PanOculus: A Novel, Multifaceted Diagnostic Tool for Skin Cancer, Diabetic Retinopathy, and Otitis Media Powered by Deep Learning

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Isolated from the reach of Western medicine, many developing nations lack access to skilled physicians and expensive equipment such as otoscopes, skin biopsy tools, and ophthalmoscopes. As a result, preventable diseases including otitis media — with half a billion cases annually — melanoma— the most lethal skin cancer in the world— and diabetic retinopathy— affecting 93 million people worldwide— are allowed to pass undiagnosed and untreated. The tragic ramifications of such diseases, including permanent hearing loss, permanent blindness, and death, go down by as much as 75% with early diagnosis (NCBI), and thus the solution of PanOculus is formulating an inexpensive solution to diagnose and facilitate treatment for otitis media, skin cancer, and diabetic retinopathy in developing countries. The project consists of two parts. First is an inexpensive, lightweight physical phone attachment designed in autoCAD and 3D printed, working in conjunction with a compact 20D condensing lens. Second is a mobile application enabled with machine learning diagnostics and cloud compatibility to contact doctors remotely for treatment plans. The diagnostic algorithm used is a neural network, specifically an Inception-V3 model retrained on three image datasets, and the accuracy was optimized using data augmentation, regularization with label smoothing, and datasets with a diverse diagnostic portfolio, yielding up to a 97.4% accuracy when exposed to new image data. PanOculus circumvents the infrastructural and economic impediments that prevent accessible medical diagnosis in the developing world, and through a syncretism of medicine, computer science, and engineering, attempts to pioneer a new forefront of change.

Awards Won:
ASU Rob and Melani Walton Sustainability Solutions Service: Award of $1,000