *The Journal of Investigative Dermatology*, *144*(3). https://doi.org/10.1016/j.jid.2023.10.004
Original URL	https://www.sciencedirect.com/science/article/pii/S0022202X23029640
Source type	Journal Article
Keywords	Convoluted neural network, Melanoma, Dermoscopy, Mobile apps, Primary care
#Tags	#SkinCancerDetection #HumanAICollaboration #AIvsDoctors
Summary of key points + notes (include methodology)	• AI is very accurate at analyzing skin cancer images in order to detect cancer • Collaboration between AI and doctors works better than letting AI operate on its own. • Most studies test AI diagnosis models in artificial lab settings, not in real clinics, which makes it hard to judge how well it works with actual patients. • AI struggles with identifying rare lesion types • AI often beats dermatologists when sorting lesions into categories, so it's a good backup for dermatologists to have. • AI works best when it gives probabilities of having a certain diagnosis, instead of simple yes or no answers. • AI does pretty well in studies but often has worse performance in real world type of scenarios where patients may have more complex issues. • The study reviewed other studies comparing how AI performs vs. dermatologists in diagnosing the cancer, or in classifying multiple lesion types. • This study also analyzed trials where doctors used AI tools to refine their decisions of making diagnoses
Research Question/Problem/ Need	The article talks about how AI performs in real-world, when doing skin cancer detection, compared to controlled lab settings. The main thing is

	showing how AI struggles with certain lesion types. There's a clear need for real-world studies to evaluate how AI can best complement human expertise and improve patient outcomes. This study wants to address challenges like overcounting lesions and handling diverse lesion types.
Important Figures	n/a
VOCAB: (w/definition)	**AI-Assisted Diagnosis**: Using artificial intelligence to help doctors figure out what's wrong. **Dermoscopy**: A special tool doctors use to zoom in on skin spots to check for cancer. **Binary Classification**: When AI sorts things into two groups, like cancerous vs. not cancerous. **Multiclass Classification**: When AI sorts things into more than two groups, like different types of skin conditions. **Overcounting**: When AI counts too many skin spots or moles by mistake. **Nevi**: Another word for moles, which can sometimes be a sign of skin cancer risk.
Cited references to follow up on	n/a
Follow up Questions	1.) How can future studies make sure that the AI is trained to handle more complex skin lesion types, to improve its performance in the real-world? 2.) What more specific steps could be taken to better integrate AI into clinical practice while addressing such as overcounting and lack of context? 3.) How might incorporating patient-specific preferences improve the model's performance in real-world applications?

Article #12. Notes: Human-AI interaction in skin cancer diagnosis: a systematic review and meta-analysis

Article notes should be on separate sheets

Source Title	Npj | Digital Medicine
Source citation (APA Format)	Krakowski, I., Kim, J., Zhuo Ran Cai, Daneshjou, R., Lapins, J., Eriksson, H., Lykou, A., & Linos, E. (2024). Human-AI interaction in skin cancer diagnosis: a systematic review and meta-analysis. *Npj Digital Medicine*, *7*(1). https://doi.org/10.1038/s41746-024-01031-w
Original URL	https://www.nature.com/articles/s41746-024-01031-w
Source type	Journal Article
Keywords	AI-Assisted Diagnosis, Skin Cancer Detection, Sensitivity, Specificity, Human-AI Collaboration, Clinical Decision-Making
#Tags	#AIinDermatology #SkinCancer #AIHumanCollaboration
Summary of key points + notes (include methodology)	• AI tools for skin cancer diagnosis show a lot of promise for improving diagnostic accuracy. • AI-human collaboration seems to be becoming the most practical and ethical approach to diagnosing in clinical practice. • Most past studies were conducted in more controlled environments, not in real-world clinical settings. • More non-dermatologists benefited the most from using AI as an assistant to diagnose • This shows the potential for AI to be a beneficial tool to less-experienced medical professionals. • Searched five databases (PubMed, Embase, IEEE Xplore, Scopus, and conference proceedings) for studies between January 2017 and November 2022. • The article focused on studies comparing doctors diagnosing skin cancer with and without the use of AI.
Research Question/Problem/ Need	This study talks about how it's important to see how AI impacts the accuracy of skin cancer diagnosis when used alongside clinicians. Even though AI seems to be working well in more controlled settings, there is a very limited understanding of how effective it is in the real-world, in clinical

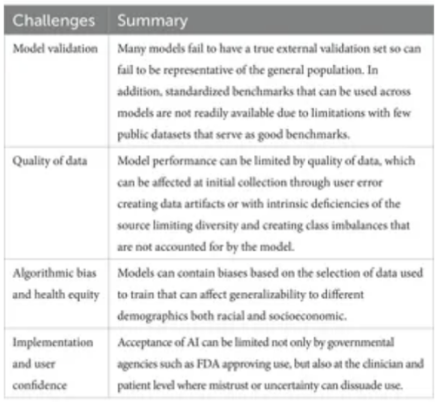
	environments specifically, and how it influences doctors on medical decision-making and diagnoses. Further research is needed to figure out what the benefits and challenges of integrating AI into clinical practice are.
Important Figures	**Fig. 1: Study selection.**  Flow diagram of the study selection process. **Fig. 2: SROC Curves.**  SE sensitivity, SP specificity. Performance of clinicians with no AI assistance (**a**) compared to AI-assisted clinicians (**b**) in the included studies.
VOCAB: (w/definition)	**AI-Assisted Diagnosis**: Using AI to help doctors identify diseases more accurately. **Sensitivity**: The ability to correctly identify people with skin cancer. **Specificity**: The ability to correctly identify people without skin cancer. **Systematic Review**: A study that collects and summarizes all research on a specific topic. **Meta-Analysis**: A method of combining data from multiple studies to draw broader conclusions.

