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Commentary

Using Artificial Intelligence for the Diagnosis of Prostate Cancer: The Paper of Yuichiro Oishi et al. Is a Step Forward on the Way of Precision Medicine

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Yuichiro Oishi et al. presented an interesting study reporting the ability of Artificial Intelligence (AI) to diagnose and locate prostate cancer from multiparametric MRI (mpMRI) [1]. The authors evaluated the diagnostic performance of their AI with a ROC analysis; interestingly the area under the ROC curve was 0.985, while the sensitivity and the specificity were 0.875 and 0.961 ($p < 0.01$), respectively. Figure 1 of the paper shows that the regions of the prostate labeled by AI as prostate cancer correspond strictly to the cancer areas identified at pathological examination of the gland. These good results justified the strong conclusions of the paper: "*diagnostic partition using the superpixel method and SVM-computed likelihood maps enables automated diagnosis of prostate cancer location and shape in mpMRI*" [1]. Many aspects of this paper deserve to be emphasized. During the last two decades, numerous attempts to use radiomics for the diagnosis of cancer have been made [2]. So far, the dimensions of the dataset have always been a major limiting factor for the AI training and consequently for its diagnostic performance. The AI-based computer-aided diagnosis used in this study interestingly reached a good result with only a small number of patients, apparently overcoming the need for a large dataset. The authors achieved this result by sampling all the peripheral zone pixels for training the Support Vector Machine. Using this strategy, the dataset which resulted was very large despite the small number of patients included in the study. Because of the previous consideration, the strategy proposed by Yuichiro Oishi et al. will probably be crucial in the development of future diagnostic tools.

Of course, AI-based computer-aided diagnosis will finally overcome the problem of inter-observer variability in the evaluation of mpMRI that nowadays represents a major barrier to standardize the radiological diagnosis [3]. Yuichiro Oishi et al. did not train the AI to identify the cancer histology (Gleason score/ISUP grade), therefore a prostate biopsy would be still necessary to determine the histological characteristics of the tumor; however, the clinical advantages produced by a precise tumor localization (as seen in Figure 1 in the paper) are enormous. In the future, authors will probably be able to create a likelihood map differentiated by ISUP grade just by increasing the number of patients in the dataset, permitting AI to determine the ISUP grade as well as the tumor shape. Consequently, AI will produce something more than a virtual biopsy: AI will be able to produce a virtual pathological examination of the whole gland. In this scenario the prostate biopsy will lose its key role in the management of the disease. Because the number of patients that undergo prostate biopsy every day and the burden of morbidity due to the procedure it is easy to see the impact that the virtual pathological examination would have on public health [3,4]. Furthermore, the precise knowledge of tumor shape will permit better planning, choosing between organ sparing or aggressive and demolitive treatments as appropriate. Today, there are no ongoing clinical trial evaluating the benefit of AI in the management of patients with prostate cancer; the use of AI-based computer-aided diagnosis systems is still only

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experimental but the number of encouraging results is rapidly increasing. If the information about histological features of tissue is contained in mpMRI, the AI will be able to recognize it and make this information intelligible to us.

Finally, Yuichiro Oishi et al. show that the future of multidisciplinary will consists not only in the cooperation between physicians but also in cooperation between physicians and mathematicians, engineers, and other information technology specialists. Extracting and making intelligible for the human eye the existing information about tumor features from imaging would permit better risks stratifications, tailored patients counseling, and management. The development of an AI system able to recognize diseases from imaging is not risk-free. If the enthusiasm for the good results forces the application of AI in clinical settings before adequate validation, the consequences would be negative both for patients and for the research in this field.

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