Accuracy of left ventricular mechanical dyssynchrony indices for mechanical characteristics of left bundle branch block using cardiovascular magnetic resonance feature tracking

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## Instructions

Data and code to reproduce all aspects of the current study is available in the provided zip file.

To reproduce the study results and manuscript you will need to install [Docker](https://https://www.docker.com/). Further usage instructions can be found [here](https://docs.docker.com/get-started/).

Unzip the content of data.zip as well as that of dillacs-study.zip. Move all the image data contained in the data.zip unzipped folder into the dillacs-study\analysis\data\raw\_data\ folder.

In a new terminal, navigate to the folder containing the unzipped contents of dillacs-study.zip.

Start with building the docker image by running the following command in a terminal

docker build --tag dillacs .

You have now built the docker image containing the software needed to reproduce the study.

Proceed by spinning up a container based on the newly built image. The container will automatically run all code in the correct order.

docker run --rm -it --name dillacs --mount type=bind,source=$(pwd),target=/project dillacs

(If you are on a windows machine please change the source=$(pwd) to source=C:\\path\_to\_the\_extracted\_zip\_file where you provide the full pathway to the extracted archive.)

The resulting manuscript file can then be found in the ./analysis/paper/\_book/ folder.

CMR files are analyzed in [Segment](https://medviso.com/) (v3.0, Medviso®, Lund, Sweden) which is freely available for download to view the CMR images.

A detailed outline of the image content of each exam is provided in the file named image\_data\_content.csv. In short all CMR exams contain CMR cine shortaxis stacks covering the left ventricle, 78/80 contain cine 2-chamber images, 79/80 contain cine 3-chamber images, and 79/80 contain cine 4-chamber images. All subjects had no focal abnormalities by LGE imaging (images not provided).

Below is an overview and short explanation of the files contained in, and produced by the current study:

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├── analysis  
│   ├── data  
│   │   ├── derived\_data # Data produced during code excecution  
│   │   │   ├── cleaned\_data.Rds # CMR and demographics data  
│   │   │   ├── dyssynchrony\_data.Rds # Addition of dyssynchrony analysis results  
│   │   │   ├── figs.Rds # Figures data  
│   │   │   └── statistics.Rds # Results from statistical analysis  
│   │   └── raw\_data  
│   │   ├── demographics.csv # Demographics data for subjects enrolled in the study  
│   │   └── mri\_data  
│   │   ├── analyzed # CMR exams delineated and with feature tracking results  
│   │   └── original # Original CMR exams  
│   ├── figures  
│   │   ├── dyssynchrony\_distribution.tiff  
│   │   ├── performance\_measure\_cutoff.tiff  
│   │   └── roc\_by\_dyssynchrony\_index.tiff  
│   ├── paper  
│   │   ├── abstract.Rmd # Article abstract  
│   │   ├── appendix.Rmd # Contains images and table 1  
│   │   ├── auxilliary  
│   │   │   ├── references.bib # Biblatex reference file  
│   │   │   └── vancouver.csl # Citation style format  
│   │   ├── background.Rmd # Article background  
│   │   ├── \_book  
│   │   │   ├── Loewenstein-et-al.---Diagnostic-performance-of-left-ventricular-mechanical-dyssynchrony-indices-using-CMR-feature-tracking.docx # Final article  
│   │   │   ├── abstract.md # Generated  
│   │   │   ├── appendix.md # Generated  
│   │   │   ├── background.md # Generated  
│   │   │   ├── discussion.md # Generated  
│   │   │   ├── methods.md # Generated  
│   │   │   ├── reference-keys.txt # Generated  
│   │   │   └── results.md # Generated  
│   │   ├── \_bookdown\_files  
│   │   │   └── appendix\_files  
│   │   │   └── figure-docx  
│   │   │   ├── dysboxplot-1.tiff # Generated, inserted into paper  
│   │   │   ├── dysrocplot-1.tiff # Genereated, inserted into paper  
│   │   │   └── performanceplot-1.tiff # Generated, inserted into paper  
│   │   ├── \_bookdown.yml # Configuration file for bookdown library  
│   │   ├── discussion.Rmd # Article discussion  
│   │   ├── \_main.rds # Generated, cached data during article rendering  
│   │   ├── methods.Rmd # Article methods  
│   │   ├── \_output.yml # Configuration file for bookdown output format  
│   │   ├── preamble.tex # Configuration for double spacing for pdf output format  
│   │   ├── reference.docx # Word docx style template  
│   │   └── results.Rmd # Article results  
│   └── scripts # R code extracted from vignettes  
│   ├── data\_processing-GEN.R  
│   ├── data\_processing-GEN.Rout  
│   ├── dyssynchrony\_analysis-GEN.R  
│   ├── dyssynchrony\_analysis-GEN.Rout  
│   ├── figures-GEN.R  
│   ├── figures-GEN.Rout  
│   ├── statistics-GEN.R  
│   └── statistics-GEN.Rout  
├── dillacs.Rproj # Rstudio project file, containing project specific options  
├── Dockerfile # Docker build file, contains instructions for building docker image with required software to reproduce the current study  
├── env.yml # Conda environment configuration file, specifies required software libraries  
├── Makefile # Makefile, runtime automation instructions for correct runtime order and excecution  
├── R # Custom R functions  
│   ├── formatCons.R  
│   ├── geom\_signif.R  
│   ├── get\_segment\_data.R  
│   ├── offset2groups.R  
│   ├── strain\_cure.R  
│   └── strain\_ssi.R  
├── README.md # This README  
└── vignettes  
 ├── LP-data\_processing.Rmd # Code for extracting CMR and demographics data  
 ├── LP-dyssynchrony\_analysis.Rmd # Code for performing dyssynchrony analysis  
 ├── LP-figures.Rmd # Code generating figures of study results  
 └── LP-statistics.Rmd # Code for performing statistical analysis