	Data Distribution Shifts: Changes in the type or quality of data, which can affect AI performance. **Contingency Table**: A table used in studies to show the accuracy of diagnostic tests (e.g., true positives vs. false positives). **Covidence**: A software tool that helps organize and screen research studies for systematic reviews.
Cited references to follow up on	n/a
Follow up Questions	**1.)** How can we make sure AI works just as well in real-life clinics as it does in controlled lab studies? **2.)** What are some challenges doctors might face when using AI tools during diagnosis? **3.)** How can AI be improved to better support less-experienced doctors or non-specialists?

Article #13. Notes: Artificial intelligence and skin cancer

Article notes should be on separate sheets

Source Title	Frontiers
Source citation (APA Format)	Wei, M. L., Tada, M., So, A., & Torres, R. (2024). Artificial intelligence and skin cancer. *Frontiers in Medicine*, *11*. https://doi.org/10.3389/fmed.2024.1331895
Original URL	https://www.frontiersin.org/journals/medicine/articles/10.3389/fmed.2024.1331895/full
Source type	Journal Article
Keywords	Skin Cancer Screening, Machine Learning, Gene Expression Profiling, Smartphone Self-Screening, Image Quality, Clinical Implementation
#Tags	#SkinCancerDetection #GeneExpressionProfiling #SmartphoneApps #ImageQuality #AIinDermatology
Summary of key points + notes (include methodology)	• AI is helping dermatologists, general practitioners, and even patients with skin cancer screening and diagnosis, with improved accuracy of the diagnoses • AI can identify melanoma and non-melanoma skin cancers through images and RNA datasets. • AI tools are also being developed right now to help patients self-screen using smartphone apps • But now, no FDA-approved applications exist yet in the U.S. • SVM and Random Forest Machine Learning models, are used for GEP analysis, in order to predict melanoma diagnosis. • A big flaw is that AI struggles with variations in data image quality, biases in training datasets, and the lack of more robust real-world performance. • High-quality images and having standardization (meaning no bias in amounts) in data collection are important for improving AI predictions in diagnoses. • The study examined AI's performance on tasks like image classification, lesion monitoring, and molecular profiling. •
Research Question/Problem/ Need	How can AI be effectively integrated into skin cancer diagnosis and monitoring, in order to improve the accuracy of the diagnosis, and be very accessible for both doctors and their patients?

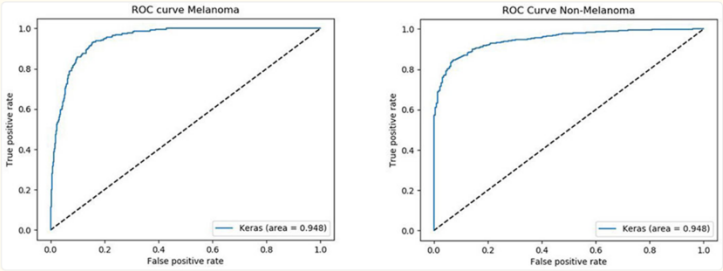
Important Figures	Table 1  **Table 1**. Challenges in AI in dermatology.
VOCAB: (w/definition)	**Gene Expression Profiling (GEP)**: A technique to analyze the activity of genes, used in diagnosing and predicting skin cancer. **Random Forest**: A machine learning algorithm that uses decision trees to make predictions. **Support Vector Machine (SVM)**: A machine learning model that separates data into categories. **Lesion**: A skin spot or abnormality that may require medical attention. **Sensitivity and Specificity**: Metrics for measuring how well AI detects actual cases (sensitivity) and avoids false positives (specificity).
Cited references to follow up on	n/a
Follow up Questions	How can AI models be trained to deal with more diverse skin tones and lesion types to reduce biases? What steps are needed to improve image quality standards in clinics for better AI performance? How can patients safely use AI self-screening tools without risking misdiagnosis?

Challenges	Summary
Model validation	Many models fail to have a true external validation set so can fail to be representative of the general population. In addition, standardized benchmarks that can be used across models are not readily available due to limitations with few public datasets that serve as good benchmarks.
Quality of data	Model performance can be limited by quality of data, which can be affected at initial collection through user error creating data artifacts or with intrinsic deficiencies of the source limiting diversity and creating class imbalances that are not accounted for by the model.
Algorithmic bias and health equity	Models can contain biases based on the selection of data used to train that can affect generalizability to different demographics both racial and socioeconomic.
Implementation and user confidence	Acceptance of AI can be limited not only by governmental agencies such as FDA approving use, but also at the clinician and patient level where mistrust or uncertainty can dissuade use.

Article #14. Notes: The Potential of Using Artificial Intelligence to Improve Skin Cancer Diagnoses in Hawai‘i’s Multiethnic Population

