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High accurancy and effectiveness with deep neural networks and artificial intelligence in pathological diagnosis of prostate cancer: Initial results

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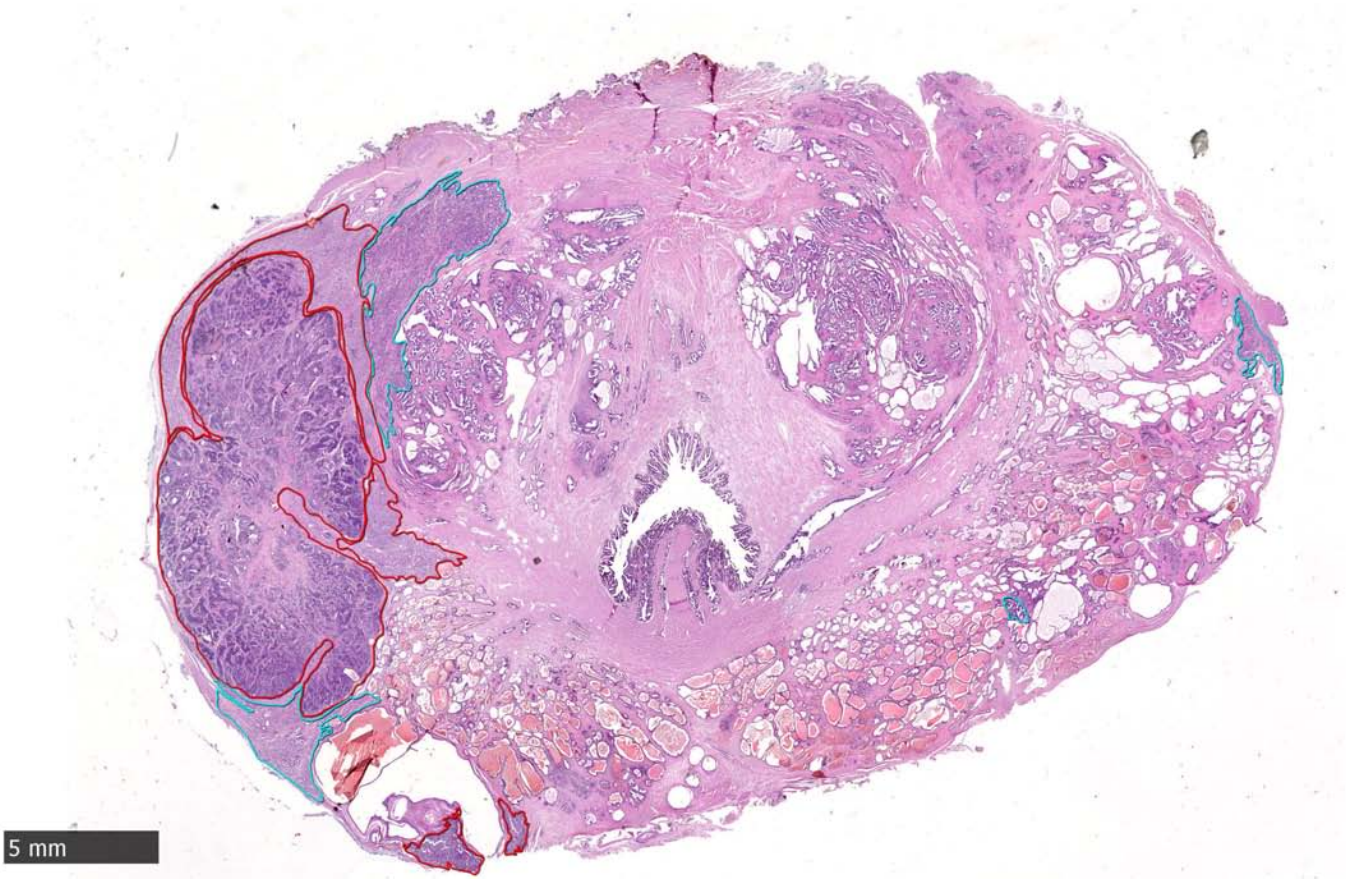
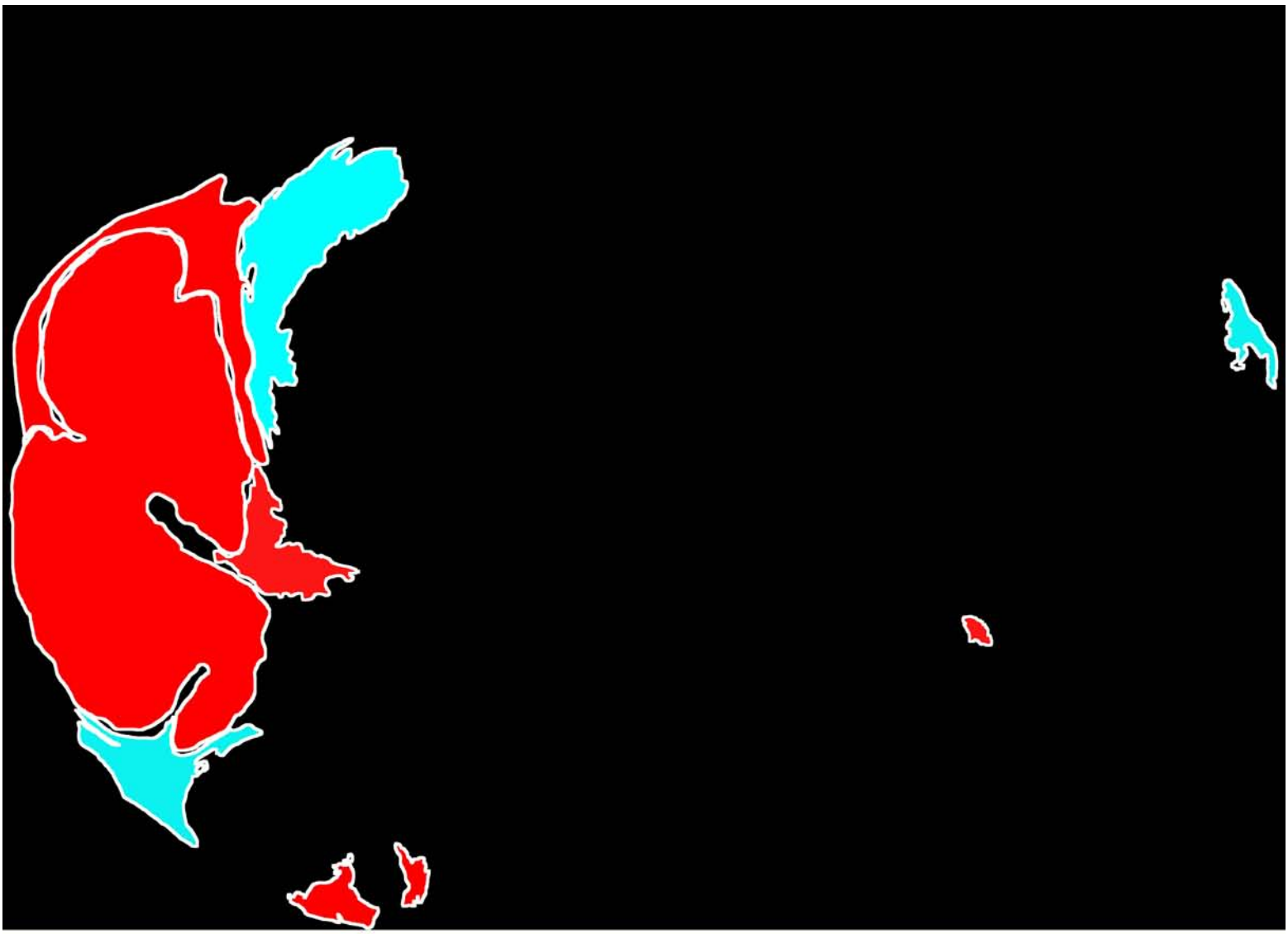
Introduction & Objectives: Most prostate cancers are adenocarcinomas and their pathology is highly associated with prognosis. Artificial intelligence (AI) now is going to become a hot topic in our daily life. AI and deep neural networks may play a major role in medical fields. In this study, we explored the application of AI in prostate pathology diagnosis, leading to a rapid, exact and high-efficiency technique.

