

# A study presents an algorithm that automates electrocardiogram recordings

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An electrocardiogram (ECG) is an examination that records the electrical activity of the heart during the cardiac cycle. It is non-invasive and usually involves placing electrodes on the subject's skin. It is a most

indicated type of examination when there is suspected heart disease and also in routine preventive health check-ups.

The cardiac cycle entails the emptying of blood from the atria to the ventricles ("P" wave, red in the image), the contraction of the ventricles to propel blood to the different tissues and organs of the body ("QRS" wave, green in the image), and the relaxation of the ventricles to get ready for the next heartbeat ("T" wave, magenta in the image).

The electrocardiographic signal is, however, underutilized from a technological point of view. "While many cardiologists and specialized health personnel have experience in interpreting an electrocardiogram and attempting diagnosis, much of this process is not automated," explains Guillermo Jiménez-Pérez, first author of a paper published in *Scientific Reports* which presents an algorithm to delineate an electrocardiogram, that is, an analytical method to perform a separation/quantification of the different phases involved in the cardiac cycles.

The measurements of the different phases of the cardiac cycle must be made robustly, that is, they must be applicable to the broad variability of possible cases. In the first place, due to the many possible morphologies that may arise from patient to patient (the picture depicts a representation of different pathological and normal heartbeats, which may vary greatly between individuals), and also to promote their use for subsequent comparative analyses. "That is, being able to obtain the morphology of the different QRS of a particular patient may help identify which aspects of the QRS are abnormal in relation to the [general population](#)—or even with regard to the patient a few years earlier," Pérez-Jiménez explains.

This work was published in *Scientific Reports* on 13 January, and was conducted by Guillermo Jiménez-Pérez and Oscar Camara, members of

the PhySense research group, within the BCN MedTech Research Unit, attached to the UPF Department of Information and Communication Technologies (DTIC), together with Alejandro Alcaide of San Jorge University in Zaragoza.

For the study authors, the fact that the technique of electrocardiography is not yet automated is surprising, given that many of the major trends associated with technology today are based on automation through the development of [artificial intelligence](#) algorithms.

In this context, the work published in Scientific Reports has been framed . Through the use of state-of-the-art artificial intelligence techniques, an algorithm for the delineation of the electrocardiogram has been developed, improving performance over other existing algorithms in the scientific literature.

These algorithms are obtained by mass capture and processing of data and, once developed, are able to process new data very quickly and robustly. This paradigm, that of artificial intelligence, has many positive externalities, such as the ability to process and use increasing amounts of data which, in turn, are useful for annotation and processing. of new data, thus creating positive feedback loops that ultimately produce benefits for the user.

"The use of such technologies must be done with caution and, especially, with a vision for the future," say the authors of the study. Of paramount importance is the use of artificial intelligence to process data so that the results obtained are immediately interpretable; that is, artificial intelligence aimed at obtaining measurements (quantification) of the objective reality that surrounds it.

"These measurements can be used in subsequent processes to perform more complex tasks such as, returning to the original topic, simplify the

workload of the doctor or for the accurate diagnosis of heart disease," explains Jiménez-Pérez. In short, they are reliable technologies for carrying out many types of subsequent analyzes that can be interpreted directly by healthcare professionals, meeting all the ethical and confidentiality requirements required for the biomedical field.

**More information:** Guillermo Jimenez-Perez et al, Delineation of the electrocardiogram with a mixed-quality-annotations dataset using convolutional neural networks, *Scientific Reports* (2021). [DOI: 10.1038/s41598-020-79512-7](https://doi.org/10.1038/s41598-020-79512-7)

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