Article notes should be on separate sheets

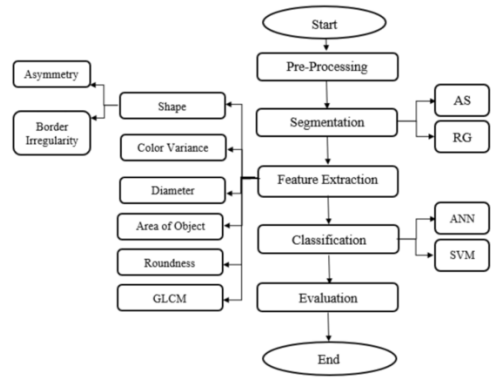
Source Title	National Library of Medicine
Source citation (APA Format)	Willingham, M. L., Spencer, S. Y. P. K., Lum, C. A., Navarro Sanchez, J. M., Burnett, T., Shepherd, J., & Cassel, K. (2021). The potential of using artificial intelligence to improve skin cancer diagnoses in Hawai’i’s multiethnic population. *Melanoma Research*, *31*(6), 504–514. https://doi.org/10.1097/CMR.0000000000000779
Original URL	https://pmc.ncbi.nlm.nih.gov/articles/PMC8580213/
Source type	Journal Article
Keywords	melanoma, public health skin cancer, ethnic skin, artificial intelligence
#Tags	#SkinCancerDetection #ConvolutionalNeuralNetworks #ImageProcessing #DeepLearning
Summary of key points + notes (include methodology)	• AI can help dermatologists by classifying images of lesions as melanoma or non-melanoma, with lots of precision. • The images were cropped to focus on the lesion’s most important parts, making the model more accurate. • Google’s InceptionV3 architecture was used as the base CNN model • Modifications were made to classify images into benign vs. malignant categories, but also melanoma vs. non-melanoma categories. • The study uses 50 images (25 from ISIC and 25 pathologically confirmed). • For the image preprocessing, the images were cropped using the CROPGUI program to focus on lesions’ most important sections, to improve the classification’s accuracy. • AI and dermatologist results combines, correctly classified 100% of the images.
Research Question/Problem/ Need	How can AI effectively assist dermatologists and doctors in diagnosing skin cancer, specifically melanoma vs. non-melanoma, to improve accuracy and reduce any kinds of diagnostic delays? The is a need for reliable AI tools to support dermatologists, especially in challenging skin cancer cases.

Important Figures	Figure 1.  Open in a new tab ROC Melanoma vs Non-Melanoma 70% Trained, 20% Validate, 10% Test
VOCAB: (w/definition)	**AUC (Area Under the Curve)**: A measure of how well a model distinguishes between classes; higher values indicate better performance. **ISIC Dataset**: A large archive of dermatoscopic images used for training and testing AI in skin cancer detection. **CROPGUI**: A tool used to crop images and remove background interference, improving AI focus on lesions. **InceptionV3**: A CNN architecture designed for image classification tasks, known for its high accuracy and efficiency. **Fleiss' Kappa**: A statistical measure used to assess agreement between multiple raters or classifiers.
Cited references to follow up on	n/a
Follow up Questions	How can the AI model be changed to deal with more diverse datasets, some of which having some various skin tones and lesion types? What are some additional steps that can be taken to improve the agreement (Fleiss' Kappa) between AI and dermatologists? How can preprocessing tools, like CROPGUI, be further used to improve image quality and AI performance?

Article #15. Notes: Early automated detection system for skin cancer diagnosis using artificial intelligent techniques

Article notes should be on separate sheets

Source Title	Nature Scientific Reports
Source citation (APA Format)	Mahmoud, N. M., & Soliman, A. M. (2024). Early automated detection system for skin cancer diagnosis using artificial intelligent techniques. *Scientific Reports*, *14*(1), 9749. https://doi.org/10.1038/s41598-024-59783-0
Original URL	https://www.nature.com/articles/s41598-024-59783-0
Source type	Journal Article
Keywords	Skin Cancer Detection, Artificial Neural Networks (ANN), Adaptive Snake (AS), Region Growing (RG), GLCM, ABCDE Rules, Image Preprocessing, AI in Dermatology
#Tags	#ImageProcessing #ArtificialNeuralNetworks #SkinLesionDetection
Summary of key points + notes (include methodology)	• An AI automated diagnosis models is a very good accurate alternative to more traditional methods of skin cancer detection. • **With an ANN:** High accuracy (94%) with very strong precision, sensitivity, and specificity for classifying skin cancer lesions. • **With an SVM**: Used for comparison but showed lower performance than ANN. • **Some of the image preprocessing steps included** include noise removal, contrast enhancement, and image smoothing using filters like DullRazor, median, Gaussian, and Lee filters. • **For the image segmentation,** the study applied **Adaptive Snake (AS)** and **Region Growing (RG)** algorithms to isolate lesions from the background in their pictures. • **The** ANN outperformed the SVM in all of the evaluation metrics.
Research Question/Problem/ Need	How can AI models improve the efficiency and accuracy of skin cancer detection compared to more traditional methods? There is the need for efficient and accurate, as well as user-friendly AI systems to help with in early detection and diagnosis of skin cancer.

Important Figures	Figure 1  Flowchart for the implemented proposed system.
VOCAB: (w/definition)	**Adaptive Snake (AS)**: A segmentation technique that adjusts to the shape of lesions for accurate detection. **Region Growing (RG)**: A segmentation method that starts from a seed point and grows based on pixel similarity. **Artificial Neural Networks (ANN)**: A machine learning model inspired by the human brain, used for classifying data. **Support Vector Machine (SVM)**: A machine learning model that separates data into categories using boundaries. **Gray Level Co-occurrence Matrix (GLCM)**: A statistical tool to analyze image texture and patterns. **ABCDE Rules**: A guideline for evaluating skin lesions based on asymmetry, border irregularity, color, diameter, and evolving features. **DullRazor Algorithm**: A preprocessing filter for removing hair and other noise from skin images. **Segmentation**: The process of separating the lesion from the image background.
Cited references to follow up on	n/a
Follow up Questions	How can Adaptive Snake be further used in cases of diverse lesion types and skin tones? What are the challenges in using ANN-based skin cancer diagnosis models in the real-world, maybe compared to CNNs?

	How can features extracted using GLCM and ABCDE rules improve the AI's performance for more rare and complex skin conditions?

