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# Ambulatory Peritoneal Dialysis Analysis Framework

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**Abstract.** This paper presents the design of an autonomous tracking device to enhance understanding of ambulatory peritoneal dialysis. The resulting tool aims to serve as a framework for research analysis and a decision support for treatment adjustments in peritoneal dialysis.

**Keywords.** Peritoneal dialysis, chronic kidney disease, monitoring device, database pipeline, framework.

## 1. Introduction

Peritoneal dialysis is a treatment for patients with chronic kidney disease that uses the peritoneum's biological mechanism as a natural filter to replace defective kidney functions [1]. It has to be done in the hospital several times a week, which implies many constraints in the patient's life. However, this operation is facilitated if performed at home on ambulatory [2]. Despite this added comfort, ambulatory peritoneal dialysis is very difficult for caregivers to monitor [3]. The quantity of readings is not sufficient, as there is 36% risk of peritoneal degradation and loss of ultrafiltration after four years on peritoneal dialysis [4,5]. Currently, most patients requiring dialysis prefer to sacrifice their comfort for better supervised operations in hospital - only 6.2% of dialysis patients are on peritoneal dialysis while the rest are on hemodialysis [6]. This paper proposes a research analysis framework in order to simplify the follow-up of the data remotely.

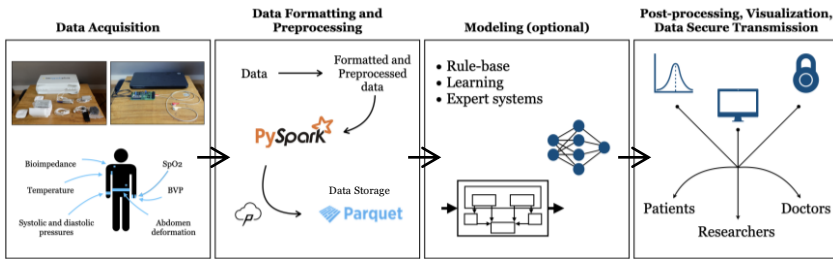
## 2. Methods and Results

Several variables were selected to constitute the patient's data (Fig.1). For each, a preprocessing function was developed to clean the signal. In most cases, a median filter was applied - window size 5, as well as a notch filter at 50 Hz or a threshold. The EDM (Empirical Mode Decomposition) method was used to remove oscillations due to

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breathing or heartbeat in the bioimpedance. By removing the uninteresting IMFs (Intrinsic Mode Function) [7], it is possible to recover a smooth signal.



**Figure 1.** Data pipeline of the Ambulatory Peritoneal Dialysis Analysis Framework (SpO<sub>2</sub> : blood oxygenation, BVP : blood volume pressure).

The database was developed in Python using the PySpark and Petastorm libraries [8,9] for structure and autonomous filling, and saved in Parquet [10]. This format is designed to accommodate a large number of entries [8,10] and to work with machine learning processes. The framework is automated from the collection of the data to its entry into the database (Fig. 1).

### 3. Discussion and Conclusions

This paper presents a data routing pipeline and framework to measure, store, and analyze automatically physiological parameters for continuous monitoring of ambulatory peritoneal dialysis. The feasibility of this device has been tested, but further research and additional measurement campaigns need to be organized on healthy and sick patients for comparison and complete demonstration. The work presented here aims at facilitating research from a medical point of view in order to enable ambulatory peritoneal dialysis to be better managed, offering a decision support tool for treatment adjustments.

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