Literary Review of Continuous Authentication and Gait Analysis

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This paper for obvious reasons will be split into two sections. Both fields covered in this paper are so expansive that in the interest of clarity a few assumptions will be made about the scope of this analysis to reduce the content to a reasonable size. First for the gait analysis the focus will be on gait analysis done on arm swing alone and not full body. Second for continuous authentication only direct biometric authentication will be considered for this paper as other forms such as behavioral and recognition authentication do not provide any insight into the unique issues this study faces.

Continuous authentication is a new and constantly evolving field. Examples of current work in this field are keyboard, virtual keyboard, behavioral, gestural, temporal, biometric, recognition and tactile authentication. These are by no means the only avenues being pursued but they are the major one with the most supporting research. The current leading field in continuous authentication is based on behavioral biometrics (<http://ieeexplore.ieee.org/abstract/document/6459891/>) . The method for behavioral authentication depends on establishing a baseline for an everyday activity such as typing in a password, using the computer or typing on a smartphone. Once this baseline is established future interactions can be compared to determine if the same user is indeed accessing the system or an imposter. Simple biometric authentication has been in use for decades in the application of fingerprints, facial recognition (<http://ieeexplore.ieee.org/document/6528223/>) , retinal scans (<http://ieeexplore.ieee.org/document/7847561/>) , vein pattern analysis (<http://ieeexplore.ieee.org/document/7882698/>) , ear shape configuration (<http://ieeexplore.ieee.org/document/7893882/>) , and many others. However, these methods do not allow for continuous authentication in any convenient or reliable manner. Advances in multimodal authentication still use behavioral biometrics but they also combined it with older standard biometrics (<http://ieeexplore.ieee.org/document/7844515/>). This leads to the conclusion that while there are great advances being made there is no frontline so to speak. All the methods discussed only come into play only after access to restricted content has been granted however brief. The idea of a constant security that comes into effect almost from the moment the user enters the building is vastly preferable.

Gait analysis is divide into two separate but related fields. The first one is a security and identification field where the purpose is to reliably identify a person simply by using cameras and other technology to record their walking gait and match it to earlier collected information. This is not a well-researched field as of today. However, some early attempts have been made ([www.mdpi.com/2073-8994/8/10/100/pdf](http://www.mdpi.com/2073-8994/8/10/100/pdf)). Work has also been completed to attempt to quantify the errors and issue of using accelerometer data in non-ideal conditions (<http://ieeexplore.ieee.org/document/7518029/>) .The second field is in medicine as when the first field was initially being explored there was a correlation to certain medical conditions that could be identified by the computer driven gait analysis that human doctors where incapable of themselves. In this manner, it has become a diagnostic tool for the medical field as well. Most of the leading work in arm swing and trunk analysis are being done to look for markers of Parkinson’s (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5053872/>) / (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4713791/>) / (<http://ieeexplore.ieee.org/document/7591269/>) /

However, none of these sources have made use of any technique for gathering the arm swing data other than motion capture camera technology. Further research into gait analysis all concentrates on measuring parts of the body not covered in this review.

In conclusion while the field of continuous authentication continues to advance in the realms of behavioral and camera based authentication, continuous passive biometric authentication remains the end goal of this line of research. Hopefully the introduction of a device small enough to be worn by a reasonable employee and capable of gathering a large amount of biometric data will advance this goal.