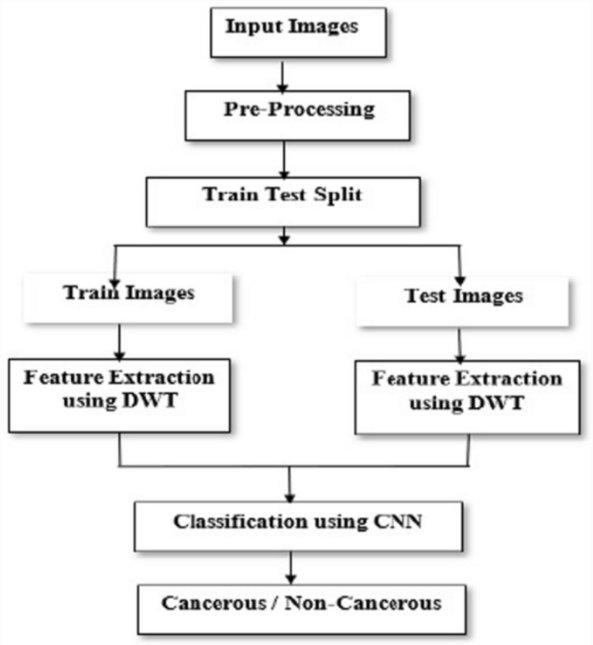
Article #16. Notes: Artificial intelligence-driven enhanced skin cancer diagnosis: leveraging convolutional neural networks with discrete wavelet transformation

Article notes should be on separate sheets

Source Title	Springer Open
Source citation (APA Format)	S. P. Angelin Claret, Jose Prakash Dharmian, & A. Muthu Manokar. (2024). Artificial intelligence-driven enhanced skin cancer diagnosis: leveraging convolutional neural networks with discrete wavelet transformation. *The Egyptian Journal of Medical Human Genetics*, *25*(1). https://doi.org/10.1186/s43042-024-00522-5
Original URL	https://jmhg.springeropen.com/articles/10.1186/s43042-024-00522-5
Source type	Journal Article
Keywords	Skin Cancer Detection, CNNs, DWT, HAM10000 Dataset, ISIC Dataset, Data Preprocessing, Median Filter, Feature Extraction
#Tags	#SkinCancerAI #ImageProcessing #ConvolutionalNeuralNetworks #DiscreteWaveletTransformation
Summary of key points + notes (include methodology)	• The study combined the use of Convolutional Neural Networks and Discrete Wavelet Transformation to make skin cancer detection accuracy a lot higher. • They used the HAM10000 dataset with 10,015 images covering seven types of skin lesions. • The DWT extracts relevant image features • The DWT-CNN model had high sensitivity (94%) and specificity (91%) • It did better than other machine learning methods like Artificial Neural Networks (ANNs) and Multilayer Perceptron (MLP). • For image preprocessing, they did resizing, grayscale conversion, noise reduction (median filtering), and data augmentation. • They evaluated the model's performance using sensitivity, specificity, and other metrics.
Research Question/Problem/ Need	How can using both CNNs and DWT improve the accuracy and efficiency of skin cancer detection? A reliable, AI tool that can diagnosis early and precisely is in need in the real word for both doctors and patients, to reduce delays, improving treatment outcomes.

Important Figures

Fig. 1



Overall workflow of CNN with DWT features in deep learning. Combine CNN and DWT features for deep learning with an efficient and powerful image processing workflow

Fig. 2

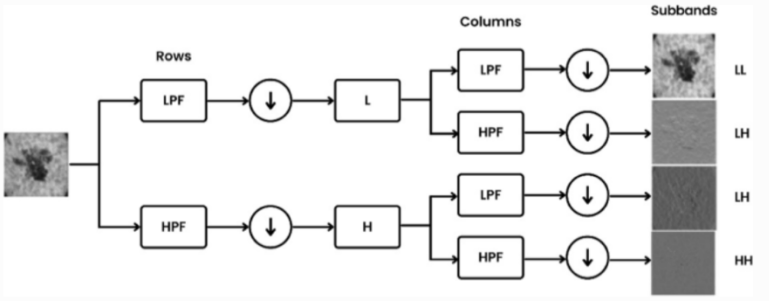
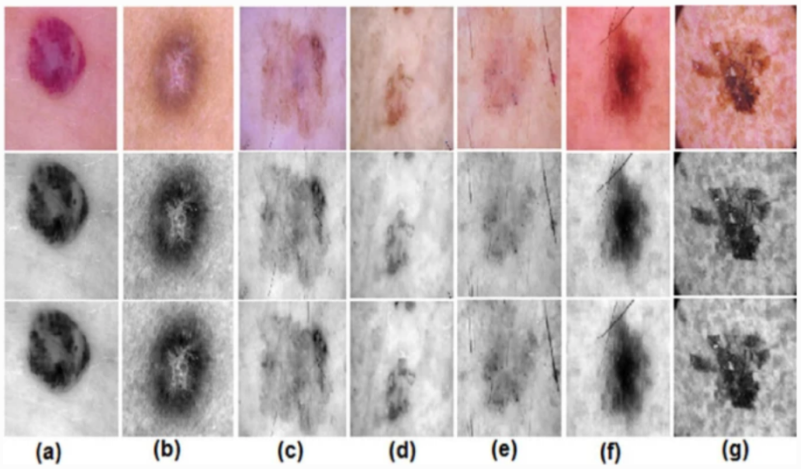


Image extraction using DWT feature. Extract images utilizing the discrete wavelet transform feature for enhanced analysis and processing

	Fig. 3  Images of skin cancer and DWT feature extracted images of seven cancer types. Skin cancer images and DWT-extracted images representing seven cancer types for analysis
VOCAB: (w/definition)	**Discrete Wavelet Transformation (DWT)**: A method to extract detailed features like texture and edges from images. **Sensitivity**: The ability of the model to correctly identify positive cases (e.g., malignant lesions). **Specificity**: The ability of the model to correctly identify negative cases (e.g., benign lesions). **Median Filter**: A preprocessing technique to reduce image noise while preserving fine details. **Softmax Function**: A mathematical function used in CNNs to classify images into multiple categories. **Data Augmentation**: Techniques to increase the diversity of training data by making modifications like rotations or flips.
Cited references to follow up on	n/a
Follow up Questions	What are some more various preprocessing steps could improve the performance of CNN models in real-world applications? How does the DWT-CNN way of doing this project compare with other techniques for medical imaging?

