**Detection of Prostate Cancer in Whole Slide Images Through End to End Training With Image Level Labels**

* The detection of prostate cancer in whole slide images is a critical task in pathology, requiring high levels of expertise and time-consuming analysis by pathologists. Digital pathology and machine learning techniques have emerged as potential tools to assist pathologists in the detection of cancerous regions and provide quantitative data to support their diagnosis.
* A recent study proposed an end-to-end training approach using convolutional neural networks (CNNs) to detect prostate cancer in whole slide images with image-level labels. The proposed method takes in an entire slide image as input and outputs a probability map indicating the likelihood of cancer presence. The study used a dataset of 4,654 prostate cancer whole slide images with image-level labels indicating the presence or absence of cancer. The dataset was split into training, validation, and test sets, with 60%, 20%, and 20% of images, respectively.
* The proposed method uses a CNN architecture that combines a backbone network with a probability map estimation module. The backbone network is based on a ResNet-50 architecture, which extracts high-level features from the whole slide images. The probability map estimation module generates probability maps indicating the presence of cancer in the input images. The proposed method is trained end-to-end, with the loss function based on the weighted cross-entropy loss, which balances the contribution of positive and negative samples.
* The study evaluated the proposed method's performance using the area under the receiver operating characteristic curve (AUC-ROC) and compared it with other state-of-the-art methods. The proposed method achieved an AUC-ROC of 0.956 on the test set, outperforming other methods that achieved AUC-ROC values between 0.85 and 0.94. The study also evaluated the model's interpretability using saliency maps, which showed that the model's attention was focused on regions that are clinically significant for prostate cancer diagnosis.
* The proposed method's advantages include its ability to handle whole slide images and its simplicity in training with image-level labels. The method's end-to-end training approach enables the model to learn features directly from the input images and generate probability maps indicating the likelihood of cancer presence. However, the proposed method has some limitations, such as the need for large datasets of annotated images and the possibility of overlooking small cancerous regions.
* In conclusion, the proposed method shows promising results for the detection of prostate cancer in whole slide images using image-level labels. The study demonstrates the potential of using end-to-end training with image-level labels for detecting prostate cancer in whole slide images. The method's performance can be improved by incorporating more advanced CNN architectures and training on larger datasets. Further research is needed to evaluate the method's performance on different types of cancers and to address its limitations.