The iSpy Platform: A Multi-Faceted Suite of Affordable Smartphone Imaging and Sensor-Based Utilities for the Non-Invasive Detection of Parkinsonian Tremor and Skin Cancer via Machine Learning

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Skin cancer and Parkinson's Disease are among the most serious noncommunicable diseases (NCDs) in the world. Early detection and treatment allow Parkinson's patients to mitigate complications and drastically improve their quality of life and enables skin cancer patients to reduce the risk of death by 96%. Due to the necessity of expensive equipment and trained professionals, the screening process is inaccessible to millions of people. The goal of this project was to develop an end-to-end platform for detecting a multitude of diseases using deep learning models housed on a smartphone, starting with skin lesions and Parkinsonian tremor. For skin cancer, classification was performed using image preprocessing, feature extraction, and transfer learning on the Inception-V3 neural network. The model was trained with 25,000 training images from an annotated dataset to ensure its validity over a wide range of conditions. Additionally, a lens attachment was 3D printed to integrate with the smartphone environment, enabling users to capture and analyze pictures from their mobile devices. For Parkinson's, pictures of Archimedes spiral drawings were taken and a random forest classifier was used to detect signs of tremor. Both processes obtained promising results, comparable to those of doctors in a clinical setting, but in a far more affordable and accessible manner. The applications of the iSpy Platform are twofold: first, it presents a novel solution for the early detection of skin cancer and tremor, and second, the project approach can easily scale to detect other NCDs that currently account for over 70% of deaths worldwide.

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