Aggregation and Visualization Platform For Indicators Across Patient Cardiovascular Datasets

AUTHORS

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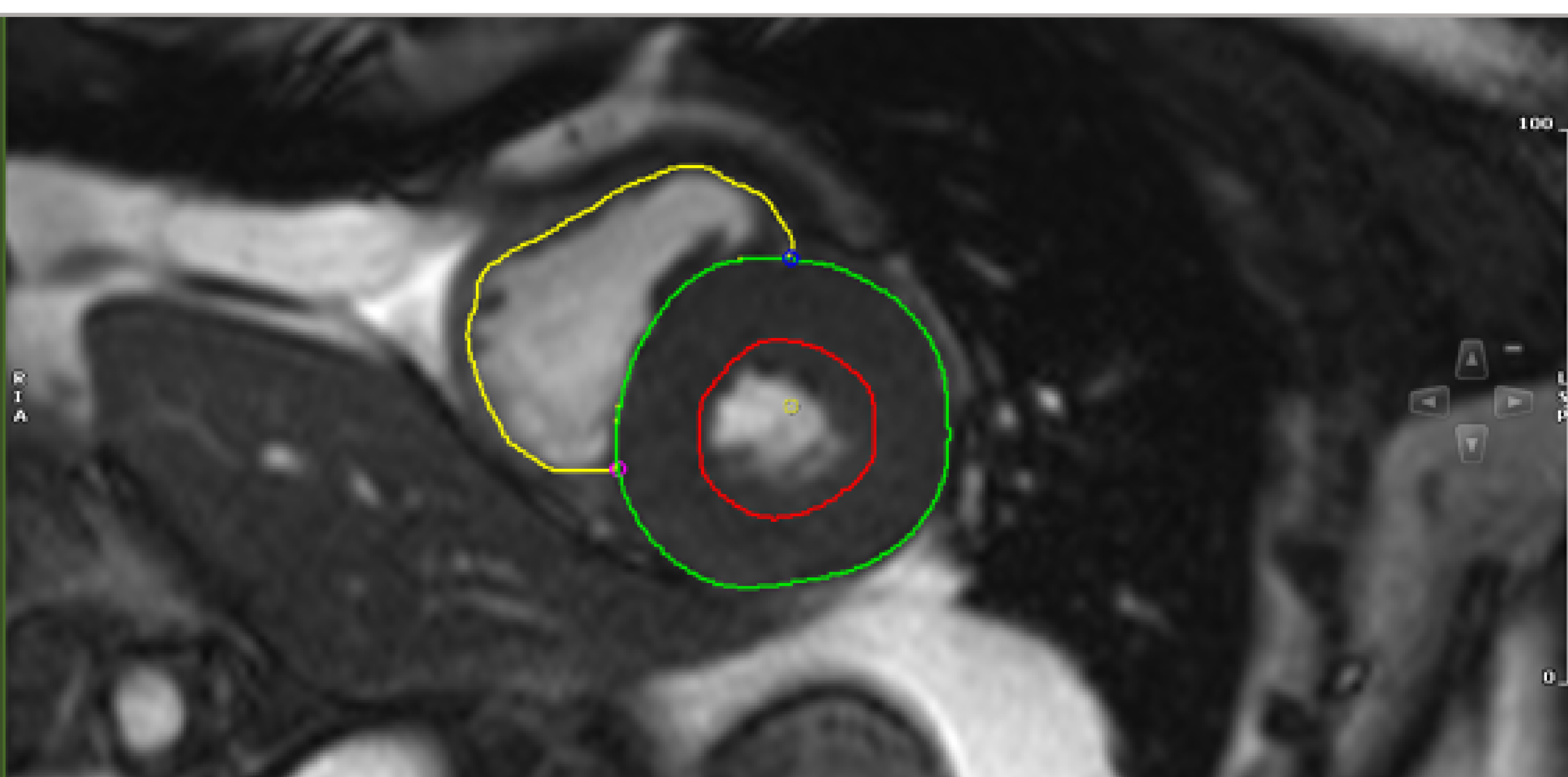
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Aggregating and visualizing data acquired from cardiovascular images acquired from Circle Cardiovascular Imaging's software, cvi42. Various cohorts and metrics are displayed to enable pattern recognition and improve health care diagnosis.

