Detection of Humans Carrying Concealed Objects

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Problem:

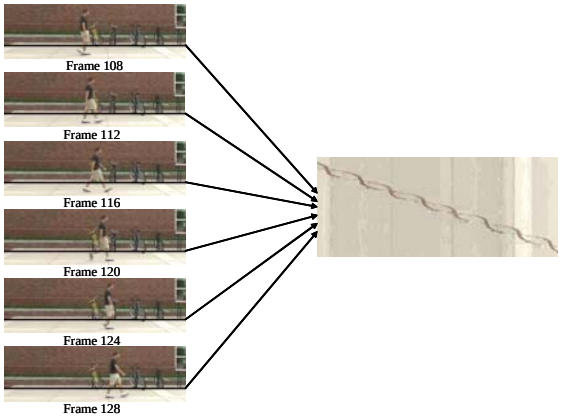
•Detect concealed objects on the ankle and around the midsection by looking at gait changes using computer vision techniques
•Detect deviations to the geometric symmetry of the human gait

Difficulties :

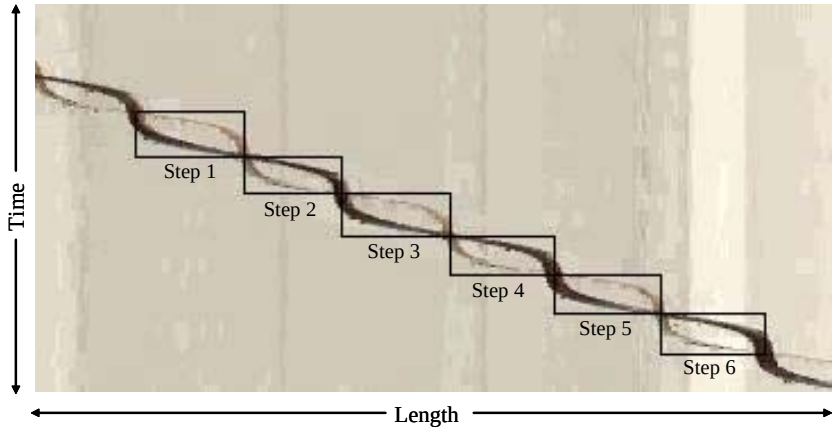
•An individual's gait can change from day to day or the way they compensate for a load
•Viewing angles and background clutter can also change human gait

Approach:

•Step length and step time are measured by creating a double helical pattern to represent human gait
•Double helical pattern is created by taking a slice from each frame of a video sequence and stacking them in order

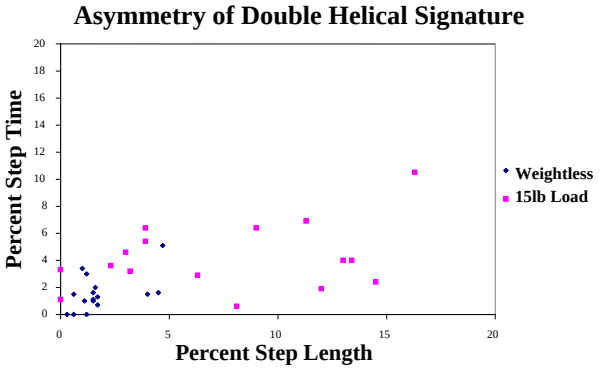


•From the double helical pattern step length and time can be easily measured

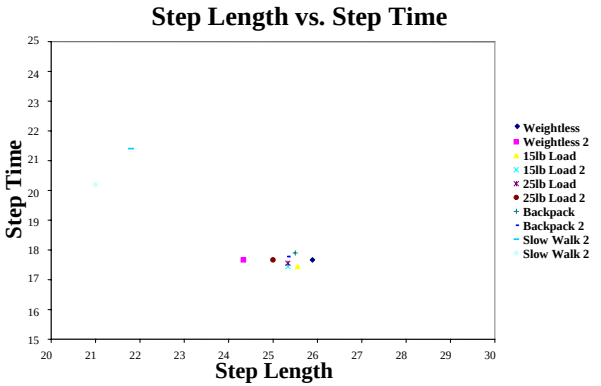


Results:

•With a 15 pound ankle weight the geometric symmetry of the gait is lost
•The data shows clear separation between weightless and loaded geometric symmetries



•With a variety of loads in the midsection area gait geometric symmetry is unaffected
•In this case the step length and step time do not significantly change with midsection loads



Conclusion:

•In this study it was found that a concealed object of 15 pounds placed on the ankle could be reliably detected due to alterations in the geometric symmetry of the human gait
•Concealed objects around the midsection are very difficult to detect and loads up to 25 pounds could not reliably be detected

Implications:

•With the ability to detect concealed objects using computer vision the efficiency and effectiveness of video surveillance would be greatly enhanced
•Changes in gait that are invisible to an observer can be seen with computer vision