Decoding Complex Cardiac Arrhythmia using Mathematical Optimization

Sebastian Sager

Institute of Mathematical Optimization

sager@ovgu.de

joint work with *Florian Kehrle* and *Eberhard Scholz*

Abstract

It is an open clinical problem to distinguish atrial flutter from atrial fibrillation. The discrimination is imperative, as atrial fibrillation is the most frequent arrhythmia in the adult (about 6 million individuals across Europe) and both types have to be treated differently in the interest of the patient. Atrial flutter is underrecognized in clinical practice. Especially in cases of irregular ventricular response it is often misinterpreted as atrial fibrillation. Caused by an increasing number of left atrial catheter ablations (pulmonary vein isolations), the number of left atrial flutter is increasing at an alarming rate, making the mentioned decoding task an ubiquitous one.

We discuss different possible mathematical approaches to the discrimination problem and present a phenomenological modeling approach that leads to a challenging optimization problem. For the resulting non-standard mixed-integer nonlinear optimization problems we present tailored solution strategies and very encouraging results from a transfer to clinical practice.

*

References

[1] SCHOLZ, E.P., KEHRLE, F., VOSSEL, S., HESS, A., ZITRON, E., KATUS, H.A., SAGER, S., *Discriminating atrial flutter from atrial fibrillation using a multilevel model of atrioventricular conduction*, Heart Rhythm, DOI: 10.1016/j.hrthm.2014.02.013, 2014.