Revolutionizing Non-Invasive Blood Glucose Monitoring With AI-Powered Infrared Spectroscopy

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Diabetes is one of the leading causes of death and chronic disease in the United States. Current glucose monitoring devices require painful blood sticks that lead to poor monitoring adherence and eventually, worse outcomes. Similarly, current noninvasive techniques are not sufficiently accurate for practical at-home use. Using near infrared spectroscopy and machine learning techniques, this study aimed to create an inexpensive, noninvasive blood glucose monitoring device that meets FDA standards. Glucose peak absorption spectra were identified at 850nm and 1550nm. To improve accuracy, 1450nm, which is absorbed solely by water, was novelly used to isolate glucose absorption from glucose and water's overlapping spectra in blood. These wavelengths' reflections off a finger were measured and input into a support vector regression machine learning model (SVM) to predict blood glucose. The machine learning model generated an R squared value of 0.905 and mean absolute percent error of 3.9%, signifying high accuracy when predicting glucose levels. A paired two one-sided T-test (TOST) evaluated the equivalence between the means of the model's predictions and the FDA-approved glucometer, while allowing for the FDA-accepted 15 mg/dL difference between the two. Based on the test, the prototype produces results statistically equivalent to an FDA-approved glucometer ($P<.001$). Thus, this multispectral optical device can revolutionize at-home diabetic care for millions of patients through inexpensive, accurate, and painless blood glucose monitoring.

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