Article #17. Notes: Validation of artificial intelligence prediction models for skin cancer diagnosis using dermoscopy images: the 2019 International Skin Imaging Collaboration Grand Challenge

Article notes should be on separate sheets

Source Title	The Lancet
Source citation (APA Format)	Combalia, M., Codella, N., Rotemberg, V., Carrera, C., Dusza, S., Gutman, D., Helba, B., Kittler, H., Kurtansky, N. R., Liopyris, K., Marchetti, M. A., Podlipnik, S., Puig, S., Rinner, C., Tschandl, P., Weber, J., Halpern, A., & Malvehy, J. (2022). Validation of artificial intelligence prediction models for skin cancer diagnosis using dermoscopy images: the 2019 International Skin Imaging Collaboration Grand Challenge. *The Lancet Digital Health*, *4*(5), e330–e339. https://doi.org/10.1016/s2589-7500(22)00021-8
Original URL	https://www.thelancet.com/journals/landig/article/PIIS2589-7500(22)00021-8/fulltext
Source type	Journal Article
Keywords	Image Artifacts, Balanced Accuracy, HAM10000 Dataset, BCN20000 Dataset
#Tags	#ClinicalValidation
Summary of key points + notes (include methodology)	• AI has a diagnostic accuracy in skin cancer detection • There are some challenges in real-world scenarios though, with handling diverse datasets. • This study used 25,331 training images from HAM10000 and BCN20000 datasets, covering eight diagnostic categories, with test images from additional datasets (Turkey, New Zealand, Sweden, Argentina). • During the testing process, it was seen that the best algorithm achieved 82% balanced accuracy on HAM10000 but only 58.8% on the BCN20000 dataset, which is more realistic in real world applications. • Some image artifacts like hair and pen markings show a decreased accuracy when using the model to diagnose. • The ISIC Challenge had 129 algorithms submitted by 64 teams, tested on 8,238 images from datasets, in order to solve the same

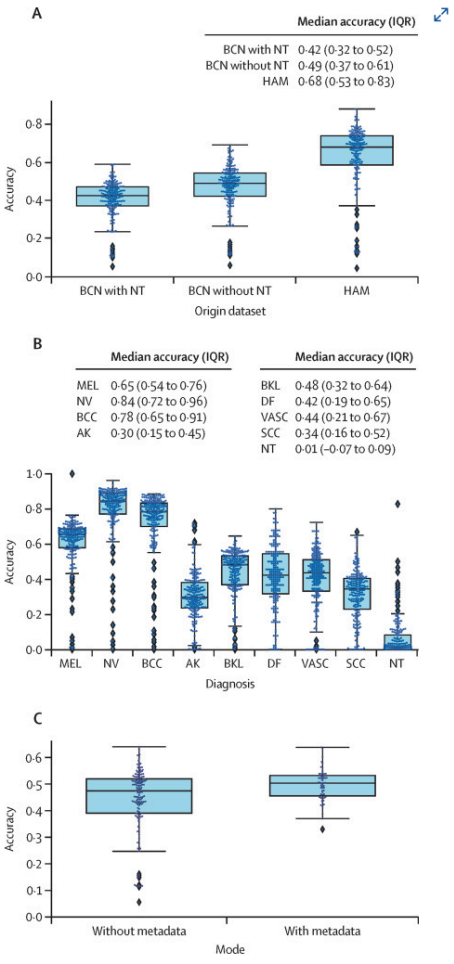
	problem. • The algorithms evaluated on balanced accuracy, AUROC, and confusion matrices. • There were comparisons made between the algorithms and actual dermatologists' diagnoses using t-tests and statistical analyses.
Research Question/Problem/ Need	How do some real-world factors, for example, untrained disease categories, impact the accuracy and reliability of AI in skin cancer detection and diagnosis? AI models need better training, to handle real-world challenges, to make sure they're safe. This helps with that reliability factor.
Important Figures	 Figure 1 Algorithm accuracy across all submissions, by dataset, metadata use, and diagnostic class
VOCAB: (w/definition)	**Balanced Accuracy**: A metric that accounts for class imbalances by averaging recall across all classes. **Untrained Categories (NT)**: Diagnostic categories not included in the training data, requiring algorithms to identify unknowns.

	Image Artifacts: Features like hair, pen marks, or lighting variations that can impact diagnostic accuracy. **AUROC**: Area Under the Receiver Operating Characteristic Curve, measuring classification performance. **Confusion Matrix**: A table showing the true versus predicted classifications, used to evaluate algorithm performance.
Cited references to follow up on	n/a
Follow up Questions	How can AI systems be trained to recognize untrained categories instead of misclassifying them during that testing process? How can datasets like BCN20000 include more diverse conditions so that real-world training will be better?

Article #18. Notes: Artificial intelligence for melanoma diagnosis: how can we deliver on the promise?

