

# Myocardial torsion estimation with Tagged-MRI in the OsiriX platform

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## Medical background

Myocardial torsion (MT) is a key component of cardiac function and it plays a crucial role in the assessment of the functionality of the left ventricle [1]. Meanwhile, tagged Magnetic Resonance (TMR) is one of the few modalities that allows measurement of intramural motion. Despite this, there are few intuitive tools for torsion estimation in TMR.

Hospital Sant Pau [HSP] uses OsiriX [2] in their own clinical workflow and research. This Mac-based, open-source platform integrates a user friendly DICOM sequence viewer with a flexible plug-in system that extends its functionality, enabling advanced image processing techniques.

## Tagged MRI analysis

For computation of motion estimation in tagged-MRI, the interactive and augmented modelling group [CVC] has developed the Harmonic Phase Flow (HPF) plugin. HPF is a variational approach that works in the Gabor domain, ensuring optical flow invariance as well as motion tracking robustness. Additionally, HPF computes wall deformation without overestimating motion at injured areas.

Myocardial torsion was computed as the difference in global rotation between two SA views at Base-Apex and Mid-Apex levels. For each SA level, global rotation was estimated using HPF motion vectors within the LV domain. This domain was delimited by manual segmentation of LV walls boundaries at a reference frame. At other stages of cardiac cycle, these boundaries were updated by means of HPF.

## Clinical validation

The final version of the HPF plugin (see fig.1) was deployed at [HSP] in September 2011. In order to validate its functionality, we tested on sequences acquired using different protocols and including healthy and pathological cases (see table 1). For each dataset,

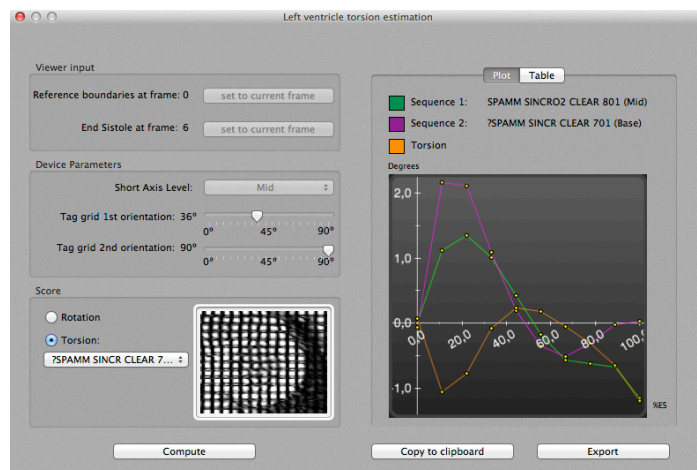


Figure 1: Plugin interface

two clinical experts segmented the left ventricle(LV) boundaries in order to assess inter-observer variability.

Source	# Seqs	Healthy?	Modality	Device
CCB	21	Yes	SPAMM	Siemens
HSP	8	No	CSPAMM	Philips
CCB	12	No	SPAMM	Siemens
HGM	7	No	SPAMM	Philips

Table 1: Datasets

## Conclusions

Torsion scores have similar trends for SPAMM acquisitions. Pathological cases introduce expected deviations from the ground truth. However, C-SPAMM sequences were too noisy for robust motion extraction. We plan to fine-tune the acquisition process in order to determine optimal parameters for deformation tracking.

## Download

The plugin binaries and source code (GPLed v3) are available at <http://iam.cvc.uab.es>.

## Acknowledgements

Thanks to [HSP,CCB,HGM] for providing and testing clinical sequences. Financial support was provided by TIN2009-13618, CSD2007-00018 projects and the Ramon y Cajal grant.

## References

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- [2] Rosset, A., Spadola, L., Ratib, O.: Osirix: an open-source software for navigating in multidimensional dicom images. *J Digit Imaging* **17**(3) (Sep 2004) 205--16