Accuracy of AI Whole Slide Image Analysis Is Adversely Affected by Pre-Analytical Factors such as Stained Tissue Slide and Paraffin Block Age.

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Background

Personalized medicine and accurate quantification of tumor and biomarker expression have become the cornerstone of cancer diagnostics. This requires Quality Control of research tissue samples to confirm that adequate target tumor tissue is present in the tissue sample. Digitalization of Pathology stained tissue samples makes it easier to archive, preserve and retrieve slides and paraffin blocks for review or study in time of need. Can pre-analytic and analytic factors such as digital image reproducibility, different machine algorithms, tissue age and condition of hematoxylin and eosin (H&E) stained tumor tissue be mediated so that morphometric algorithms can quantify the percentage of tumor?

Methods

H&E slides with whole-slide images from CHTN-MWD Image Quality Control Repository were utilized. Rapidly processed, consented research tissues had been fixed, stained and scanned contemporaneously (within one month). Two cohorts of malignant, colorectal cancer, 20X WSI (ScanscopeXT, Leica Biosystems, Illinois) and slides were assembled. The recent cohort had 76 images created in 2018 or later. Aged cohort had 73 from specimens procured 5 -8 years ago. 20 recent adenocarcinoma Whole-slide images were used to construct image analysis algorithms (VIS, Visiopharm A/S, Denmark) using machine learning to produce morphometric maps and calculate tissue and tumor areas. Tumor areas in the images from the aged cohort were grouped by year (2012 –2014).

Results

Algorithmic analysis results of 69 images from rescanning aged slides vs. that of contemporaneous images found 18 (28%) had similar tumor areas (within 10%), 56 (82%) had similar tissue areas and 54 (79%) had a similar percentage of tumor. Figure shows example (left to right) H&E images, classification maps; (top to bottom) original contemporaneous, rescan, recut; scale 1mm.

Conclusions

Images of aged H&E slides and stained paraffin block re-cuts produce different tumor quantification compared to the original scans likely due to pre-analytical factors. The difference in the tumor area detected between original and later rescanned images trended upward from 2012 to 2014. Less tumor area is detected as slides age. Recut and H&E stained tissues from stored paraffin blocks may detect more tumor due to excess eosinophilia.