Master 2 Internship
With an option to continue to a PhD

Mathematical and computational models and methods for the real-time soft calibration of measuring devices in clinical chemistry and immunoassays for in vitro diagnostic

Company: DiaSys Technologies, 1682 rue de la Valsière, Montpellier, France

Duration: 6 months

Indicative date for beginning of the internship: February-March 2023

Contact:
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Context
DiaSys Technologies is part of the DiaSys group, whose parent company is located in Germany, near Frankfurt. The DiaSys group is developing, producing and distributing in-vitro diagnostic reagents in clinical chemistry (enzyme tests, colorimetry) and immunoturbidimetry for almost 30 years all over the world.

DiaSys Technologies is a company based in Grabels, near Montpellier, France. It is made up of a multidisciplinary team of around thirty people: electronics engineers, mechanical engineers, software developers, biology/biotechnology engineers.

It develops fully-automated analyzers, which aim is to fully automate in vitro diagnosis for various techniques: enzymatic tests, immunoturbidimetric tests and chemiluminescent immunoassays. These medical devices are intended for hospitals and clinical laboratories.

DiaSys Technologies also collaborates with PES DiagnoseSysteme, a company of about fifteen employees, based in Leipzig, Germany. PES is specialized in chemiluminescent immunoassays development for in vitro diagnostics.

More information about DiaSys Technologies and the DiaSys group: https://www.diasys-diagnostics.com/

DiaSys Technologies is collaborating on this project with the “EuroMov Digital Health in Motion” research unit, which works at the crossroads between artificial intelligence, movement sciences and health sciences.

More information about Euromov: https://euromov.eu/accueil/
Description

When performing in-vitro diagnostic, the hospital or clinical laboratory must guarantee that the measured value during a test matches the real value. To achieve this, regular calibrations must be performed independently for each analyte. These calibrations are performed with samples whose analyte concentration is known and has been previously verified with a reference method. In some cases, these samples are purchased freeze-dried and must be re-suspended prior to calibration.

Calibration validity varies from one analyte to another, ranging from three days up to six weeks.

When it is necessary to perform tests on 100 different analytes, these frequent calibrations can become extremely time-consuming. In addition, obtaining calibration samples is expensive, especially if several concentration levels are necessary to perform the calibration. Furthermore, these frequent calibrations increase the risk of a bias being inserted during the re-suspension of the freeze-dried calibration sample.

In response to these issues, the objective of this project is to develop mathematical and computational models and tools to model the measuring device drift in the presence of endogenous and exogenous variables. The estimation of this drift and its use in the production of the measurement, what we call soft calibration, will make it possible to reduce the frequency of physical calibration of an analyte, to reduce the number of concentration levels to perform a calibration, or a combination of both. These mathematical models and their computational counterpart will have a universal scope easily adaptable to real cases encountered in practice.

The first stage of the work will be the production of a bibliographic state of the art. At the same time, several sets of enzymatic tests and immunoassays data will be used to continuously test innovative mathematical and computer tools responding to the issues presented. Finally, once these tools have been developed, they will be analytically tested according to CLSI criteria (repeatability, reproducibility, accuracy, linearity, limit of detection, limit of quantitation, stability, method correlation).

Required profile

Master 2 in Applied Mathematics, Computer Science or BioInformatics.

Solid knowledge in mathematics, optimization, statistics. Experience in developing computer programs (Matlab, R, Python, etc.).

Good level of written and oral English (C1).

Curious and motivated spirit. Organizational and project management skills. Willingness to work in a multi-disciplinary context. Ability to quickly understand concepts outside of one's area of expertise.

Good quality of written and oral communication (reports, presentations, communication with collaborators).

Having a basis in in vitro diagnostics or at least having an attraction for biology and biotechnology would be a plus.