Gait recognition technology

Technology

The study encompasses quantification, (I. E. Introduction and analysis of measurable parameters of gaits), as well as Interpretation, I. E. Drawing various conclusions about the animal (health, age, size, weight, speed etc.) from its gait pattern. HISTORY: The pioneers of scientific gait analysis were Aristotle in De Moot Animal (On the Gait of Animals) and much later In 1 680, Giovanni Alfonse Borealis also called De Moot Manually (l et II). In the ass's, the German anatomist Christian Wilhelm Braun and Otto Fischer published a series of papers on the bohemianism of human gait under added and unloaded conditions.

With the development of photography and cinematography, it became possible to capture image sequences that reveal details of human and animal locomotion that were not noticeable by watching the movement with the naked eye. Edward Unabridged and ? tine-Jules Marry were pioneers of these developments in the early 1 9005. For example, serial photography first revealed the detailed sequence of the horse " gallop", which was usually misrepresented In appalling made prior to this discovery.

Although much early research was done using film cameras, the widespread application of gait analysis to humans with pathological conditions such as cerebral palsy, Parkinson disease, and neuromuscular disorders, began in the 1 sass with the availability of video camera systems that could produce detailed studies of individual patients within realistic cost and time constraints. The development of treatment regimes, often Involving orthopedic surgery, based on gait analysis results, advanced significantly in the ass's.

Many leading orthopedic hospitals worldwide now have gait labs that are routinely used to design treatment plans and for follow-up monitoring. Development of modern computer based systems occurred independently during the late ass's and early ass's in several hospital based research labs, some through collaborations with the aerospace industry. Commercial development soon followed with the emergence of commercial television and later Infrared camera systems In the mild-ass's.

PROCESS AND EQUIPMENT: A typical gait analysis laboratory has several cameras (video and / or infrared) placed around a walkway or a treadmill, which are linked to a computer. The patient has markers located at various points of reference of the body (e. G. Iliac spines of the half of the body segments. The patient walks down the catwalk or the treadmill and the computer calculates the trajectory of each marker in three dimensions. A model is applied to calculate the movement of the underlying bones. This gives a complete breakdown of the movement of each Joint.

To calculate the kinetics of gait patterns, most labs have floor-mounted load transducers, also known as force platforms, which measure the ground reaction forces and moments, including the magnitude, direction and location (called the center of pressure). The spatial distribution of forces can be measured with petrography equipment. Adding this to the known dynamics of each body segment, enables the solution of equations based on the Newton-Euler equations of motion permitting computations of the net forces and the net moments of force about each Joint at every stage of the gait cycle.

The computational method for this is known as inverse dynamics. This use of kinetics, however, does not result in information for individual muscles but muscle groups, such as the extensor or fellers of the limb. To detect the activity and contribution of individual muscles to movement, it is necessary to investigate the electrical activity of muscles. Many labs also use surface electrodes attached to the skin to detect the electrical activity or electromyography (MEG) of, for example, a muscles of the leg.

In this way it is possible to investigate the activation times of muscles and, to some degree, the magnitude of their activation? thereby assessing their contribution to gait. Deviations from normal cinematic, kinetic, or MEG patterns are used to diagnose specific pathologies, predict the outcome of treatments, or determine the effectiveness of training programs FACTORS AND PARAMETERS: The gait analysis is modulated or modified by many factors, and changes in the aroma gait pattern can be transient or permanent.

The factors can be of various types: Extrinsic: such as terrain, footwear, clothing, cargo Intrinsic: sex (male or female), weight, height, age, etc. Physical: such as weight, height, physique Psychological: personality type, emotions Physiological: anthropometric characteristics, I. E. Measurements and proportions of body Pathological: for example trauma, neurological diseases, musculoskeletal anomalies, psychiatric disorders The parameters taken into account for the gait analysis are as follows: Step length Stride length Cadence Speed Dynamic Base Progression Line

Foot Angle Hip Angle TECHNIQUES: and analyzed, and interpretation, where conclusions about the subject (health, age, size, weight, speed, etc.) are drawn. The analysis is the measurement of the following: Temporal / spatial It consists in the calculation of " speed, the length of the rhythm, pitch, and so on. These measurements are carried out through: Stopwatch and marks on the ground. March on a pressure mat. Kinematics 1 . Chromatography is the most basic method for recording of movement. Strobe lighting at known frequency has been used in the past to aid in the analysis of gait on single photographic images. Cine film or video recordings using footage from single or multiple cameras can be used to measure Joint angles and velocities. This method has been aided by the development of analysis software that greatly simplifies the analysis process and allows for analysis in three dimensions rather than two dimensions only. 3. Passive marker systems, using reflective markers (typically reflective balls), allows for accurate measurement of movements using multiple cameras (typically five to twelve cameras), simultaneously.

The cameras utilize high-powered strobes (typically red, near infrared or infrared) with matching alters to record the reflection from the markers placed on the body. Markers are located at palpable anatomical landmarks. Based on the angle and time delay between the original and reflected signal, triangulation of the marker in space is possible. Software is used to create three dimensional trajectories from these markers that are subsequently given identification labels. A computer model is then used to compute Joint angles from the relative marker positions of the labeled trajectories.

These are also used for motion capture in the motion picture industry. 4. Active marker systems are similar to the passive marker system but use " active" racers. These markers are triggered by the incoming infra red signal and respond by sending out a corresponding signal of their own. This signal is then used to triangulate the location of the marker. The advantage of this system over the passive one is that individual markers work at predefined frequencies and therefore, have their own " identity".

This means that no post-processing of marker locations is required, however, the systems tend to be less forgiving for out-of-view markers than the passive systems. 5. Inertial (cameras) systems based on MESS inertial sensors, mechanical models, and sensor fusion algorithms. These full-body or partial body systems can be used indoors and outdoors regardless of lighting conditions. Kinetics Is the study of the forces involved in the production of movements. Dynamic electromyography Is the study of patterns of muscle activity during gait.

Gait analysis is used to analyze the walking ability of humans and animals, so this technology can be used for the following applications: Medical diagnostics Pathological gait may reflect compensations for underlying pathologies, or be responsible for causation of symptoms in itself. Cerebral palsy and stroke patients are commonly seen in gait labs. The study of gait allows diagnoses and intervention strategies to be made, as well as permitting future developments in rehabilitation engineering.

Aside from clinical applications, gait analysis is used in professional sports training to optimize and improve athletic performance. Gait analysis techniques allow for the assessment of gait disorders and the effects of corrective orthopedic surgery. Options for treatment of cerebral palsy include the artificial paralysis of spastic muscles using Bottom or the lengthening, re-attachment r detachment of particular tendons. Corrections of distorted bony anatomy are also undertaken (ecosystem).

Biometric identification and forensics Minor variations in gait style can be used as a biometric identifier to identify individual people. The parameters are grouped to spatial- temporal (step length, step width, walking speed, cycle time) and cinematic Anoint rotation of the hip, knee and ankle, mean Joint angles of the hip/knee/ankle, and thigh/trunk/foot angles) classes. There is a high correlation between step length and height of a person. The approach above belongs to the model-based approach.

Another appearance-based approach recognizes individuals through binary gait silhouette sequences. For example, silhouette sequences of full gait cycles can be treated as AD tensor samples, and multilayer subspace learning, such as the multilayer principal component analysis, can be employed to learning features for classification. Comparative bohemianism By studying the gait of non-human animals, more insight can be gained about the mechanics of locomotion, which has diverse implications for understanding the biology of the species in question as well as locomotion more broadly.