Article notes should be on separate sheets

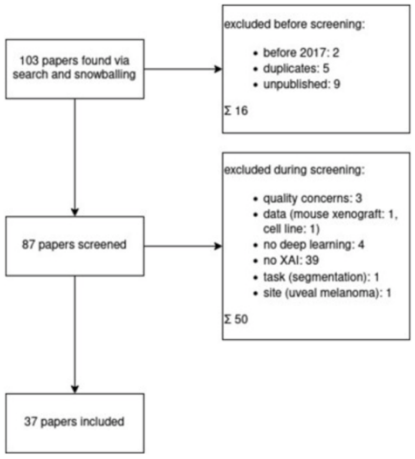
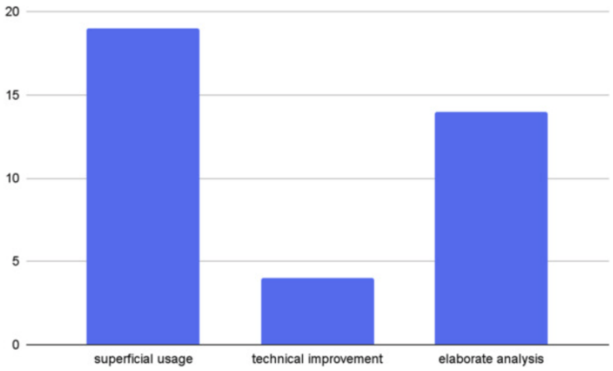
Source Title	ESMO Annals of Oncology
Source citation (APA Format)	Mar, V. J., & Soyer, H. P. (2018). Artificial intelligence for melanoma diagnosis: how can we deliver on the promise? *Annals of Oncology*, *29*(8), 1625–1628. https://doi.org/10.1093/annonc/mdy193
Original URL	https://www.annalsofoncology.org/article/S0923-7534(19)34114-6/fulltext
Source type	Journal Article
Keywords	Melanoma Diagnosis, Convolutional Neural Networks, Self-Skin Examination (SSE), Smartphone Applications, Decision Support Tools, Atypical Melanomas
#Tags	#MelanomaDetection #DermatologyAI
Summary of key points + notes (include methodology)	• AI using CNNs shows higher diagnostic accuracy than most dermatologists in identifying melanomas • This offers more accessible diagnostic solutions. • AI can prioritize more high-risk patients • AI systems seem to be struggling with atypical melanomas that lack sufficient representation in training datasets. • AI could improve access to care in rural areas and reduce the burden on specialists. • Compared AI diagnostic performance (AUC = 0.86) to dermatologists' (AUC = 0.79) in melanoma detection. • Checked AI's performance on atypical melanomas and noted down any challenges in diversity of the dataset and imaging artifacts.
Research Question/Problem/ Need	How can AI improve accuracy in diagnosing melanoma and other skin cancers while still taking into account challenges with atypical lesions?
Important Figures	n/a
VOCAB: (w/definition)	**AUC (Area Under the Curve)**: A measure of model performance; higher values indicate better accuracy.

	Self-Skin Examination (SSE): A method where patients check their own skin for suspicious lesions. **Decision Support Tool**: AI tools used by doctors during consultations to assist with diagnosis and management. **Atypical Melanomas**: Unusual forms of melanoma that are harder to diagnose due to lack of pigment or unique visual features. **Dermoscopy**: A non-invasive technique for examining skin lesions with a magnifying device. **Image Artifacts**: Factors like hair, lighting, or compression during imaging that can affect diagnostic accuracy.
Cited references to follow up on	n/a
Follow up Questions	1.) How can AI systems be trained to better identify atypical melanomas? 2.) What can be done to integrate AI into like smartphone apps? 3.) How can regulatory frameworks be used to make sure the model ensures a level of safety, plus efficiency, in dermatology?

Article #19. Notes: Explainable artificial intelligence in skin cancer recognition: A systematic review

Article notes should be on separate sheets

Source Title	ScienceDirect
Source citation (APA Format)	Hauser, K., Kurz, A., Haggenmüller, S., Maron, R. C., von Kalle, C., Utikal, J. S., Meier, F., Hobelsberger, S., Gellrich, F. F., Sergon, M., Hauschild, A., French, L. E., Heinzerling, L., Schlager, J. G., Ghoreschi, K., Schlaak, M., Hilke, F. J., Poch, G., Kutzner, H., & Berking, C. (2022). Explainable artificial intelligence in skin cancer recognition: A systematic review. *European Journal of Cancer*, *167*, 54–69. https://doi.org/10.1016/j.ejca.2022.02.025
Original URL	https://www.sciencedirect.com/science/article/pii/S095980492200123X
Source type	Journal Article
Keywords	Explainable AI (XAI), Deep Neural Networks (DNNs), Skin Cancer Detection, Heatmaps, Post-Hoc Explanations, Model Interpretability, Diagnostic Accuracy
#Tags	#SkinCancerDetection #MachineLearning #DeepLearning
Summary of key points + notes (include methodology)	• DNNs have shown promise in skin cancer detection • Most studies apply existing XAI methods (for example, heatmaps) to interpret model decisions • But only a few develop new XAI techniques. • Studies lack rigorous statistical evaluation • XAI tools often need human interpretation, and this leads to risks of confirmation bias. • Studies included in this article focused on DNNs for skin cancer classification tasks with XAI methods. • The study extracted insights on how XAI affects human interpretation and diagnostic accuracy. • Overall, 37 studies were assessed
Research Question/Problem/ Need	How can XAI methods improve the level interpretability and reliability of AI models in skin cancer detection in the real world?

