

Image Quality Assessment in Digital Pathology – The Analysis of Background in Whole Slide Images

Thomas Schrader¹, Anne Nadolny¹, Robert Piduch¹ and Peter Hufnagl²

¹University of Applied Sciences Brandenburg (Germany)

²Charité, University Hospital Berlin (Germany)

thomas.schrader@computer.org

Abstract. *Introduction:* The application of Whole Slide Images (WSI) as virtual slides (VS) is the clue of digital pathology. Two main factors limit currently the application of WSI in daily use: the scanning speed and the expectation of constant image quality. The automatic scan process should ensure a constant image quality at a high level. Meanwhile many libraries of VS exist for educational, research and retrieval purposes. As research data repositories the quality of data as well as of images is a requisite for further usage of these data and images. An Image- and Data Quality Assessment Ontology (IDQA) was developed to structure and relate various image and data quality aspects to data life cycle and responsibilities. The current work presents one aspect of image quality: background errors.

Material & Methods: 50 random selected WSI with different stainings (e.g. HE, PAS) and various image objects (biopsies and other specimen) were analysed: The differentiation of background and specimen object based on transformation from RGB to HSI (Hue, Saturation, Intensity). The background information was used to specify scanning quality by analysing homogeneity, ergodicity and descriptive statistics for the different channels of HSI. The non random error pattern was specified by Principal Component Analysis (PCA). The Hough transformation was used to identify lines after edge detection by the Canny-Operator.

Results: The 50 WSI were ranked related to background homogeneity and error free area. A high level of local deviation from the main distribution in the H-, S-, I-channels indicates small artifacts on the slide caused by the laboratory process (dust, bubbles). Systematic background errors have a repeating pattern in x and/or y direction.

Discussion: The background area represents information not only about the scanning process but also about the creation process of the slide itself: illumination errors create a specific pattern of background (stripes vs. mosaic error pattern). Dust, air bubbles and corners of cover slip are related to the laboratory process. Background image quality is only one but an important quality aspect in Image Quality Assessment.

Keywords: Digital Pathology; Whole Slide Image; Virtual Slide; Image Quality; Data Quality; Image Quality Assessment; Background Error