An Algorithm For Automatic Histologic Grading Of Prostate Cancer
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SUMMARY
UCLA researchers in the Departments of Radiological Sciences and Pathology and Laboratory Medicine have developed a novel computer-aided diagnostic tool for histologic grading of prostate cancer.

BACKGROUND
Prostate cancer is the most predominant and second most deadly form of cancer in men in the United States. Pathologists use Gleason grading of histological images to quantitatively describe prostate cancer, related to severity of disease. Treatment plans are determined based on these evaluations of disease progression. However, the grading process is time consuming and subject to inter- and intra-observer variability. Although these variations may have a substantial impact on future treatment strategies, a more consistent method for grading prostate cancer does not exist. Current attempts towards a precise Gleason grading method rely on computer-aided diagnostic (CAD) tools, yet these algorithms remain prone to subjectivity and have limited reproducibility. Such CAD tools may still leave prostate cancer patients with inaccurate Gleason grading and epithelial cells detection.

INNOVATION
UCLA researchers have developed a novel method to diagnose prostate cancer and automatically perform Gleason grading based on histological whole slide images. A region-based convolutional neural network (R-CNN) framework allows for multi-task prediction of epithelial cells and Gleason grading simultaneously. Compared to previous CAD tools using single medical image segmentation models for prostate cancer diagnosis, this algorithm provides complementary contextual information to improve performance. Artifacts caused by the system are offset by a post-processing step that is absent from other methods. This multi-task design achieved an epithelial cells detection accuracy of 99.07% and an average AUC of 0.998. Gleason grading overall pixel accuracy was 89.40%, with a mean intersection over union of 79.56%. The algorithm is particularly valuable for diagnosis of cancers featuring glands structures, such as colon cancer and prostate cancer.

APPLICATIONS
- Prostate and other cancer diagnosis based on histological images
- Gleason grading of prostate cancer
- Histological epithelial cells detection

ADVANTAGES
- Repeatable, precise method absent of inter- and intra-observer variability
- Multi-task model provides complementary contextual information compared to single task models
- Simultaneous epithelial cells detection and Gleason grading
- Post-processing connected conditional random field (CRF) compensates for the artifacts caused by the algorithm
- Excellent diagnosis of cancers that contain glands structures, such as prostate cancer and colon cancer

STATE OF DEVELOPMENT
The method has been developed and tested for accuracy of epithelial cells detection and Gleason grading based on 513 histological images.

RELATED MATERIALS

OTHER INFORMATION
KEYWORDS
oncology, cancer, prostate cancer, colon cancer, diagnostics, histologic grading, region-based convolutional neural networks, R-CNN, Gleason grading, Mask R-CNN, computer-aided diagnosis (CAD)

RELATED CASES
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