Neural network analysis visualization approach for diagnostic pathology

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Introduction

Neural network (NN) analysis is getting wider for both research and diagnostic pathology. Currently pixel-by-pixel classification approach is the leading one, though it demands comparatively huge computational resources. We developed an approach for pathologists to interact with a whole slide image (WSI) NN analysis.

Material and methods

We used a server-based software (SaaS) to upload WSI, analyze it with NN model on a tile-by-tile basis for primary breast lesions and cancer metastases. The classification task analysis is typically represented with probabilities for each of the categories. We used the category with the highest probability for each tile to color the tile, provide classification category and the probability. Pathologist can apply cut-off for the probability and observe only those tiles with probability higher than the chosen. Additionally, tiles quantity for each classification group were provided with corresponding probability.

Results

The approach and its application to routine diagnostic process were verified by 5 qualified pathologists. Testing sample included 57 cases of primary breast lesions and 30 cases with 137 lymph nodes, 77 positives. Colored tiles and text information with the highest probability were recognized as convenient approach for WSI NN analysis. It was identified, that in 40 to 50% cases pathologists used additional information to review statistical data on tiles quantity with different probability.

Conclusions

We developed an approach and a software tool for pathologists to interact with WSI NN analysis, which includes visual information, statistical data and ability to adjust it to a demanded level of classification confidence.

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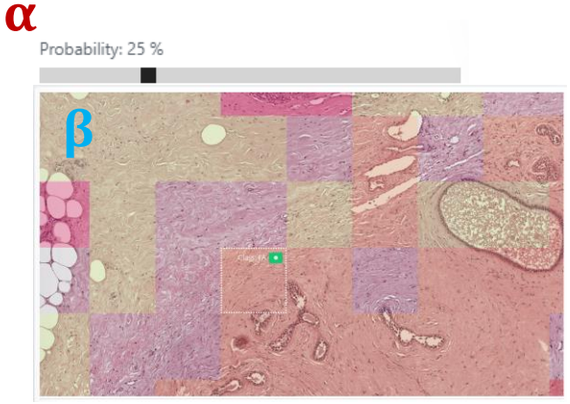

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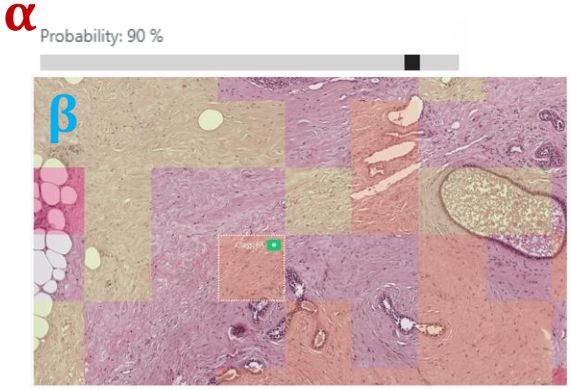

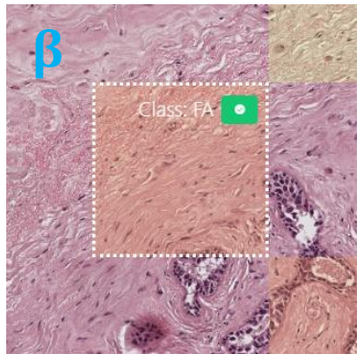

Analysis Result: FA

G1-G3 (invasive carcinoma NOS) – Протоковый рак
Lob-CR (lobular carcinoma) – Дольковый рак
FCD (fibrous cystic disease) – Фиброзно-кистозная мастопатия
FA (fibroadenoma) - Фиброаденома
DCIS (ductal carcinoma in situ) – Неинвазивный протоковый рак (DCIS)
Pap (papilloma) – Папиллома
BG (background) – Фоновые структуры