Development of an Intelligent Expert System for Online Bladder Cancer Diagnosis

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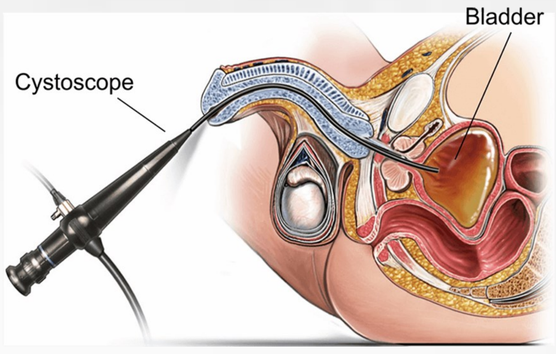
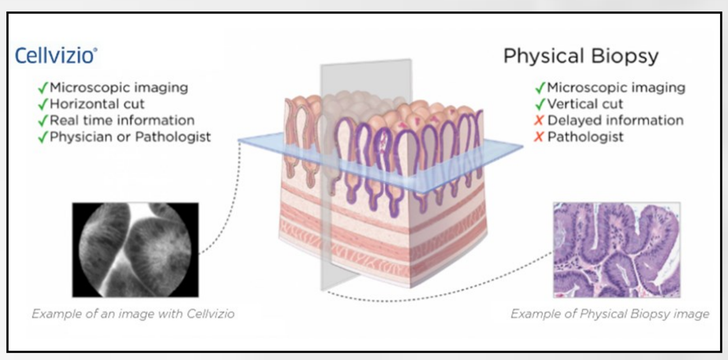
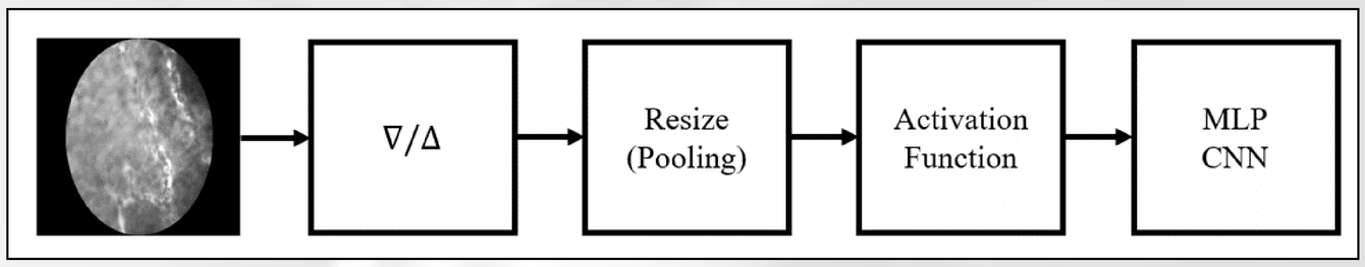
Abstract: This project refers to research that can be divided into several segments: database development to be used as data for training of various artificial intelligence algorithms, exploring the ability to apply algorithms for image contour detection to improve accuracy of AI algorithms and machine learning Investigation of the possibility of applying various. artificial intelligence algorithms to the detection of bladder cancer. Based on the results of previous research, selecting 2 or more algorithms that will be used to develop a bladder cancer diagnosis system implementation on HPC systems to solve Big Data problems.

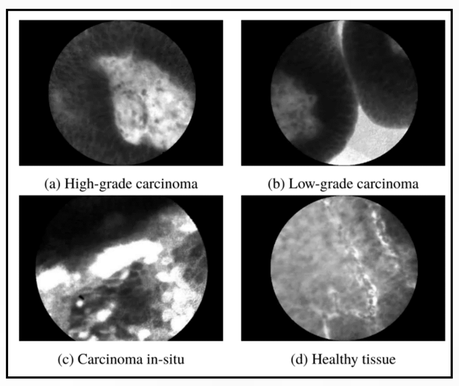




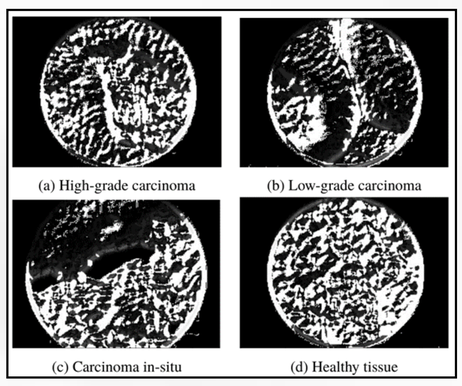
Cystoscopy is a standard procedure for visual evaluation of bladder mucosa. An optical biopsy can be performed (cystoscopy + endo microscope). It enables in-vivo and less invasive diagnosis of bladder cancer, Disadvantage is that CIS detection accuracy does not exceed 75%. Application of artificial intelligence algorithms with the aim of increasing diagnostic accuracy.

