**HIT 759**

**Proposal Report**

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**Topic considered**

For this project, our team decided between three topics, which all revolved around skin cancer. At first, we were going to focus on skin cancer, but we realized that the subject was too broad. We wanted to make the topic more specific, so we had to choose between focusing on squamous cell carcinoma, basal cell carcinoma, or melanoma skin cancer. We ultimately came to the decision that the topic of implementing machine learning to detect melanoma skin cancer would be the most suitable for us. Our group member, Danielle, works in Dermatology, so from experience she knew that melanoma is the deadliest form of skin cancer. Basal cell carcinoma and squamous cell carcinoma can be identified easier than melanoma, and they are not as fatal as melanoma.

**Topic of choice**

Implementing machine learning algorithms to detect melanoma skin cancer has the potential to transform the way this fatal cancer is diagnosed and treated. Melanoma skin cancer is a form of cancer that begins in the cells that create pigment in the skin, the melanocytes (*Melanoma*, 2022). Without detection, melanoma can rapidly spread and be lethal. Early detection is essential for effective treatment, and machine learning techniques have shown promise for enhancing the precision and speed of melanoma diagnosis. Dermatologists can swiftly identify probable cases of melanoma and intervene before cancer advances by analyzing photos of skin lesions with machine learning algorithms.

Numerous research has proved the capability of machine learning algorithms to identify melanoma skin cancer. We utilize a range of machine learning algorithms to predict whether a tumor is benign or malignant based on the attributes presented by the data. The research published in the Journal of the American Academy of Dermatology, for instance, demonstrated that a machine-learning algorithm could reliably differentiate between melanoma and non-melanoma skin lesions with a sensitivity of 92.1% and a specificity of 91.1% (Haenssle et al., 2018). Another study published in the Annals of Oncology discovered that a deep learning algorithm could identify melanoma with 95% sensitivity and 91% specificity, outperforming human dermatologists in the same job (Han et al., 2018).

Using machine learning algorithms for the identification of melanoma skin cancer is not only essential for enhancing diagnosis and treatment but also has the potential to have a substantial impact on public health. According to the American Cancer Society, melanoma skin cancer is the sixth most prevalent cancer in the United States, and its prevalence has been rising over the past several decades (*Key Statistics*, 2022). By increasing the precision and speed of melanoma detection, machine learning algorithms can help minimize the death rate associated with this fatal disease and eventually save lives.

**Proposed solution**

Mayo Clinic indicated that a physical skin exam and receiving a skin biopsy for lab examination would be the method to detect melanoma skin cancer (*Melanoma*, 2022). Patients should obtain skin checks by a board-certified dermatologist once per year in person. However, many patients do not even see their primary care provider once a year. Seeing the dermatologist yearly just adds another chore to their list. Some patients may not believe that annual physical exams are necessary and it also might be too expensive for testing. Without physical exams, it can harm patients because if melanoma skin cancer is caught too late, treatment may not be available. With this in mind, our project's goal is to develop a scanning tool that can detect melanoma and be available for use at home.

From our research in this area, skin scanners are generally created to be used in the office by a dermatologist rather than by the patient at home. Afifi et al. (2020) indicated various methods to detect melanoma cells through non-invasive visual-based technologies, for instance, dermoscopy, total body photography, sequential digital dermoscopic imaging, specialized imaging modalities with non-visible light, mobile applications, teledermatology, and technology-aided diagnosis.

Our proposed solution is to develop a skin scanner that may use total body photography and sequential digital dermoscopic imaging to detect melanoma. The tool will be available to purchase without a prescription and will have easy-to-follow instructions. The scanner will be made affordable to everyone. Users will also create an account and download an accompanying mobile application to store information and communicate with dermatologists. Once the skin scanner scans the users’ skin, it will keep the pictures in the app. Any abnormal appearing moles will be flagged, and users will be advised to see a dermatologist to have that mole biopsied. Board-certified dermatologists local to the users' area will be listed in the app along with accepted insurance.

**References on your topic of choice**

We have reviewed five journals and articles regarding melanoma skin cancer and technological tools that would assist in diagnosis. The articles and journals from Han et al. (2018), Haenssle et al. (2018), Key Statistics (2023), and Mayo Clinic (2022) assist us in gaining more knowledge on melanoma skin cancer and how technologies will help with diagnostic procedures. Besides, we used the article from Afifi et al. (2020) to develop technological features for our skin scanner. Please refer to our references section at the end of the report for full citations.

**Brainstorming methods**

Our group was able to brainstorm through blackboard collaboration (toward the end of some classes) and through WhatsApp. We created a group chat on WhatsApp where we shared our ideas for the project with each other. WhatsApp has worked very well for us as everyone has contributed to the brainstorming process and splitting the work. In the future, we will continue to text each other in our group chat and initiate group calls.

**References**

Afifi, L., Cortez, J., Johal, A., Nosrati, A., Tam, A., Vora, N. B., Wei, M. L., Wong, A., Yan D., Yeniay, Y. & Young, A. T. (2020, June 18). *The role of technology in melanoma screening and diagnosis*. Wiley Online Library. <https://onlinelibrary.wiley.com/doi/full/10.1111/pcmr.12907>

Haenssle, H. A., Fink, C., Schneiderbauer, R., Toberer, F., Buhl, T., Blum, A., Kalloo, A., Hassen, A. B. H., Thomas, L., Enk, A., Uhlmann, L., Reader study level-I and level-II Groups, Alt, C., Arenbergerova, M., Bakos, R., Baltzer, A., Bertlich, I., Blum, A., Bokor-Billmann, T., Bowling, J., … Zalaudek, I. (2018). Man against machine: diagnostic performance of a deep learning convolutional neural network for dermoscopic melanoma recognition in comparison to 58 dermatologists. *Annals of oncology: Official journal of the European Society for Medical Oncology*, *29*(8), 1836–1842. <https://doi.org/10.1093/annonc/mdy166>

Han, S. S., Kim, M. S., Lim, W., Park, G. H., Park, I., & Chang, S. E. (2018). Classification of the Clinical Images for Benign and Malignant Cutaneous Tumors Using a Deep Learning Algorithm. *The Journal of investigative dermatology*, *138*(7), 1529–1538. <https://doi.org/10.1016/j.jid.2018.01.028>

*Key Statistics For Melanoma Skin Cancer*. American Cancer Society. (2023, January 12). Retrieved March 14, 2023, from <https://www.cancer.org/cancer/melanoma-skin-cancer/about/key-statistics.html>

Mayo Clinic (2022, June 18). *Melanoma*.<https://www.mayoclinic.org/diseases-conditions/melanoma/diagnosis-treatment/drc-20374888>