Path-Bots to diagnose skin cancer

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Background

Skin cancer is the most common form of cancers in humans and its prevalence is approximately 5 times higher than the prevalence of breast or prostate cancer and higher than the prevalence of all other cancers. The incidence rates of non-melanoma skin cancer increased by 147% in the UK between 1993-1995 and 2013-2015(1).

Of all the cancers, basal cell carcinoma (BCC) is the commonest tumour treated in National Health Service. The accurate diagnosis of basal cell carcinoma is crucial because pathological parameters play a major role in defining patient treatment and has direct implications for the prognosis of individual patients.

Being most common type of skin cancer, basal cell carcinoma samples reflect a significant proportion of a pathologist's workload(2). Reporting of each cancer sample is a time consuming process. There is nationwide shortage of patholgists, with already overstreched services due to ageing population, increase in workload as well as increased complexitiy of the diseases.

Artificial Intelligence is already with us in healthcare. Google's DeepMind has taught machines to read retinal scans with at least as much accuracy as an experienced junior doctor.
The proposed Path-Bots can perform tidious time consuming tasks for the pathologists as well as augment and strengthen their expertise

Objectives

This study aims to determine if computer assisted diagnostic algorithms can facilitate the process of pathology reporting of BCC in routine practice.

Methodology

Research plan and environment
Thiswill be a retrospective diagnostic study requiri ng several milestones to be achieved.
The project will be run mainly at the UHCW NHS Trust Centre of Excellence for Artificial Intelligence in Digital Pathology, in collaboration with the TIA lab (Tissue Image Analytics Laboratory) at the Warwick University's Computer Science department. The UHCW Pathology department has become the first one in the UK to 'go digital' for routine diagnostics after the publication of world's largest study for validation of digital pathology led by Snead (Snead et al., Histopathology 2016 (4)

Data source and collection
Reported cases of various skin cancers will be obtained from the UHCW pathology archive collection for the last one year, this will be around 2500 cases with approximately 3200 whole slide images.

Computer algorithm development
This will involve dataset preparation, provision of a large number of annotations by the pathologists, training, testing and validation.

This is an ongoing innovative study being performed at the 'Centre of Excellence for Artificial Intelligence in Digital Pathology' University Hospitals Coventry & Warwickshire, in collaboration with University of Warwick

Transformation of current practice

Existing model	Path-Bot model
Pathologist examines each and every slide	Path-bot examines each and every slide
Correctly Identifies the tumour	Records tumour type,diameter, stage, depth of invasion,margin status, nerve or blood vessel involvement.
Measures its size to provide cancer stage	Formulates a report and highlights the important areas on the slide
Determines the depth of tumour invasion	Pathologist confirms the report findings and issues the report
Assesses for any nerve or blood vessel involvement	
Assesses if the specimen margins are tumour free	
Records findings in a report	
Issues the report	

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Expected outcome and impact on patient care

At a time of widespread clinician burnout and a shortage of staff, Path-Bots offer the potential to automate some of the workload and reduce the burden of routine tasks. This could enable pathology departments to cope with ever-increasing workload.

This will improve the specimen turnaround times resulting in more efficient and timely patient care.

Although the breadth of skills and experience required of a pathologist cannot be replicated, these Path-Bots are expected to be decision supporting tools, rather than decision making tools. This could be another great technological leap.

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