AFFILIATIONS

Contours of the Heart from cvi42

01. Introduction

- Circle Cardiovascular Imaging's software, cvi42, generates contours of the heart's physical components from cardiovascular images
- Contours are useful for acquiring data from images and calculating mass, volumetric, and indexed measurements about heart function
- Current software lacks the ability to aggregate and visualize data from multiple studies
- Hospitals must manually compile data using spreadsheets
- This limitation is a significant barrier to maximizing the potential of the tool in areas such as diagnosis, clinical research, and quality control
- This project aims to develop a platform to enable the aggregation and visualization of various indicators across multiple studies

02. Objective/Motivation

- Develop a platform for visualizing and aggregating cardiovascular indicators across studies
- Platform useful for diagnosis, clinical research, and quality control
- Add batch processing and visualization of patient studies to Circle Cardiovascular Imaging's software suite
  - healthcare practitioners require time-sensitive information to treat, and care for patients in need
- Improves healthcare practitioners' access to data and visualization for efficient patient care.

Tech Stack - Front-end
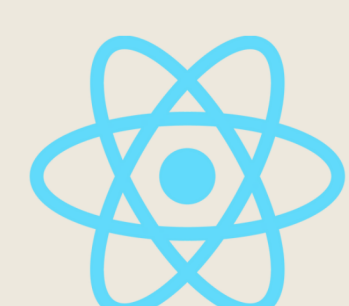
React   **Mantine**   **nivo**

Tech Stack - Back-end

Python   **Django**   **SQL**

03. Aggregation and Visualization Procedure

In the process of aggregating and visualizing data within our platform, there are 3 main steps. The process begins by processing the output of the scientific report generated after cardiovascular images have been taken of a patient. The platform can handle single uploads, as well as batch uploading. Once the studies have been processed, cohorts are assigned to the studies enabling groups of studies to be viewed on a singular visualization. The visualizations enable users to select from metrics that will be displayed within the visualization and subsequently make changes such as changing the metrics, or the desired cohort.
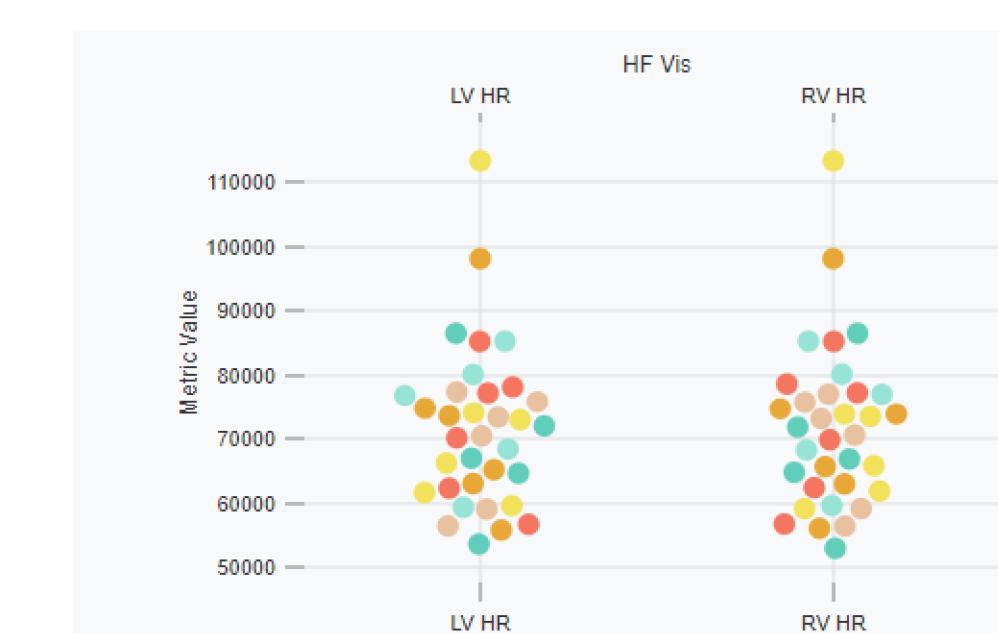

Scientific report generated by Circle CVI's software CVI42

Results from processing the data within the scientific report

Visualization created by the platform with the heart rate of the left and right ventricle

04. Applications

- Potential applications include
  - deriving normal values across different populations
  - facilitating longitudinal studies
  - enabling quality control and automation
- The platform enables more efficient and effective use of the software in clinical settings.


