

Validation of an open source digital image analysis platform for the systematic scoring of immunohistochemically-stained tumour tissue microarrays

HAGAN, R.S.¹; Craig, S.¹; Dunne, P.D.¹; Salto-Tellez, M.¹; Loughrey, M.B.²

¹Queen's University Belfast, Belfast, United Kingdom; ²Royal Victoria Hospital / Queen's University Belfast, Belfast, United Kingdom

Purpose of the study: The use of predictive and prognostic biomarkers has the potential to provide a comprehensive understanding of cancer. Traditional research methods of scoring biomarkers stained by immunohistochemistry (IHC) involve manual assessment of tissue microarrays (TMA) by pathologists, which is both labour intensive and time-consuming. These methods can be confounded by variation in results due to intra- and inter-observer assessment. Digital pathology image analysis may alleviate this critical bottleneck in tissue biomarker analysis, speeding up the process whilst providing robust and reproducible results. This study aims to test new, open-source digital image analysis software, QuPath, compared to traditional manual immunoscore analysis of selected biomarkers in a cohort of colorectal cancer (CRC) TMAs.

Methods: We analysed expression of three biomarkers (CD3, CD8 and p53) in a large population-based CRC cohort (n=740), using manual and digital image analysis (QuPath) methods. Manual and digital scores were assembled and statistical analysis on the prognostic value of each biomarker was assessed. Additionally, resulting scores obtained using the same raw digital images from multiple independent observers with varying experience in pathology and computational biology were analysed.

Summary of results: Our results demonstrate the ability of QuPath to generate comparable data to manual scoring as well as significant intra-observer comparability, regardless of user expertise. Statistical analysis of the prognostic relevance of biomarkers showed high concordance between users, validating the utility of QuPath.

Conclusions: Data presented here highlight the utility of digital pathology image analysis software in providing robust biomarker immunoexpression data. These results provide an exciting glimpse into some of the potential applications of QuPath and show evidence that tissue-based biomarker analysis in cancer pathology can be aided by digital analysis.