Practicum Sprint 6 - Academic Paper

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1 ABSTRACT

The demographic landscape of the U.S. continues to shift such that our country is becoming increasingly racially diverse. Naturally, this racial diversity is predicted to translate to the U.S. healthcare system's patient population, requiring medical providers to be well-versed in a broader set of disease presentations. Cutaneous (skin) diseases offer an apt example of how a patient's race and skin color can cause disease presentations to significantly deviate from historical norms, and research confirms the healthcare system's struggles to provide quality dermatologic care to people of color (POC) relative to their White counterparts. Such a discrepancy necessitates the development of a tool for use by medical providers to assist them in their understanding and detection of cutaneous diseases in POC. The following project outlines the details of a research notebook used for developing a computer vision model to achieve that end.

2 BACKGROUND

The U.S. Census Bureau projects that by 2050, about half of all patients seen in the U.S. healthcare system will have skin of color (SOC). [1] These SOC patient groups include African-Americans, Asians, Hispanics, Native Americans and Pacific Islanders. As these communities continue to grow, so will the likelihood of dermatologists encountering cutaneous (skin) diseases that happen more frequently in SOC patients, happen exclusively in SOC patients, and/or present differently in SOC patients than their White counterparts. [1]

3 PROBLEM STATEMENT

This project seeks to address the racial disparities that currently exist in skin disease outcomes. For example, "The 5-year melanoma survival [rate] is 74.1% for Blacks compared to 92.9% for Whites", despite melanoma being more common in non-Hispanic Whites than Blacks and Hispanics. [2] Additionally, Blacks tend to present with later stage or more aggressive non-melanoma skin cancer (NMSC), such as squamous cell carcinoma, than Whites despite having lower incidence of NMSC. [2] Aiding medical providers in their understanding, and

more importantly diagnoses, of SOC patients' cutaneous disease presentations is paramount to delivering life-saving quality of care to these communities.

4 SOLUTION

My sole project deliverable is an AWS SageMaker research notebook housing ML lifecycle components such as identifying and framing the business problem, data processing (data retrieval, data preprocessing, feature engineering), and model development. The notebook is comprised of fetching the images and their metadata uploaded to a S3 bucket in my AWS account, exploratory data analysis (EDA) to examine the data elements, feature engineering tasks such as data augmentation, and the construction and evaluation of a convolutional neural network (convnet) used for applying computer vision to detecting cutaneous diseases in SOC patients. I had to learn how to build neural network architectures to complete this project, so a great deal of research was invested into the Tensorflow documentation to determine the best architecture formats and hyperparameter tuning decisions.

5 OUTCOME & FURTHER WORK

I believe my project at this time is unsuccessful. Success would've required that my convnet performed better than the 73.9% baseline accuracy; this is the accuracy a medical provider would achieve with the dataset if they always predicted a disease presentation was benign. More often than not the model's performance falls short of the baseline, but I believe this can be improved with future work. For starters, learning how to architect neural networks was a sizeable learning curve for me, and I likely didn't optimally tune all of the hyperparameters while training the convnet. Additionally, neural networks perform best with large amounts of data, so more data augmentation is likely needed to further enhance the dataset's size.

6 REFERENCES

1. Berg, S. (2017, July 19). In dermatology, health disparities can be skin deep. American Medical Association. Retrieved February 25, 2024, from https://www.ama-assn.org/delivering-care/patient-support-advocacy/dermatology-health-disparities-can-be-skin-deep

2. Buster, K. J., Stevens, E. I., & Elmets, C. A. (2013). Dermatologic Health Disparities. Dermatologic Clinics, 30(1), 53–59. https://doi.org/10.1016/j.det.2011.08.002