Comparison of primary tumor and metastatic tumor tissue datasets to train neural network model for metastasis detection

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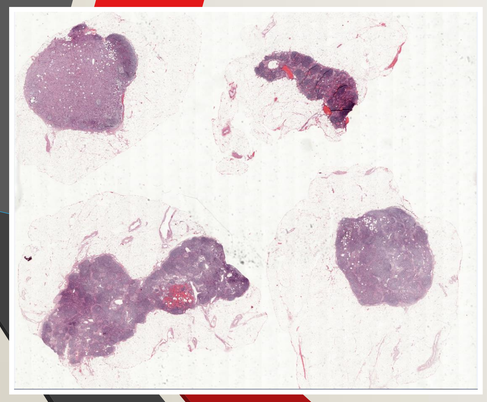
Introduction

Traditional methods of detecting lymph node metastases stained with hematoxylin and eosin are labor-intensive, time-consuming and routine. Convolutional neural network (CNN) can help pathologists to reduce or eliminate human factor, but annotated datasets are of limited availability. The aim of the study was to identify if initial tumor samples applicable to train models to identify metastases.



Materials and methods

We prepared three datasets and trained three corresponding CNN models. The first dataset and model: 6 cases, 126 lymph nodes, 91 with metastases, 16048 tiles. The second: primary breast cancer: 41 cases, 12943 tiles. The third is a summary of the first and the second. Models were trained with efficintnetB0 and the outcome was tested with 137 newly collected lymph nodes, including 77 with breast cancer metastases.

Results

Model 1 demonstrated higher sensitivity than model 2 and 3: 86.3%, 74.7% and 67.9%, respectively. NPV: 80.4%, 70.4%, 63.4%, respectively Although group 3 had almost two times image quantity comparing to 1 and 2, model 3 demonstrated the lowest sensitivity of all models. The specificity and PPV did not differ significantly in all CNN models and had a range 67.2-74.6% and 75.3-78.5%, respectively.

Table 1. Characteristic of dataset

	Model 1	Model 2	Model 3
Breast tumor	16048	12943	28991
Lymph node tissue	6407	6407	6407
Rubbish	236	236	236

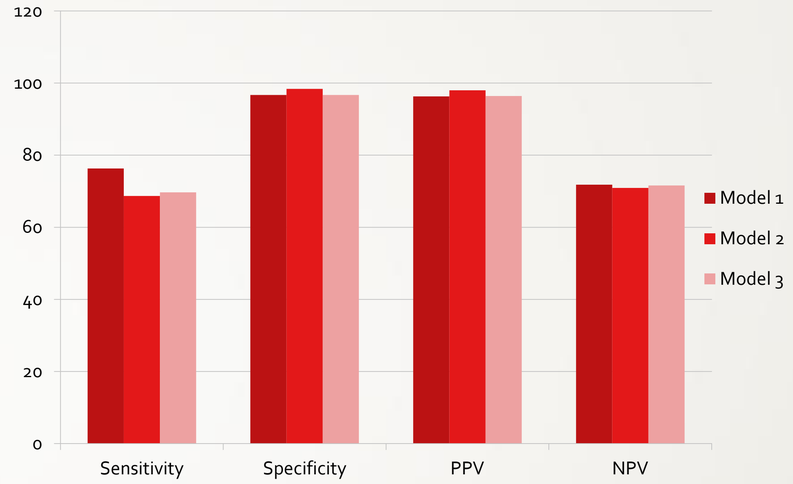


Diagram. The main parametrs

Conclusions

CNN model trained with metastases outperformed CNN trained with primary tumor samples, though having lower dataset size. It was demonstrated on a limited dataset with only breast cancer metastasis and needs further research to confirm.

Competing interests

The research is granted by Foundation for Assistance to Small Innovative Enterprises (FASIE). 119034, 1/5, 3rd Obydenskiy per, Moscow, Russia