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EDITORIAL COMMENT

Machine learning – coming soon to a cath lab near you? Or 'don't hold your breath'?

Machine learning – brevemente num laboratório de hemodinâmica perto de si? Ou é melhor esperar sentado?

António Miguel Ferreira[a,b]

[a] *Serviço de Cardiologia, Hospital Santa Cruz, Centro Hospitalar de Lisboa Ocidental, Lisboa, Portugal*
[b] *Unidade de Imagem Cardiovascular – Hospital da Luz, Lisboa, Portugal*

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A journey of a thousand miles begins with a single step.
Ancient Chinese proverb

Artificial intelligence (AI) has emerged as one of the most promising areas in cardiovascular medicine in recent years. Unbound by human limitations, AI promises us increased efficiency in both small and complex tasks, improved workflows, lower error rates, deeper insights on clinical data, and more informed decision-making. Of course, several dangers also loom, including the real applicability of this technology and the possibility of harming patients with errors or unintentional discrimination.

Machine Learning (ML) is a specific branch of AI that focuses on the use of data and algorithms to emulate the way that humans learn, gradually improving its performance. Using complex statistical models and algorithms, these systems use the data to learn how to perform a specific task without explicit instructions on how to do it. Deep learning, a sub-field of ML, builds on a complex architecture of algorithms modeled on the human brain, enabling the use of unstructured data such as images and text as input.

In catheterization labs across the world, the use of ML is still in its infancy, but the potential applications are vast. These include overcoming human subjectivity in grading coronary stenosis, differentiating culprit from non-culprit lesions, and perhaps even inferring functional significance from a simple angiography. However, before being able to perform these complex tasks, ML systems must first be capable of interpreting invasive coronary angiography (ICA) images with high accuracy. Differentiating coronary arteries from surrounding structures and catheters is a very simple task for any human with average visual acuity (even with little training), but quite a complex task for ML systems. In a way, even computers must learn how to walk before they can run...

In this issue of The Portuguese Journal of Cardiology, Menezes et al. present their results on the automatic segmentation of ICA images using deep learning techniques.[1] Using a dataset of images from patients undergoing ICA at a single University center, the authors developed and tested ML models to perform the automatic segmentation of coronary arteries and catheters. They assessed the performance of these models using the usual metrics in this field, but also using a set of criteria created for this specific study. Overall, the results are encouraging. The trained ML model is capable of segmenting the coronary tree with good (although not perfect) accuracy, proving that the task is feasible and laying the groundwork for future developments. Even though it might be hard to see the immediate usefulness of this technology in its current state, work such as this is a fundamental first step on which to build the tools that will ultimately benefit both clinicians and patients. The creation of expert criteria for grading the quality of segmentation may also prove to be a valid contribution to the field.

E-mail address: amcsferreira@chlo.min-saude.pt

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Despite its merits, several limitations of this study should also be acknowledged. Segmentation was performed on a manually chosen single frame from each projection, and all images come from a single center, which may limit the applicability of the model at other hospitals using different angiographers. Also, patients with implanted cardiac devices were excluded in order to limit the complexity of the image datasets. Nevertheless, as the ancient Chinese proverb goes, ''A journey of a thousand miles begins with a single step''. Remarkably, the next steps on this journey may prove even more challenging. It is estimated that more than 90% of ML models never reach the ''production'' stage for a number of reasons, including problems in generalizability, lack of resources, and adverse institutional culture.[2] Only time will tell if this team of researchers will have the energy and means to follow through and deliver a usable (and useful) ML model that patients can benefit from. I wish them the best of luck.

Conflicts of interest

The author has no conflicts of interest to declare.

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