Purpose:
One cyclic peptide named PLZ4 was identified that could selectively bind to bladder cancer cell lines and all of the 5 primary bladder cancer cells from human patients, but not to normal urothelial cells, cell mixtures from normal bladder specimens, fibroblasts, and blood cells. Beads coated with PLZ4 will have cancer cells bound on it when used for screen. It is labor intensive for human to read microscope images to make a diagnosis. A computer algorithm is developed to automate the segmentation and analysis.

Methods:
The computer algorithm has to complete two tasks. First, segment the image to isolate individual beads. Secondly, analysis each bead to determine whether it have cell binding. Various image processing algorithms were applied to pre-process the image. A flood-fill algorithm was used to isolate individual beads from background. A rejection mechanism was setup to throw away regions that are mis-registered as beads to make the algorithm robust. The gradient magnitude of the image was used for deciding whether cell attachment exists. The regions around the edge and inside of the bead were analyzed. Scoring function was setup based on the training data.

Results:
The algorithm performed well in segmenting individual beads even when a lot of the beads are touching each other. Only about 1% of the beads failed to get detected. The algorithm assigns proper confidence level for cell attachment that is generally agreed by human. The result is improvable when more training data is provided.

Conclusions:
The automated detection and scoring algorithm for bladder transitional cell carcinoma screening with PLZ4 coated beads is promising for automatic imaging detection during diagnosis and follow-up/surveillance of noninvasive and advanced bladder cancer.