**Abstract:**

**Background:** Current bladder cancer grading often requires invasive procedures such as cystoscopy and biopsy, leading to low diagnostic efficiency, poor patient experience, and variability in accuracy depending on the physician's experience. Different grades correspond to different treatment approaches, making accurate grading crucial.

**Aims:** To automate bladder cancer grading using magnetic resonance imaging (MRI) images, thereby increasing the speed and accuracy of diagnoses.

**Materials and Methods:** This study collected magnetic resonance imaging (MRI) images from 100 patients diagnosed with bladder cancer, with cancer grades and regions annotated by experienced physicians. Initially, a Convolutional Neural Network (CNN) model was trained to differentiate cancerous regions from normal tissue. Subsequently, a bimodal Gaussian mixture model was established to characterize features of the cancerous regions, identifying two peak features. Using a genetic algorithm, regions matching these peak features were crossovered and mutated to replicate multiple areas like the original cancer regions. The Manhattan distance between these replicated regions and the original cancer regions was computed to establish a correlation between the distance and the cancer grades.

**Results:** The CNN model achieved a <>% accuracy rate in identifying cancerous regions. The genetic algorithm generated 100 similar regions, and training results indicated a positive correlation between the distance and the cancer grades(or specific distance intervals correspond to grades).

**Conclusion:** This study demonstrates the feasibility of using MRI imaging to automate bladder cancer grading, which could significantly improve current diagnostic and treatment strategies.

**keywords:** bladder cancer, convolutional neural network, magnetic resonance imaging, automated cancer grading, genetic algorithm, gaussian mixture model