Purpose: During the treatment, a patient is continuously monitored by video cameras. The therapists are supposedly to watch the monitors and interrupt the treatment if any significant patient motion is spotted. Unfortunately, patient motion can easily be overlooked with this manual approach, especially when there are many other monitors in the control console area. Motion detection algorithms can help to prevent this situation by alerting therapists if a significant motion is detected.

Methods: We propose a method based on matrix decomposition into low rank and sparse matrices to separate background and moving objects from a video camera. The matrix is formed with image frames of the video and after decomposition, the low rank component represents the background and the sparse component is used to identify moving subjects in the video. The matrix decomposition is performed by solving a convex optimization problem via an efficient alternating direction method. Combining prior knowledge about the motion of treatment machines, our method can reliably extract the actual patient motion from the machine motion and background changes.

Results: We tested the algorithm using videos obtained from a volunteer lying on the treatment couch under the linac. We managed to isolate the patient and treatment machine motions from the background.

Conclusion: Our algorithm can separate the patient motion from the background and therefore makes it possible to efficiently detect when this motion is above a certain threshold. This method requires that a large number of frames are acquired, but the concept can be extended to real time by adaptively update the low rank component.