Self-Rule to Multi Adapt automates the tumor-stroma assessment in colorectal cancer

Christian Abbet
Institutional address:
Ecole Polytechnique de Lausanne
Station 11
CH-1015 Lausanne
E-mail address: christian.abbet@epfl.ch

Linda Studer
Institutional address:
School of Engineering and Architecture of Fribourg
Bd de Pérolles 80
CH-1700 Fribourg
E-mail address: linda.studer@hefr.ch

Jean-Philippe Thiran
Institutional address:
Ecole Polytechnique de Lausanne
Station 11
CH-1015 Lausanne
E-mail address: jean-philippe.thiran@epfl.ch

Inti Zlobec
Institutional address:
University of Bern
Institute of Pathology
Murtenstrasse 31
CH-3008 Bern
E-mail address: inti.zlobec@pathology.unibe.ch

Introduction

To validate our recently proposed Self-Rule to Multi-Adapt method, which performs tissue segmentation, in a clinically relevant task, we aim to automatically compute the tumor-stroma ratio (TSR) on whole slide images (WSIs). TSR has been shown to be an independent prognostic factor in colorectal cancer, a lower ratio is associated with poorer patient outcomes.

Materials and Methods

To ensure the quality of the automatically computed TSR, we compare it to the TSR scored by pathologists (high/low, cutoff=50%) on a validation cohort (N=10). We further analyze its clinical impact using 274 H&E stained WSI from 227 patients diagnosed with adenocarcinoma and no prior treatment from the TCGA cohort. We compute TSR over the WSIs using a sliding window (2500 µm). The predictions are aggregated patient-wise by averaging.

Results

TSR achieves a 100% correspondence of high/low cases on the validation cohort. On TCGA, TSR does not correlate (χ^2-test $p>0.05$) with either pT, TNM, or pN. Using a univariate Cox model to predict overall survival, we find a hazard ratio (HR) of 0.67 (0.53-0.85) with $p=0.001$ for TSR. When adjusting for pT, TNM, and pN using a multivariate Cox model, TSR still acts as an independent prognostic factor while improving prognostic capability.

Conclusion

We show that our method has the potential for automated TSR assessment to be included in standard reporting. This would not only save time for pathologists but also provide additional information for diagnosis. For future work, we will validate our findings on additional cohorts, as well as investigate the link between TSR and other clinical parameters.