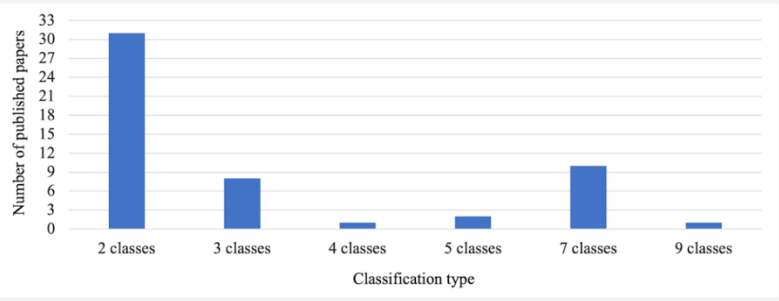
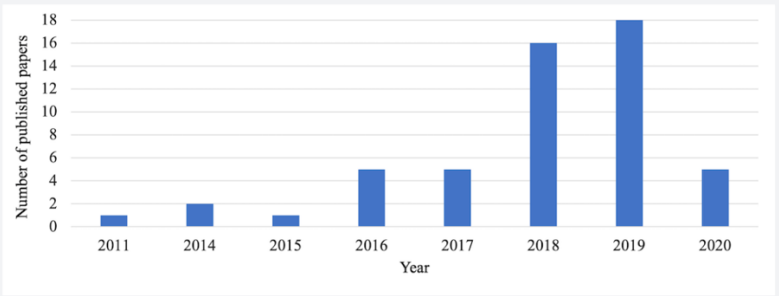
Important Figures	Fig. 2 illustrates the study selection process as a flow diagram.  Fig.3, Fig.4 accompany this section with, respectively, a general and a detailed overview of the usage of XAI. 
VOCAB: (w/definition)	**Explainable AI (XAI)**: Tools and techniques that make AI decisions easier to understand and interpret. **Deep Neural Networks (DNNs)**: Complex machine learning models used for tasks like image classification. **Post-Hoc Explanation**: An XAI method applied after a model makes a decision to explain how it reached that decision. **Heatmaps**: Visualizations showing which parts of an image influenced an AI model's decision. **Model Fidelity**: The degree to which an explanation accurately represents the inner workings of a model. **Confirmation Bias**: The tendency to interpret evidence in a way that confirms pre-existing beliefs.

	Histopathological Image: Microscopic images of tissue used to diagnose diseases like skin cancer.
Cited references to follow up on	n/a
Follow up Questions	How can XAI methods reduce the heavy level of reliance on human interpretation of certain diagnoses Are there any barriers to implementing XAI in dermatology? How does XAI impact the level of accuracy of dermatologists in real-world diagnoses of patients?

Article #20. Notes: Artificial Intelligence for Skin Cancer Detection: Scoping Review

Article notes should be on separate sheets

Source Title	JMIR Publications
Source citation (APA Format)	Takiddin, A., Schneider, J., Yang, Y., Abd-Alrazaq, A., & Househ, M. (2020). Artificial Intelligence for Skin Cancer Detection: A Scoping Review (Preprint). *Journal of Medical Internet Research*. https://doi.org/10.2196/22934
Original URL	https://www.jmir.org/2021/11/e22934/
Source type	Journal Article
Keywords	Shallow Techniques, Deep Techniques, Support Vector Machine (SVM), Neural Networks, Evaluation Metrics, F1-Score
#Tags	#ScopingReview #EvaluationMetrics
Summary of key points + notes (include methodology)	• Skin cancer diagnosis relies on physicians most of the time, making it very time-consuming and expensive. • This study looks at types of AI-based techniques used in skin cancer detection • Some key things looked at were the evaluation metrics, and any factors influencing performance. • The studies were grouped into shallow techniques and deep techniques • There were more Deep techniques (73.6%), compared to shallow techniques (26.4%). • Smaller datasets with fewer diagnostic classes had higher accuracy • This caused some confusion • There are inconsistencies in datasets and metrics, which limit reliability of AI models. • They grouped the studies by AI technique (shallow vs. deep) and evaluation metrics. • They then saw the relationship between dataset size, diagnostic classes, and the performance scores.
Research Question/Problem/ Need	What are some AI-based tools currently being used to detect and classify skin cancer. How do factors like dataset size and evaluation metrics play any kind of role or impact the reliability of these tools by doctors?

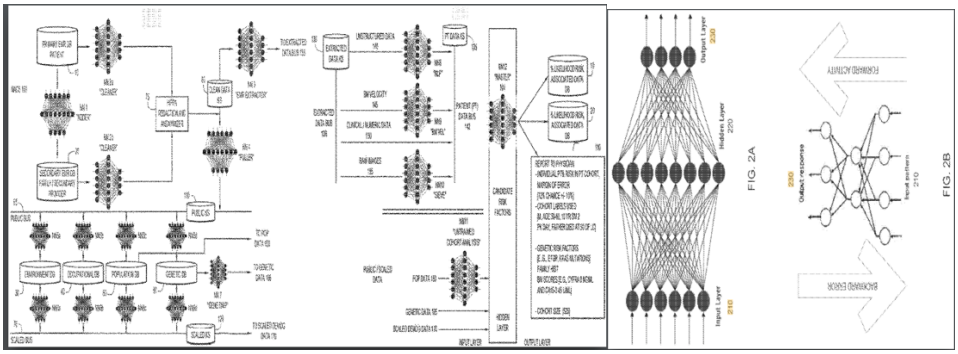
Important Figures	 Figure 5. Number of published papers by number of diagnostic classes used.  Figure 3. Number of published papers by year.
VOCAB: (w/definition)	**Shallow Techniques**: AI methods with simple architectures like SVM or logistic regression. **Deep Techniques**: AI methods using complex neural networks with multiple layers for better accuracy. **Sensitivity**: The ability of a model to correctly identify malignant cases. **Specificity**: The ability of a model to correctly identify benign cases. **Precision**: The proportion of correctly identified malignant cases out of all predicted malignant cases. **F1-Score**: A metric combining precision and recall, useful for imbalanced datasets. **True Positives (TP)**: Malignant cases correctly identified as malignant. **False Positives (FP)**: Benign cases incorrectly identified as malignant.
Cited references to follow up on	n/a
Follow up Questions	How could those evaluation metrics be standardized across different AI models for skin cancer detection?

