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AI-BASED GRADING APPROACH IDENTIFIES FNCLCC GRADE 3 SOFT TISSUE SARCOMAS

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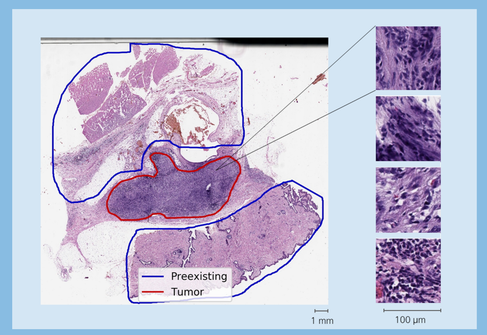
BACKGROUND: FNCLCC GRADING

- Morphological grading is an established prognostic parameter in soft tissue sarcomas
- FNCLCC [2]
  - divides sarcomas into grades G1, G2, G3 based on
    - Cell differentiation
    - Amount of mitoses
    - Prevalence of necrosis
  - Highly correlated with overall survival rate ⇒ often used for deciding on perioperative chemo- and radiotherapy
  - Major limitations:
    - Intratumoral heterogeneity is large ⇒ adversely affects grading correctness, especially in small biopsies
    - G2 sarcomas (majority of patients) are clinically equivocal

DATA



- H&E-stained sections scanned at 20× resolution (52 soft tissue sarcoma cases)
- At least 13 mm² of high-confidence tumor regions annotated per case, necrotic regions excluded
- 1.3 M image tiles of 112.6 × 112.6 µm size

CONFLICTS OF INTEREST AND FUNDING

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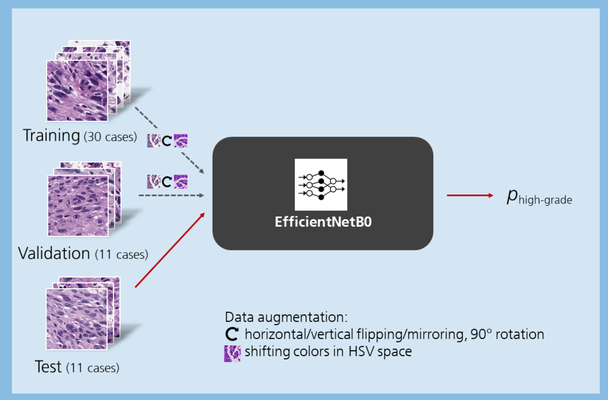
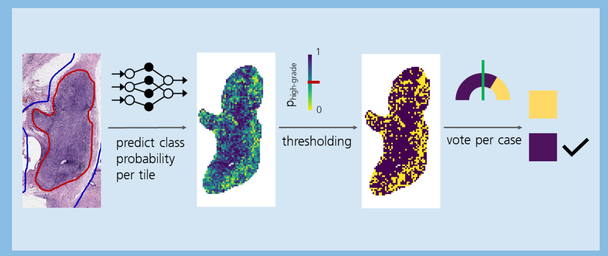
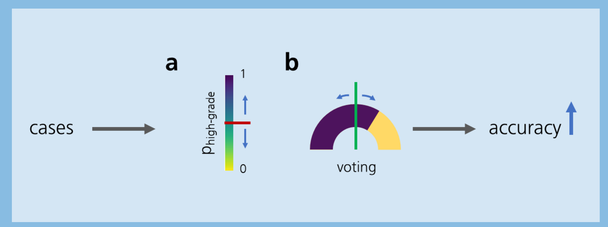
METHODS



- Customized pre-trained EfficientNetB0 [1] for classification of tiles in high vs. non-high (G3 vs. G1, G2; 24 vs. 28 cases) by predicting class probability per tile



- Optimized cut-off values of
  - a Class probability for classifying single tiles
  - b Proportion of high-grade tiles required for classifying a case as high-grade



Structure of the EfficientNetB0

RESULTS

- Accuracy (on test set):

cut-off	slide-based	case-based
default	68 %	64 %
optimized	77 %	73 %

- G3 tumors correctly classified as high grade (3/4), except for one pleomorphic liposarcoma (probably misclassified due to specific tumor morphology)
- G2 tumors classified either as low grade (4/6) or high grade (2/6)
- Single G1 tumor classified correctly

CONCLUSION

- Computerized grading is feasible for sarcomas
- AI-based analysis can recognize G3 sarcomas correctly (without being predicted on heterogeneous parameters, e.g., mitotic count and extent of necroses)
- Possibly observable patterns in tile-wise classification of G2 sarcomas require further investigation (and correlation with clinical outcome data)

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