KidneyLifePlus+ : A Chronic Kidney Disease Screening Tool Utilizing a Novel and Specialized AI Model With a Portable Hardware Device for Proactive and Non-Invasive Screening

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95% of chronic kidney disease (CKD) patients miss early detection, mostly diagnosed at late stages, contributing to an annual mortality of 11 million globally. Current screening methods, such as blood urea nitrogen (BUN) tests, require blood draws and urine collection. These methods are time-consuming, invasive, inaccessible, costly, and generate medical waste. Research has shown that CKD patients exhibit specific retinal biomarkers from the early stages. KidneyLifePlus+ aims to develop a non-invasive, simple, and cost-effective method for early-stage CKD screening, providing groundbreaking solutions. Phase 1, we developed a novel AI model using ResNet-50 to classify CKD stages, achieving 95.5% accuracy. To improve accuracy, we further observed and analyzed key biomarkers and identified edge cases, such as exudates and blood spots, and developed YOLOv8, achieving 92.4% accuracy. Saliency maps revealed vascular thinning, a key indicator of declining eGFR, prompting us to apply U-Net for blood vessel segmentation, which achieved 95.4% accuracy. Combining these models with multi-head attention increased accuracy to 96.6%, leading to the development of specific algorithms for CKD screening and better stage identification. Phase 2, we designed a low-cost fundus camera to improve accessibility, especially in rural areas. We've studied OCT light emission to safely capture images without the need for mydriatics. Eye simulator tests confirmed 95% accuracy when validated against clinical data. This discovery enables screening to be 17.14x faster and reduces the cost to $7.99, compared to traditional methods. By transforming CKD screening, KidneyLifePlus+ facilitates early treatment, reduces the global mortality rate, and reduces medical waste.

Awards Won: