Software to automate functional analysis of reconstructed EIT data

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Abstract: In order to make Electrical Impedance Tomography (EIT) analysis more accessible to clinical researchers, we have developed a tool to analyse and display functional EIT measures of reconstructed EIT data of the thorax. Features have been implemented to analyze flow, volume of breaths and basic cardiac frequency analysis.

1 Introduction

Electrical Impedance Tomography (EIT) can have high barriers to entry due to the complexity of analysis on reconstructed data. Existing clinical software performs reconstruction and basic analysis, typically providing an overview of the data and some basic analysis such as: ventilation images, regions of interest, perfusion calculation and data selection.

Several EIT analysis tools have been developed such as AUSPEX (University of Amsterdam) and IBEX [1]. Here, we seek to create an open-source and automated tool that offers the flexibility of a pluggable interface for new functional algorithms. We set out to design a tool that enables the user to select from several different analysis techniques on their reconstructed data, and run an identical analysis across a large number of files simultaneously, decreasing the complexity of EIT analysis.

Focus has been placed on flow-volume analysis for its potential for detecting and analyzing a wide variety of respiratory diseases [2].

2 Implementation and Discussion

Reconstructed EIT data is imported and options are set by user input in a config file. Several open source algorithms are available for selection which can then be run on all files contained within a directory. The results across all files are then displayed in an HTML table so they can be quickly compared across all files. The analysis works on both raw EIT data and reconstructed images. An overview of the analysis procedure including sample results shown for horse ventilation is shown in Fig 1.

The tool presented for the customisable analysis of reconstructed data allows a user to select an appropriate technique for images acquired and reconstructed using data from commercial or academic EIT systems.

References

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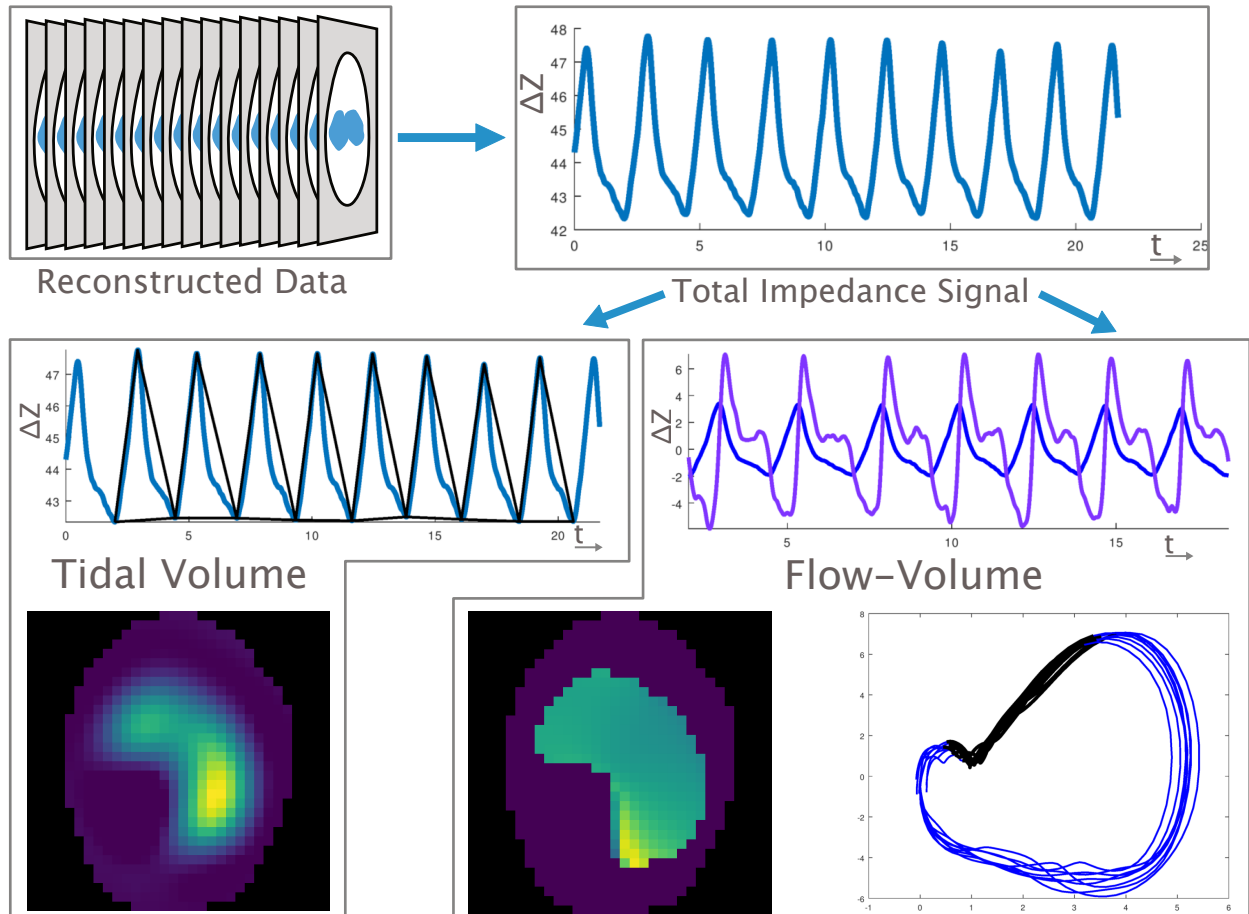
Figure 1: Reconstructed EIT images of horse ventilation are processed as the total impedance signal to detect breaths and plot the flow. Detected breaths are ensemble averaged to generate a tidal volume image. The flow signal is used to generate a flow image and create a flow-volume curve across all detected breaths.