Sci Rep. 2017 Jul 11;7(1):5059. doi: 10.1038/s41598-017-04998-7.

**Heart rhythm characterization through induced physiological variables.**

[Pons JF](https://www.ncbi.nlm.nih.gov/pubmed/?term=Pons%20JF%5BAuthor%5D&cauthor=true&cauthor_uid=28698645)1, [Haddi Z](https://www.ncbi.nlm.nih.gov/pubmed/?term=Haddi%20Z%5BAuthor%5D&cauthor=true&cauthor_uid=28698645)2, [Deharo JC](https://www.ncbi.nlm.nih.gov/pubmed/?term=Deharo%20JC%5BAuthor%5D&cauthor=true&cauthor_uid=28698645)3,4, [Charaï A](https://www.ncbi.nlm.nih.gov/pubmed/?term=Chara%C3%AF%20A%5BAuthor%5D&cauthor=true&cauthor_uid=28698645)5, [Bouchakour R](https://www.ncbi.nlm.nih.gov/pubmed/?term=Bouchakour%20R%5BAuthor%5D&cauthor=true&cauthor_uid=28698645)5, [Ouladsine M](https://www.ncbi.nlm.nih.gov/pubmed/?term=Ouladsine%20M%5BAuthor%5D&cauthor=true&cauthor_uid=28698645)2, [Delliaux S](https://www.ncbi.nlm.nih.gov/pubmed/?term=Delliaux%20S%5BAuthor%5D&cauthor=true&cauthor_uid=28698645)6,7.

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**Abstract**

Atrial fibrillation remains a major cause of morbi-mortality, making mass screening desirable and leading industry to actively develop devices devoted to automatic AF detection. Because there is a tendency toward mobile devices, there is a need for an accurate, rapid method for studying short inter-beat interval time series for real-time automatic medical monitoring. We report a new methodology to efficiently select highly discriminative variables between physiological states, here a normal sinus rhythm or atrial fibrillation. We generate induced variables using the first ten time derivatives of an RR interval time series and formally express a new multivariate metric quantifying their discriminative power to drive state variable selection. When combined with a simple classifier, this new methodology results in 99.9% classification accuracy for 1-min RR interval time series (n = 7,400), with heart rate accelerations and jerks being the most discriminant variables. We show that the RR interval time series can be drastically reduced from 60 s to 3 s, with a classification accuracy of 95.0%. We show that heart rhythm characterization is facilitated by induced variables using time derivatives, which is a generic methodology that is particularly suitable to real-time medical monitoring.

PMID: 28698645 PMCID: [PMC5505978](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5505978/) DOI: [10.1038/s41598-017-04998-7](https://doi.org/10.1038/s41598-017-04998-7)