

Keeping an eye on diabetes

A NOVEL GLUCOSE MEASUREMENT DEVICE

Lein Applied Diagnostic Ltd / University of Southampton

The need

More than 240 million people across the globe suffer from different types of diabetes. Diabetic patients must be aware of their blood glucose level at any time to be capable of successfully managing it and avoid potential risks. The process of measuring blood glucose level (taking a blood sample by pricking the finger tip) is not a pain- and risk-free procedure. Hence a non-invasive measurement method could greatly help diabetic patients.

Lein Applied Diagnostics is developing a technology platform to non-invasively measure blood glucose level via eye measurements made by a laser confocal system. The goal of this project was to develop a model to relate eye measurements (made by Lein's confocal system) to blood glucose levels.

The outcomes

There have been several suggestions in literature that blood glucose level and specific eye parameters may be correlated. Since Lein's confocal system is capable of measuring these parameters with high accuracy and precision, any relationship between blood glucose and eye parameters will become more pronounced. A confocal system is an optical device which uses a highly localised beam of light to scan a specimen and measures the reflected intensity from the specimen back at a detector through a pinhole. It provides a very high axial resolution which can reveal further information about the geometry of the scanned object.

Lein conducted a clinical trial at the Royal Berkshire Hospital to further investigate the relationship between blood glucose and eye parameters. The initial analysis of the results from the trial showed a very significant correlation between the blood glucose and the eye measurements. However, Lein wished to investigate the data further to improve the correlation and develop a model.

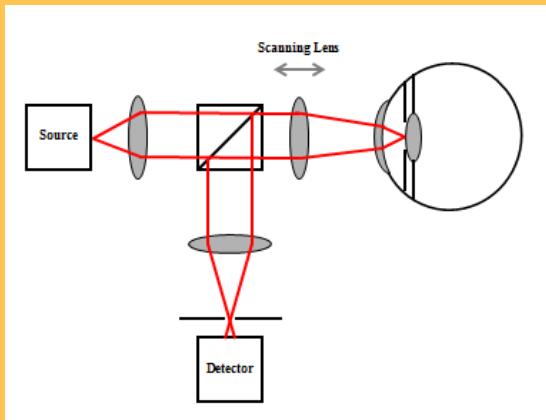
Various approaches were used during the project to improve the statistical model relating blood glucose to measured eye parameters. The student's achievements moved Lein's work forward significantly and will support its future work in this area.

"Shayan brought enthusiasm and a fresh approach to our work that produced many useful results."

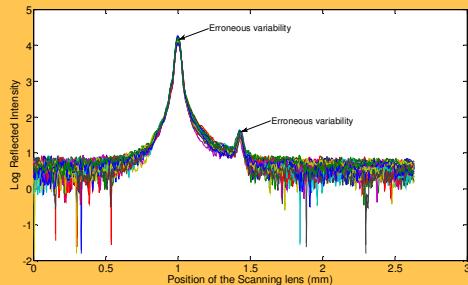
Graeme Clark
Lein Applied Diagnostics

Technical summary

Various approaches were used to improve the statistical model relating blood glucose to measured eye parameters. Improving the data quality acquired by the confocal system was one of the main areas covered during the internship. A simplified schematic of Lein's system is shown in the figure below.



During the project the variability in the scans was reduced by approximately 30% using digital filtering and interpolation in conjunction with an outlier removal algorithm.



Furthermore, the team also achieved a significant improvement (35%) in reducing the variability between sets of data (i.e. averaged parameters produced by the system became more precise using post-processing techniques developed from observations made during experimental work at Lein).

A way to improve the statistical model relating blood glucose level to specific eye parameters using an appropriate coherent averaging method was discovered.

Finally, Lein gained a deeper understanding of the most destructive sources of errors affecting its measurements.

"Working at Lein enabled me to gain a better understanding of how research in industry differs from that in academia... [Working] with experienced consultants also formed a great part of my learning...I became familiar with the physics of optics and experiment design and experimental result interpretation."

Shayan Motamed Fakhr, University of Southampton

"This internship has been a perfect demonstration of how research can be applied to improve people's quality of life. Furthermore, some of the techniques and skills learnt can be directly applied to [Shayan's] PhD project. This has been far better than any other training that we could have provided for Shayan."

Mohamed Torbati, University of Southampton

This project was part of the programme of industrial mathematics internships managed by the Knowledge Transfer Network (KTN) for Industrial Mathematics. The KTN works to exploit mathematics as an engine for innovation. It is supported by the Technology Strategy Board, in its role as the UK's national innovation agency, and the Engineering and Physical Sciences Research Council, in its role as the main UK government agency for funding research and training in engineering and the physical sciences.



Project Details

Partners

Lein Applied Diagnostics Ltd
University of Southampton

Project investment

£12,000

Intern

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