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Topological analysis of breathing patterns

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Persistent homology is one of the tools used in topological data analysis. It allows to analyze the topological features of data that persist across multiple scales. The respiratory and cardiovascular systems are strongly interconnected. In particular, breathing pattern heavily impacts the heart rate.

In this work, we apply persistent homology to the dataset that consists of breathing recordings of various patients. Those recordings contain complex patterns that may be difficult to quantify using traditional methods. After preprocessing the time series, which included filtering and transforming it into analytical signal, we were able to compute persistence diagrams. The extracted topological features were then passed to a Machine Learning model that found some patterns. Using this approach, we managed to divide samples from the dataset into two classes that differed in the regularity of the breath.

This work contributes to the growing field of topological data analysis and demonstrates the potential of persistent homology in cardiorespiratory research.