Histopathological Image Analysis for Determining Tissue Composition in Gastric Cancer

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INTRODUCTION

Gastric cancer is the fourth most common cancer, and the second most common cause of cancer-related deaths in the world. According to the WHO, 800,000 cancer-related deaths are caused by gastric cancer each year worldwide [1].

Motivation: Computer-based analysis of histological images of gastric cancer is a prospective challenge in digital pathology. Histological composition of gastric cancer tissues for diagnostic purpose is currently determined by pathologists using visual inspection in routine and research, which is a tedious and time consuming process.

Contribution: We describe an automatic method to determine histological composition of tissues in H&E whole slide images (WSI) of gastric cancer, for heterogeneous datasets with variations in stain intensity and malignancy levels. Such tissue composition analysis can potentially assist pathologists in computer-assisted diagnosis of gastric cancer. The method also provides a basis for automatic differentiation between tumor and non-tumor compartments of the tissue and determination of cancer type, grade or extent.

MATERIALS AND METHODS

Data Acquisition: Her2/neu immunohistochemically stained and H&E stained surgical specimens of 12 cases (one specimen per case) were selected from a previous study of 483 cases of gastric cancer. These were acquired from proximal or distal surgical specimens of 12 cases (one specimen per case) were selected from a previous study of 483 cases of gastric cancer. These were acquired from proximal or distal parts of stomach and scanned with Leica SCN400 microscopic whole-slide scanner at its maximum, nominally 400 times magnification and pixel size 0.0676 µm².

Data Annotation: Ten expert pathologists have annotated the WSI areas as:
- Red polygons: Her2/neu positive areas marked using the 10% cut-off rule [2].
- Blue polygons: Her2/neu negative areas morphologically identified as tumor.

The remaining areas are widely necrotic tissue regions.

CONCLUSION AND OUTLOOK

Conclusion:
- A method is proposed to automatically distinguish between various nuclei components and to determine tissue composition in H&E gastric cancer images.
- Overall classification accuracy can be further improved by adding more discriminative features to our current feature set.

Outlook:
- We aim to work towards extraction of high-level topological features based on the graph-theoretic description of tissue.
- We will also explore additional low-level features to describe the information between the nuclei components in the tissue images.

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References