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## Estimation of respiratory rate using several sensors – Collaboration IRCAD/RDS

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### IRCAD

The Research Institute against Digestive Cancer (IRCAD) is currently a world reference in the domains of medical data processing and mini-invasive surgery training. Our R&D is performed in IRCAD's Surgical Data Science (SDS) team, located in Strasbourg, France and Kigali, Rwanda.

Surgical Data Science (SDS) is about improving outcomes of surgery with AI-based software systems driven by clinical data. We aim to improve the training and capabilities of surgical teams with SDS, to reduce complications, make surgery easier and safer, and achieve better patient outcomes.

### RDS

RDS (Rhythm Diagnostic Systems) is an innovative company developing e-health devices that enable continuous and wireless monitoring of a patient's vital signs in order to detect health deterioration. The RDS solution consists of an adhesive patch with a proprietary electronic design and patented sensors that enable the non-invasive measurement of multiple parameters of clinical interest. Data is continuously collected and transferred to a digital health cloud for real-time analysis and display. The company has teams in Palo Alto (USA) and in Strasbourg (France), where it has been selected as one of the main projects of the large-scale « tomorrow's health initiative ». RDS is a winner of the famous French i-Lab competition.

RDS is currently completing the technical and regulatory certification to place its first device on the market. Beyond that, the R&D team is already engaging in the future of physiological monitoring anywhere. An essential aspect of RDS's device is the high fidelity and robustness of the estimated physiological parameters. Specifically, the multivariate nature of the Multisense monitoring device allows to cross estimate several vital signs from different sensors, yielding more robust estimates. We aim to instigate the contribution of each sensor with respect to different parameters, starting with respiratory rate, which is currently inferred from a piezoelectric sensor, an electrocardiogram (ECG), an accelerometer and two photoplethysmography (PPG) leads.

### Responsibilities

- The main objective is to estimate the contribution of each sensor for estimating respiratory rate using regression models, and identify if sensor(s) could be removed without a significant loss of estimation accuracy.
- You will first prepare a dataset for your analysis with physiological data from more than 100 subjects.
- You will suggest evaluation criteria to judge the effectiveness of the methods proposed during your internship. Special care will be given to the choice of the gold standard.
- You will contribute to writing a data collection protocol to validate the method in a prospective cohort that will be acquired during the internship.
- You will suggest and implement and compare several regression models, including machine learning methods such as Support Vector Regression (SVR). These methods will be trained on specific hardware available at IRCAD.
- Attention will be given to the generalization of the method with respect to body position and hardware version.

### Supervisors:

**Toby Collins (IRCAD) & Louis Mayaud (RDS)**  
Research fellow, Computer Sciences R&D Team  
IRCAD, 1, place de l'hôpital, 67091 Strasbourg  
E-mail: [alexandre.hostettler@ircad.fr](mailto:alexandre.hostettler@ircad.fr)

### Skills:

Python  
Signal processing  
Machine learning

**Gross salary:** 1200 €

**Internship duration:** 6 months

**Beginning of the internship:** 1<sup>er</sup> quarter of 2022

**Place:** IRCAD – Strasbourg – City Centre