Magnetic Resonance Imaging Machine

05. Discussion and Results

- The platform enables **batch processing** of data from cvi42 for creating visualizations of cardiovascular indicators
- The platform can:
  - upload multiple studies simultaneously
  - **process 50 studies in under 30 seconds**
  - group studies by user-defined cohorts
  - visualize **over 20 indicators** across studies, such as
    - heart rate
    - left/right ventricle end-diastolic volume
    - left/right ventricle end-systolic volume
  - customize visualizations
  - create workspaces for organizing visualizations
- The platform has a login and admin system for user management and an easily navigable user interface
- While currently used for short-axis cardiovascular images, the platform is extensible for use cases beyond cardiovascular imaging
- The back end is designed for future machine learning capabilities to detect patterns and variations within cohorts for better patient care.

User Interface of the Aggregation and Visualization Platform
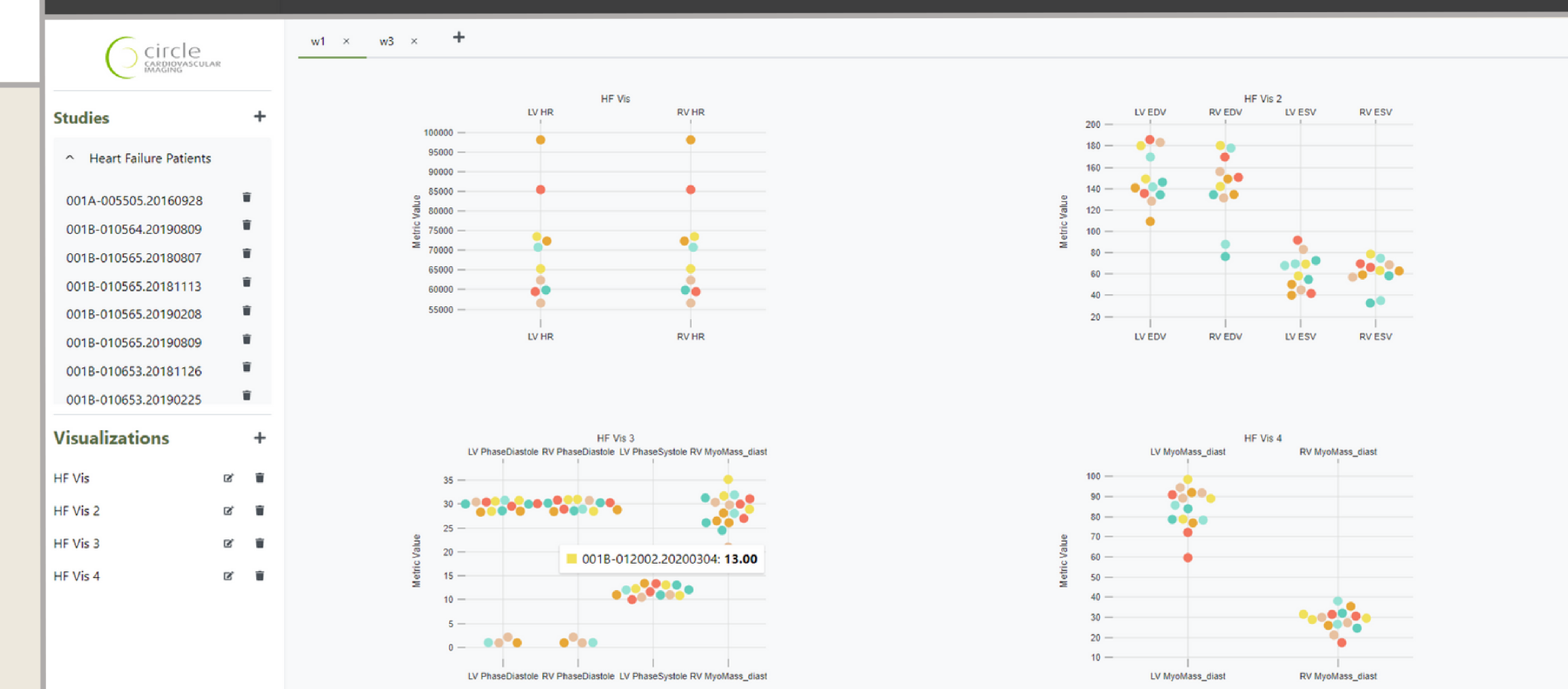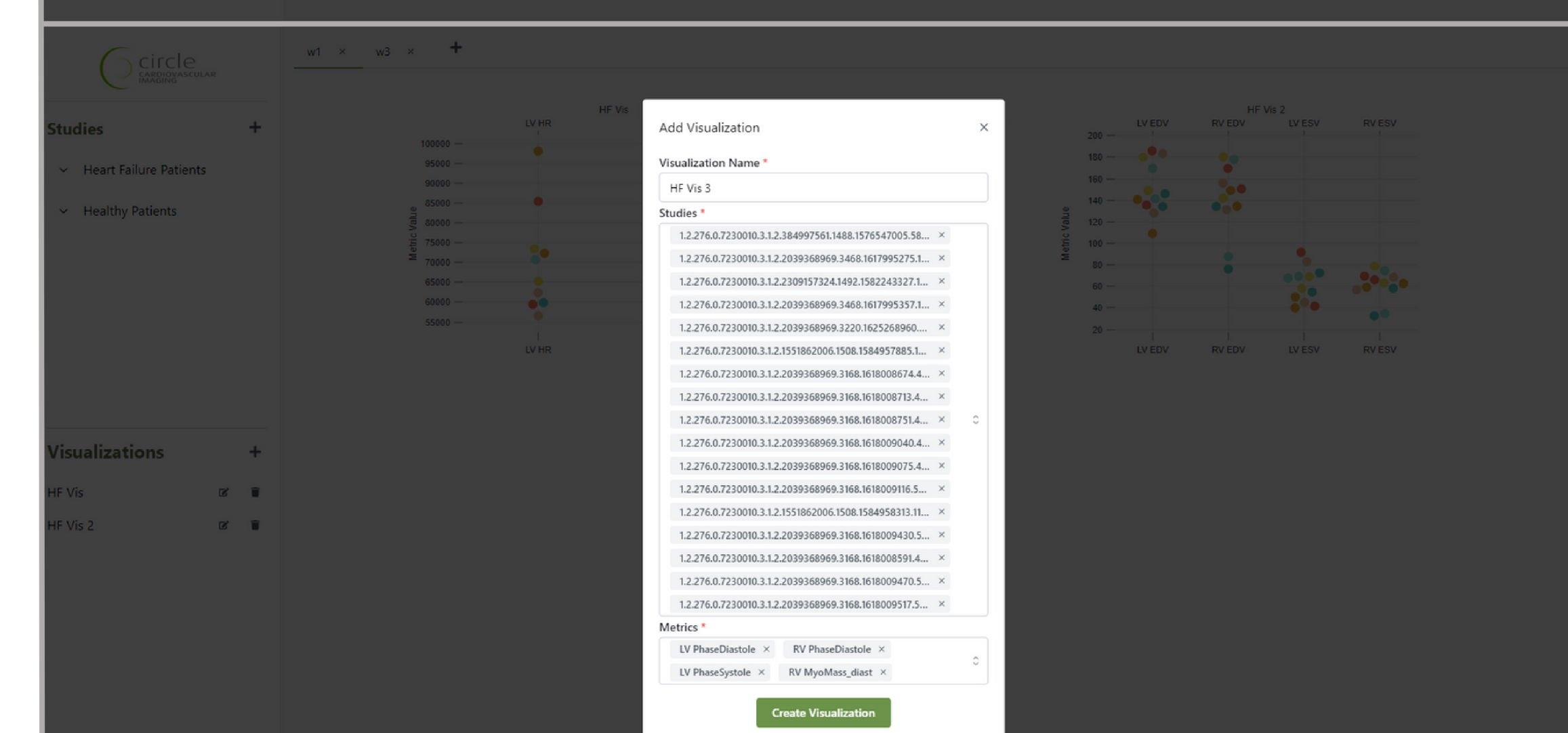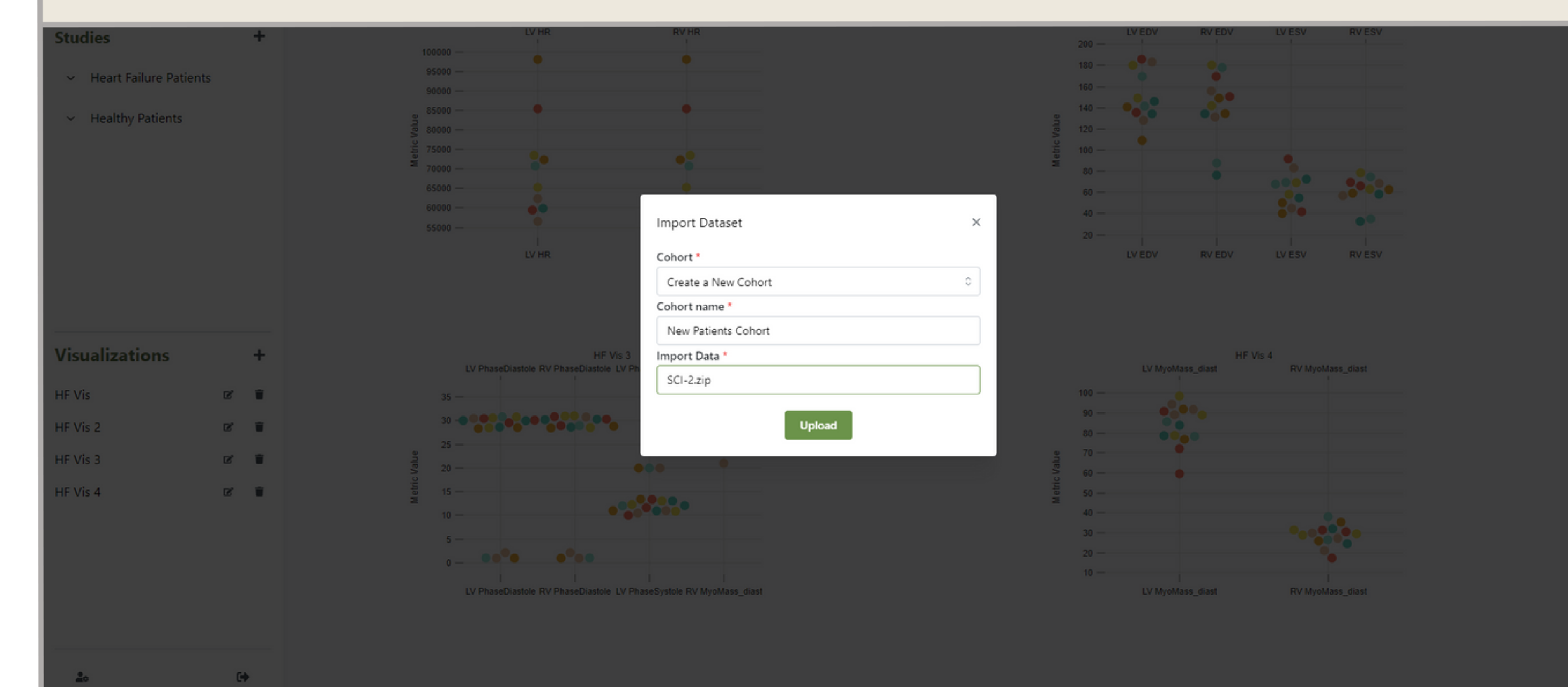
06. Conclusion

- Our platform leverages batch processing to derive values across different cohorts, perform longitudinal analysis, and identify outliers in automated results
- This enables more efficient and effective use of Circle Cardiovascular Imaging's software in clinical settings
- Healthcare professionals can provide better and more efficient care to patients
- Our project unlocks the full potential of Circle Cardiovascular Imaging's software
- The platform can efficiently aggregate and visualize data from multiple studies.