	How can you address the limitations caused by small datasets in training data? How can you make performance in real-world settings much more optimal?

Patent #1. Notes: Methods and machine learning systems for predicting the likelihood or risk of having cancer

Article notes should be on separate sheets

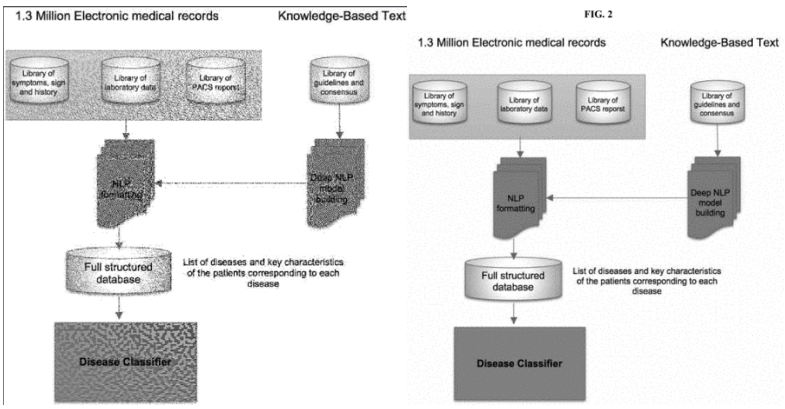
Source Title	Google Patents
Source citation (APA Format)	Cohen, J., Readick, J., Doseeva, V., Shi, P., Flores-Fernandez, J. M., (2015). *Methods and machine learning systems for predicting the likelihood or risk of having cancer* (*US12051509B)* U.S. Patent and Trademark Office. https://patents.google.com/patent/US12051509B2/en?q=(Machine+Learning+AI+model+to+diagnose+skin+cancer)&oq=Machine+Learning+AI+model+to+diagnose+skin+cancer
Original URL	https://patents.google.com/patent/US12051509B2/en?q=(Machine+Learning+AI+model+to+diagnose+skin+cancer)&oq=Machine+Learning+AI+model+to+diagnose+skin+cancer
Source type	Patent
Keywords	Machine Learning Systems, Cancer risk, Disease assessment, medical diagnosis
#Tags	Machine Learning, Diagnosis, Artificial Intelligence,
Summary of key points + notes (include methodology)	Overall, the purpose of this invention was to create a ML system that would be able to detect the cancer and be able to diagnose it before the cancer would be able to metastasize. AI could help with analyzing data to help with better decision-making for doctors to diagnose diseases, but it hasn't become a common tool in medical practice yet for doctors. AI can be used for blood testing and then using that data, analyzing it, and then coming up with a diagnosis, which was the main part of this invention. The biomarker levels are also a parameter that is taken into account when testing the AI model, so recording the biomarker changes over a certain period of time was one of the methods that the researchers followed when they were training their AI model.
Research Question/Problem/ Need	How can non-invasive tests using biomarkers and machine learning help predict if a patient has cancer more accurately?

Important Figures	
VOCAB: (w/definition)	Convolutional Neural Network: A type of model that is good for image recognition and analyzing visual data. Receiver Operator Characteristic: a type of graph that shows how well a model performs across different thresholds.
Cited references to follow up on	n/a
Follow up Questions	1.) What types of biomarkers are the most effective when predicting the likelihood of cancer? 2.) Can you still use this method and apply it to different diseases, or does it only work for different cancers? 3.) What type of data is the most effective for training the machine learning model, so that it turns out to be a pretty accurate model?

Patent #2. Notes: Deep learning-based diagnosis and referral of diseases and disorders using natural language processing

Article notes should be on separate sheets

Source Title	Google Patents
Source citation (APA Format)	Zhang, K., Zhihuan, L., Zheng, L., (2019). *Deep learning-based diagnosis and referral of diseases and disorders using natural language processing (US20210343411A1)* U.S. Patent and Trademark Office. https://patents.google.com/patent/US20210343411A1/en?q=(Machine+Learning+AI+model+to+diagnose+diseases)&oq=Machine+Learning+AI+model+to+diagnose+diseases
Original URL	https://patents.google.com/patent/US20210343411A1/en?q=(Machine+Learning+AI+model+to+diagnose+diseases)&oq=Machine+Learning+AI+model+to+diagnose+diseases+
Source type	Patent
Keywords	Automated healthcare, Clinical data analysis
#Tags	AI, EHRs, ML, Medical Diagnosis, Deep Learning
Summary of key points + notes (include methodology)	The patent talks about an AI system that is going to use deep learning to analyze electronic health records (EHRs) for diagnosing diseases. It will mimic how doctors think by identifying key features from patient data, like symptoms and test results. This system can handle challenges like unstructured text and large data volumes in EHRs, due to the AI's specialty in figuring out how to analyze these said dataset types. It will extract relevant clinical information to make accurate models for diagnosing conditions. As the patent says, this approach has been tested on different pediatric cases and has been pretty accurate in dealing with complex medical analysis. This technology could very much improve how AI assists in healthcare.
Research Question/Problem/ Need	How can AI-based models use deep learning to analyze EHRs in order to accurately diagnosis diseases, but also overcoming challenges such as large data volumes?

Important Figures	
VOCAB: (w/definition)	Electronic Health Records (EHRs): Digital versions of patients' paper charts that have detailed medical and treatment histories of the patient's past. Deep Learning: A type of machine learning that uses neural networks with multiple layers to analyze complex data patterns.
Cited references to follow up on	n/a
Follow up Questions	1.) What types of neural networks are most effective for deep learning in medical diagnosis? 2.) How does deep learning compare to other ML model methods in terms of accurately diagnosing diseases? 3.) How can deep learning models be adapted to handle the variability that could be present in medical data, especially from different EHR systems?