Smartphones, artificial intelligence and digital histopathology take on basal cell carcinoma diagnosis

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In this issue of the *BJD*, Jiang and colleagues report a method of using smartphone images to submit histology slides of suspected basal cell carcinomas (BCCs) to analysis and diagnosis with a deep neural network.[1] The smartphone microscope ocular images (MOIs), taken through the eyepiece of a microscope at 10 × magnification attached to a smartphone, performed as well as the more traditional, but much larger, whole-slide images (WSIs). The authors also found that computational resource needs could be reduced by separating straightforward from difficult cases and applying a more intensive analysis to the difficult cases only.

BCC is the most common cancer in humans worldwide,[2] and the sheer number of cases makes histopathological diagnosis time consuming, although generally straightforward. Information-rich histopathology slides are an ideal subject for computer-assisted diagnosis, and researchers are already investigating artificial intelligence histopathological analysis of a variety of cancers, including breast, cervical, prostate, pancreatic and lung cancer.[3] This study shows that even less-than-ideal histopathology slides, such as poorly focused photomicrographs taken with a smartphone, can be analysed with artificial intelligence.

One drawback to digital histopathology is that, while it is has equivalent accuracy, it is slower to perform than traditional reading from glass slides and requires excellent bandwidth and network connectivity to enable efficient loading of data-heavy images.[4] The size of the images required in this study was greatly reduced by using smartphone-captured MOI images instead of WSI. Although WSI systems can save slide images at up to 400 × magnification, the MOI needs only 10 × magnification, as BCC diagnosis relies more on overall architectural features rather than cellular structures. These smaller file sizes may assist where the network used has limited bandwidth or storage capacity.

A barrier to the use of artificial intelligence in medicine can be the high computational resources required to process detail-heavy images, which may leave low- and middle-income countries unable to benefit from this technology. Jiang and colleagues have approached this issue by incorporating a means of distinguishing difficult cases from more straightforward cases into an early step of the algorithm. Their convolutional neural network predicts whether the image contains a BCC or not, and assigns a confidence level. Images with a low confidence level ('difficult' cases) are then submitted to a more computationally intensive pixelwise segmentation. Compared with submitting all cases to pixelwise segmentation, the 'cascade' framework, which reserves the more detailed analysis for hard cases only, is almost 75% faster, without much reduction in accuracy.

As with many forays into artificial intelligence, this paper has concentrated on a binary BCC/not BCC classification. Although this is a valuable first step, future work will need to combine BCC diagnosis with a range of other diagnoses, not least the other major skin cancers, squamous cell carcinoma and melanoma.

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Conflicts of interest: H.P.S. is a shareholder of MoleMap NZ Limited and e-derm-consult GmbH, and undertakes regular teledermatological reporting for both companies. H.P.S. is also a medical consultant for Canfield Scientific Inc. and a medical advisor for First Derm, and has a medical advisory board appointment with MoleMap NZ Limited. K.J.L. has no conflicts to declare.

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