Edge detector based hybrid models used in the research are based on the theoretical knowledge of CNN, with the first layer being defined in advance. They are based on the application of gradient and Laplacian edge detectors.

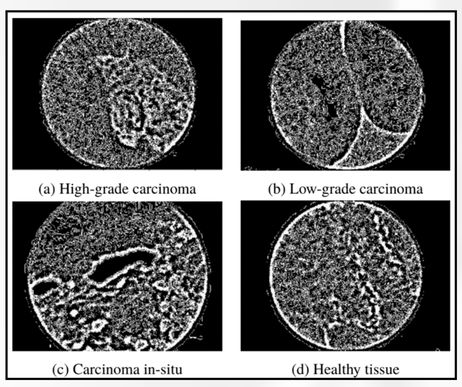




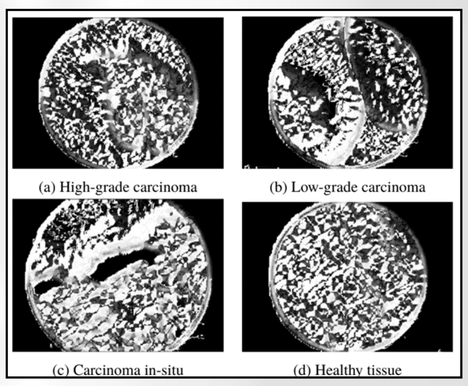
Original images.



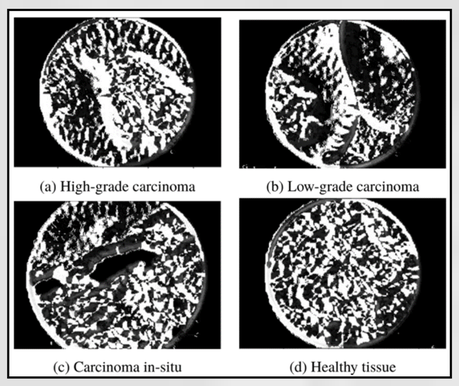
Roberts edge detector.



Laplacian edge detector.

