# BANCO DE PATENTES
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**UNIVERSITAT JAUME·I**

# SYSTEM FOR THE BIOMETRIC RE-IDENTIFICATION OF PEOPLE BASED ON GAIT ANALYSIS

## DESCRIPTION OF THE INVENTION

Researchers from the Universitat Jaume I of Castelló are working on the development of a new system for the biometric re-identification of people based on the analysis of their gait. Biometric re-identification allows the same individual to be recognised in different scenes recorded by different cameras for a short period of time. The goal is not to find out the identity of the individual but to track him or her through a network of surveillance cameras located in a public space. When a person disappears from the view of a camera and then reappears in another, the system should be able to determine that this subject has already appeared earlier and hence continue monitoring. As a result, it becomes possible to assess the normality of the sequence of spatiotemporal events formed by the images, which has an obvious application in the field of video surveillance.

Biometric re-identification is a complex problem because each camera can record the individual from a different angle, and scenarios may have different lighting conditions, as well as static or dynamic occlusions caused by other persons, vehicles or furniture. In addition, the behaviour of an individual while not on any camera is uncertain, so no prior knowledge can be assumed.

The process of re-identification may also consider other primary features that have been used in previous research in this field: the colours of the clothes worn by the person to be re-identified; whether they are carrying any packages, bags or backpacks, of they are wearing a hat, for example. One goal of the researchers at the Universitat Jaume I is to develop methods that are capable of integrating information from these primary sources with the data extracted from the analysis of the person's gait.

The most widely established biometric technologies, associated with fingerprint and facial recognition, are very reliable and difficult to fake. However, these biometric sources have obvious limitations, the most important being the need for the cooperation of the person to be identified, a condition that cannot always be fulfilled. Moreover, facial recognition requires the individual to be close to the camera and homogeneous lighting conditions. With these limitations, facial recognition technology is not suitable for certain applications of video surveillance. In contrast, identification of people by their gait can be accomplished from a distance and does not require a high resolution image or ideal lighting conditions (it works with backlighting and dim lighting).

The re-identification of people has a large number of applications in video surveillance of public spaces, such as airports, bus stations, trains or undergrounds, parks, shopping centres, big squares, street networks and places with restricted access. Besides the detection of suspicious behaviour in terms of frequency of appearance of a subject in a scene, other applications can also be imagined, for example, determining whether an object has been left and later collected by the same person, or to keep track of lost children. Other commercial applications not related to security can be foreseen, because a person's visiting the same shop several times within a short period of time could provide information about their interest in a particular product.

In all these cases, the system may issue alarms that should be evaluated by a human operator.

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In addition to the applications described in the previous section (directly linked to the task of biometric re-identification), gait analysis may have other applications in video surveillance, for example, biometric identification of individuals who are being looked for (for whom at least one sample video is needed as a reference).

Another field of application is control of access to restricted areas where the cooperation of the individual is not required or cannot be taken for granted. In this context, gait could be used independently or in combination with other sources, such as the face. In this second case, gait could be used when the person is still far from the access point and this would allow an initial selection to be made from a list of candidates, thus reducing the search space. Facial recognition could then be used when the subject is close to the point of access (and, therefore, closer to the sensor) for final identification from among those candidates selected on the basis of the analysis of their gait.

Another possible application is demographic analysis of the population in terms of gender or age range; for example, potential customers who walk past a shop window or follow a certain path in a supermarket or shopping centre. Such information may be of interest to companies for its implications in the field of marketing. Related to this area, advertising panels could have embedded systems for the recognition of gender and the estimated age range based on gait, so that their ads might be adjusted to fit the profile of the people who are walking around or approaching.

Another area of application is improvement of the capacity of robots to interact with humans. With this technology, robots could recognise individuals or profiles of people by the way they walk and consequently adapt their own behaviours, actions and gestures.

In the medical field, the analysis of gait could help to detect and to evaluate motor abnormalities related to certain diseases such as Parkinson's. It could also identify deficiencies that limit the performance of athletes. Another application would be its use in public places to detect people with gait-related motor disabilities who are having difficulty moving or perhaps carrying luggage, so that help can be provided.

Finally, the technology could be applied in the video games industry and it could improve the realism of the characters that have to walk, thanks to models of actual motion learned from real people.

Using gait as a biometric feature allows the limitations of other biometric sources to be overcome. Thus, its main advantages are:

- Re-identification does not require any previous pictures, for use as samples, of the people the system will later try to identify. The aim of the system is not to know the exact identity of an individual, but to be able to detect their presence in different scenarios captured by different cameras, and to associate those appearances to the same individual. This information can then be used to infer their route and behaviour in the public space under surveillance.

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- Its measurement is non-invasive and, therefore, it does not require the cooperation of the individual who is being watched or the need to be in contact with the sensor. That is, a person could be identified by his/her gait without being aware of it. In contrast, the most popular biometric sources (and the most discriminant) require the direct collaboration of the individual in the recognition process, which significantly restricts their application.

- Re-identification can be performed with sufficient accuracy from images acquired in adverse conditions, i.e., those captured at a distance, at a low resolution, low contrast, and with problems arising from lighting or noise. Face recognition, however, is more dependent on high-resolution images and good lighting conditions. This advantage makes gait particularly suitable for applications in uncontrolled real-world scenarios, including video surveillance and access control to restricted areas. Furthermore, since high resolution images are not necessary, another important advantage is that gait can be captured through simple video cameras stationed remotely.

- Multi-biometric recognition: this technique can be used in conjunction with other biometric sources (for example, the face) to perform a more reliable recognition under less invasive conditions. Thus, the system makes use of the advantages of the sources involved, and mitigates their limitations.

- It is very hard to hide one's gait or to mimic someone else's, since gait is affected by a person's muscular make-up.

## STAGE OF DEVELOPMENT OF THE TECHNOLOGY

Advanced stage in research and technology assessment. Incipient stage in the conception and design of potential applications.

## INDUSTRIAL PROPERTY RIGHTS

Invention protected by intellectual property rights.

## COLLABORATION SOUGHT

A business partner is being sought with which an R&D project can be jointly undertaken for the development of specific applications of this technology, with the aim of obtaining a final commercial product.

## CONTACT

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