GENERATION OF VIRTUAL PATIENTS FOR SMART WOUND CARE ELECTRONIC PATCHES

1 Supervising staff

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2 Context

The management of chronic wounds is a major clinical and economic challenge. These wounds do not follow the normal healing process and do not reach complete healing after 4 to 8 weeks, often due to stagnation in the inflammatory phase. They can lead to prolonged hospitalisation, additional treatment, a significant reduction in quality of life and an increased risk of serious infections. Their prevalence is estimated at between 1% and 2% in high-income countries, and is tending to increase with the ageing of the population and the rise in co-morbidities such as diabetes and obesity.

Despite advances in treatment, evaluation of the condition of a wound still relies mainly on visual inspection, which is subjective and not very sensitive to early signs of stagnation or infection. Additional tests (cultures, ultrasound, MRI) are costly, sometimes invasive, and do not always provide results within a clinically useful timeframe.

The AI-SWEEP research project aims to design an intelligent dressing integrating sensors for continuous measurement of physiological parameters (temperature, pH, humidity, pressure, proteases, etc.), combined with on-board electronics for data collection and transmission. Eventually, these systems will make it possible to develop AI algorithms to predict healing time or detect infection at an early stage, thereby facilitating remote, personalised care.

However, training and validating these algorithms to analyse the data requires large, well-characterised databases, which are difficult to access in a clinical context.

To overcome this problem, the aim of this thesis is to generate virtual patients suffering from chronic wounds.

3 Work

This master's thesis proposes to generate realistic data from virtual patients suffering from chronic wounds, i.e. simulated time series of biomarkers that sensors integrated into an intelligent bandage could record. This data will be used to reproduce realistic trajectories for different clinical cases (healing, stagnation, aggravation), using modelling based on the scientific literature and an existing database.

This will allow various clinical scenarios to be detected and interpreted, and the performance and robustness of prediction algorithms to be tested.

The main steps are as follows:

- Carry out a literature review on key biomarkers and their evolution in different clinical scenarios.
- Define virtual patient profiles.
- Model time series of biomarkers for different clinical cases (healing, stagnation, infection).
- Automate data generation.
- Visualise, document and validate the results obtained.