Artifical intelligence and nuclear cardiology - a current overview

Inteligência artifical e cardiologia nuclear – um panorama atual

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ABSTRACT
The aim of this article is to analyze the current overview of machine learning applied to cardiac imaging in nuclear medicine through a review of the recent literature. In recent years, new highly efficient artificial intelligence tools are revolutionizing the field of image analysis, being developed with the purpose of integrating the large volume of clinical and image information to improve the diagnosis of the disease and the risk estimate. The integration of artificial intelligence in daily clinical practice is being evaluated on several fronts and nuclear cardiology can benefit from the improvement in sensitivity, specificity, and diagnostic accuracy that the incorporation of these technologies can provide.

Keywords: Artificial Intelligence, Cardiology, Nuclear Medicine, Radiology.

RESUMO
O objectivo deste artigo é analisar a actual visão geral da aprendizagem de máquinas aplicadas à imagem cardíaca em medicina nuclear através de uma revisão da literatura recente. Nos últimos anos, novas ferramentas de inteligência artifical altamente eficientes estão a revolucionar o campo da análise de imagem, sendo desenvolvidas com o objectivo de integrar o grande volume de informação clínica e de imagem para melhorar o diagnóstico da doença e a estimativa do risco. A integração da inteligência artifical na prática clínica diária está a ser avaliada em várias frentes e a cardiologia nuclear pode beneficiar da melhoria da sensibilidade, especificidade e exactidão diagnóstica que a incorporação destas tecnologias pode proporcionar.

1 OBJECTIVE AND METHODS

The aim of this article is to analyze the current overview of machine learning applied to cardiac imaging in nuclear medicine through a review of the recent literature. A recent literature review (last 10 years) was carried out through the PubMed database using the following descriptors: artificial intelligence, nuclear medicine, and cardiology.

2 DISCUSSION AND RESULTS

We are experiencing a time when new highly efficient artificial intelligence tools are revolutionizing the field of image analysis, being developed with the purpose of integrating the large volume of clinical and image information to improve the diagnosis of the disease and the risk estimate[5].

The result of our research returned a total of 302 publications, with most articles published in the last 03 years, with a peak of publications in 2019. Analyzing these data, we can see the growing interest of the scientific community in the study of the applications of artificial intelligence in diagnosis imaging, and the branch of study focused on nuclear cardiology is no exception.

Table 01. Number of articles on artificial intelligence in nuclear cardiology by year of publication - research conducted on the Pubmed platform.

YEAR OF PUBLICATION	NUMBER OF ARTICLES
2011	3
2012	7
2013	17
2014	16
2015	19
2016	21
2017	38
2018	62
2019	77
2020	42

Graphic 01. Upward curve in the publication of articles on artificial intelligence in the field of nuclear cardiology.
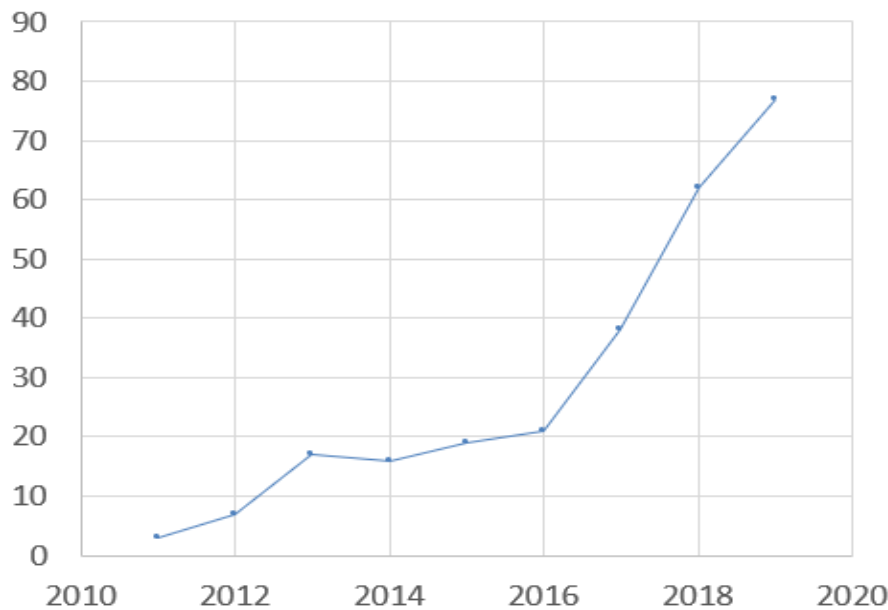
Machine learning is a field of study that has been growing in recent years, especially in specialties that involve a large collection of data in the form of interpretation and visual analysis, such as diagnostic imaging[6]. Artificial intelligence tools, as they become more sensitive, will be able to identify small variations in the image, having the potential to allow an early diagnosis, which can affect prognosis and therapy of the diseases.

We can use these tools for a variety of tasks with applications in modern nuclear cardiology, improving image quality, diagnosis, and risk prediction. A typical study of nuclear cardiology generates a wealth of data that can be efficiently integrated through artificial intelligence, which can bring several benefits in clinical practice.

The availability of reliable data is one of the main challenges for the implementation of artificial intelligence tools, however, the availability of open data platforms has facilitated the dissemination of information, which can help in terms of data processing and availability[8]. There are many challenges in the implementation of artificial intelligence in the medical routine, but promising work is already happening.

3 CONCLUSIONS

In view of the findings presented, we can conclude that the current scenario is very favorable to new technologies and the artificial intelligence tools will be increasingly in focus in future discussions and innovations. We demonstrate that artificial intelligence is

becoming increasingly present in the field of diagnostic imaging and its integration into daily clinical practice is being evaluated on several fronts. In this current context, nuclear cardiology can benefit from improving the sensitivity, specificity and precision of the diagnosis that the incorporation of artificial intelligence technologies can provide. In the modern era of machine learning, cardiac imaging may have found an ideal partnership to optimize its clinical role.

BIBLIOGRAPHIC

1.   SEETHARAM, K.; et.al. Artificial Intelligence in Cardiovascular Medicine. Curr Treat Options Cardio Med, 2019;

2.   SIEGERSMA, K.R.; et.al. Artificial intelligence in cardiovascular imaging: state of the art and implications for the imaging cardiologista. Neth Heart J, 2019;

3.   FILHO, E.M.S.; et. al. Inteligência Artificial em Cardiologia: Conceitos, Ferramentas e Desafios – "Quem Corre é o Cavalo, Você Precisa ser o Jóquei". Arq Bras Cardiol, 2019;

4.   AKTOLUN, C. Artificial intelligence and radiomics in nuclear medicine: potentials and challenges. European Journal of Nuclear Medicine and Molecular Imaging, 2019;

5.   BEAULIEU-JONES, B. et. al. Trends and focus of machine learning applications for health research. JAMA Network Open, 2019;

6.   WEST, E. et. al. Global trend in artificial intelligence – based publications in radiology from 2000-2018. AJR, 2019;

7.   NENSA, F.; DEMIRCIOGLU, A.; RISCHPLER, C. Artificial intelligence in nuclear medicine. The Journal of Nuclear Medicine, 2019;

8.   VISVIKIS, D. et. al. Artificial intelligence, machine (deep) learning and radio(geno)mics: definitions and nuclear medicine imaging applications. European Journal of Nuclear Medicine and Molecular Imaging, 2019;

9.   SLOMKA, P.J.; et. al. Application and Translation of Artificial Intelligence to Cardiovascular Imaging in Nuclear Medicine and Noncontrast CT. Seminars in Nuclear Medicine, 2020.