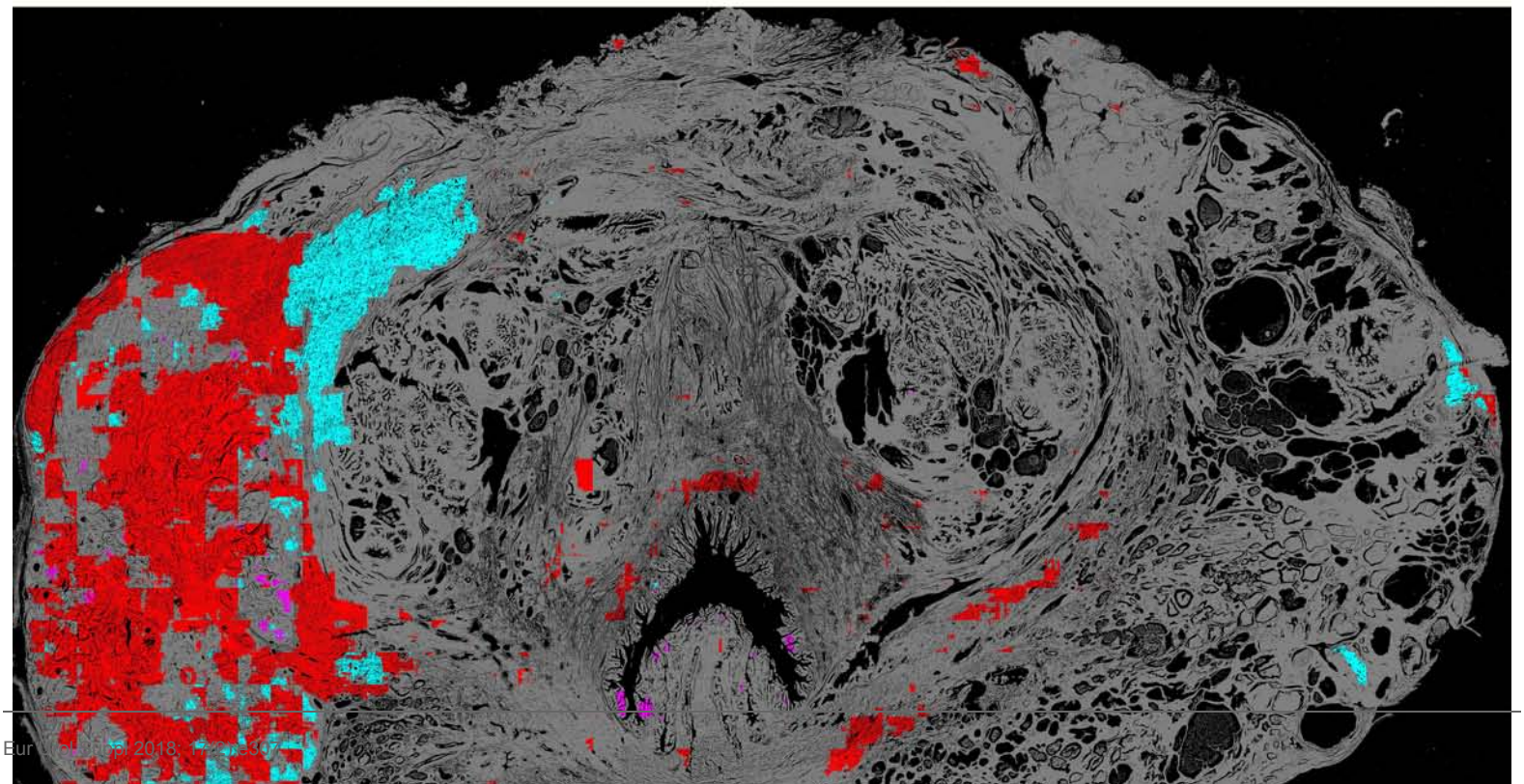
Materials & Methods: Histopathological whole mount (WM) sections of prostate after robot-assisted laproscopic radical prostatectomy were used for machine learning. The pathology of prostate was evaluated according to 2014 International Society of Urological Pathology grading systems of prostate cancer. Since there were tumor grade heterogeneity within and between tumors, we identify the regions of different tumor grade levels at the WM sections. Grade 1 (Gleason Score 3+3) and 2 (Gleason Score 3+4) were defined as the low grade group (blue), Grade 3 (Gleason Score 4+3) and 4 (Gleason Score=8) as the median grade group (red), Grade 5 (Gleason Score 9 or 10) as the high grade group (purple). After deep machine learning with large amount of pathology images, blank pathological sections were tested with AI and compared with pathologist's opinion.



Results: 283 patients containing 918 pieces of WM sections were analyzed by AI for machine learning. 10 pieces of WM sections from 10 patients were tested to evaluate the AI's diagnosis. The accuracy rate is 99.38% to identify if the section contains cancer. Additionally, We compared the

diagnosis with the grade between AI and the pathologist. The result AI exported was similar with the pathologist's diagnosis.





Conclusions: According to our initial results, AI could replace pathologists to some extend in prostate cancer pathology diagnosis. AI will have a wide application prospect in medical area in the future.