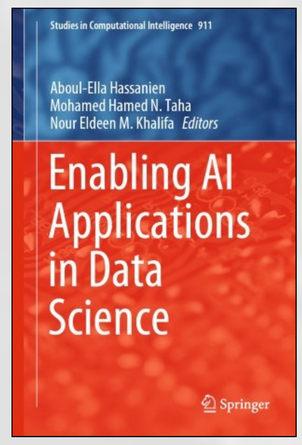


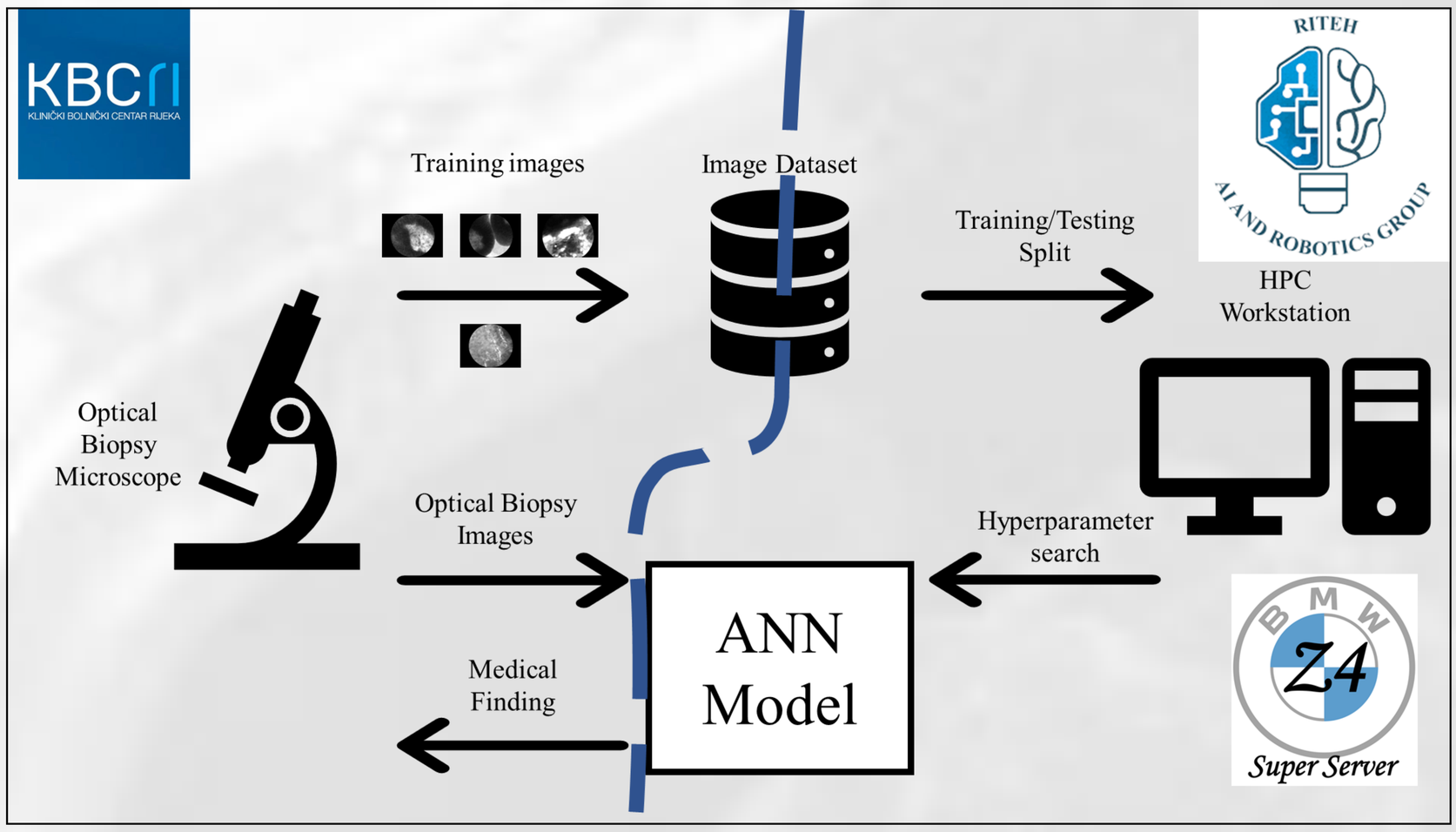
Sobel edge detector.

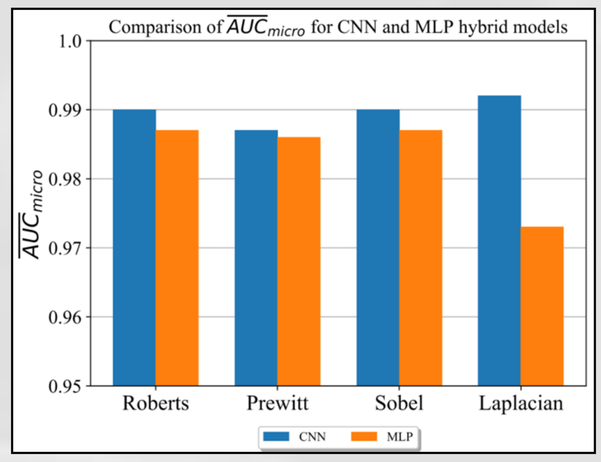


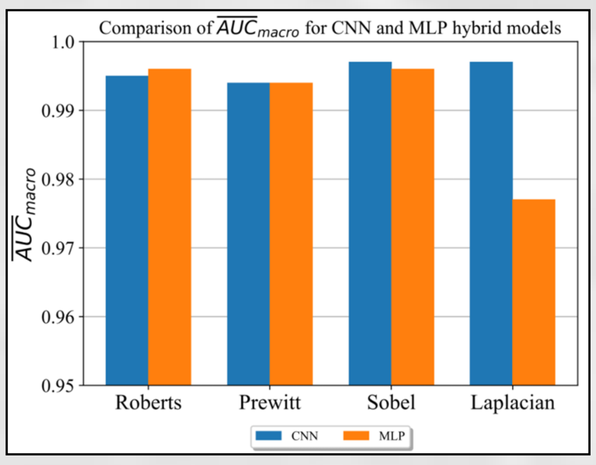
Prewwit edge detector.

Results of the applied algorithms show a higher AUROC scores in comparison to the optical biopsy performed by the doctors, and have been published in a book chapter “Edge Detector-Based Hybrid Artificial Neural Network Models for Urinary Bladder Cancer Diagnosis” (Enabling AI application in data science, ISBN 978-3-030-52057-0) and a journal article “Using multi-layer perceptron with Laplacian edge detector for bladder cancer diagnosis” (Artificial Intelligence in Medicine, DOI 10.1016/j.artmed.2019.101746). Further work is continued on improving the results and the integration of ANN models.









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