Bunk, S.A.O.

[Email address]

Abstract

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BEP Report mockup

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# Abstract

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# Introduction

In 2017, in the US alone, an estimated 252,710 new cases of invasive breast cancer and 63,410 new cases of in situ breast cancer were diagnosed amongst women [1]. Every woman undergoing treatment has some form of analysis performed on them to determine the appropriate treatment for their situation.

One such analysis technique is to assess the cellularity of a tumour to determine the effectiveness of the applied treatment. The pathological examination of tissue removed during surgery allows for the determination of tumour cellularity. Currently, it is the clinical practice that pathologists manually determine the cellularity of tissue slides, however, as this is a manual process, the variability in observers might reduce the reliability and quality of the cellularity assessment [2].

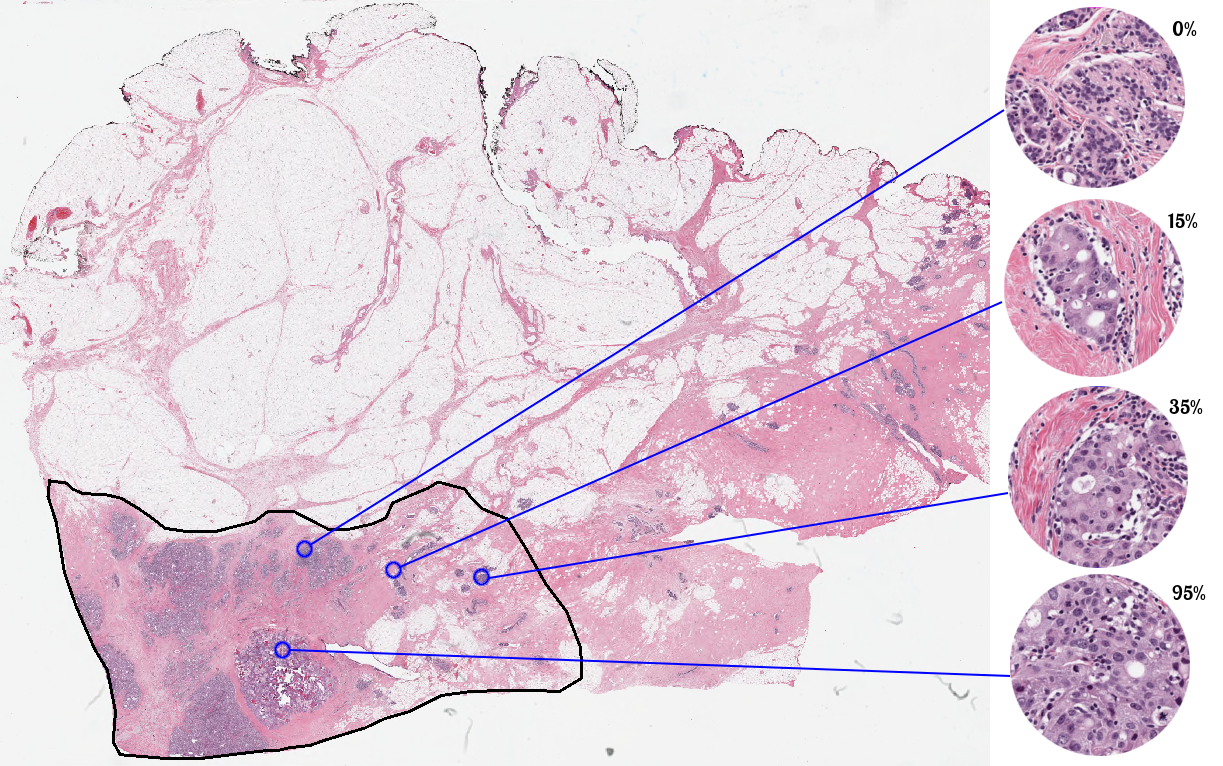


Figure 1: Haematoxylin and eosin stained slide used in the assessment of breast cancer cellularity. On the right the cellularity of specific points of the slide is estimated [2].

A computer-aided diagnoses process could possibly remove the variability of manual cellularity determination and increase the reproducibility of cellularity scores. A fully automated method can also help to increase the productiveness of pathologists, as less time needs to be spent looking at tissue through a microscope. Currently, in the machine learning space, neural networks are positioning themselves as highly useful tools for the computer-aided analysis of medical images [3]. Applying such networks to the cellularity determination process easily yields cellularity scores for the input images.

There exists a problem however, how can the effectiveness of a neural network for this task be evaluated? For a categorical output a performance score, such as classification accuracy, is easy to assign. All that is required for an accuracy score is to determine how many assignments the network got right, and how many assignments the network got wrong. For the application in cellularity determination, a metric of effectiveness is less simple to determine, as cellularity scores are not a categorical classification, but instead a continuous number between 0-1. How should the determination of network performance work for such an output?

This paper ventures to develop a method with which such networks can be consistently compared to each other, and to contrast this method to one employed in the BreastPathQ challenge [4].

## Methods

First, three standard networks were selected in order to contrast their performance between each other. These networks are Inceptionv3, VGG19 and ResNet50.

# Sources

[1] American Cancer Society. *Breast Cancer Facts & Figures 2017-2018*. Retrieved from <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/breast-cancer-facts-and-figures/breast-cancer-facts-and-figures-2017-2018.pdf>

[2] Grand-Challenges. *SPIE-AAPM-NCI BreastPathQ: Cancer Cellularity Challenge.* Retrieved from <https://breastpathq.grand-challenge.org/>

[3] Jiang, J., Trundle, P., & Ren, J. (2010). Medical image analysis with artificial neural networks. *Computerized Medical Imaging and Graphics*, *34*(8), 617-631.

[4] <http://spiechallenges.cloudapp.net/competitions/14>