# HUMAN PSYCHOMOTOR ANALYSIS USING GAIT IDENTIFICATION

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## ABSTRACT

*Emotions are articulated through multiple physiological characteristics. Gait is one of the human psychological characteristics, which is deeply affected by the emotions. Gait is a style of walking which performed on every moment. Naturally gait can be affected by emotions on a meticulous circumstance. Gait can be obtained by cameras on real time. There is various researches are available on this consent. The emotional intelligence is very much influenced the gait. This paper presents the related study which is involved in the emotional identification through gait which was dealt by different researches. A comparative study is done by this study about the existing researches.*

***Keywords Emotions, Gait, Comparative, Intelligence***

## I. INTRODUCTION

Emotions are articulated through multiple physiological characteristics. Gait is one of the human psychological characteristics, which is deeply affected by the emotions. Gait is a style walking which performed on every moment. Naturally gait can be affected by emotions on a meticulous circumstance. Gait can be obtained by cameras on real time. There is various researches are available on this consent. The emotional intelligence is very much influenced the gait. This paper presents the related study which is involved in the emotional identification through gait which was dealt by different researches, and it covers the ideas behind those researches. There are different methodologies involved on those studies that will be described clearly. A comparative study is done by this study about the existing researches.

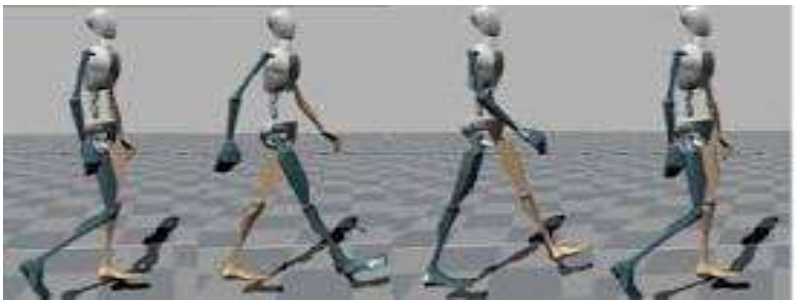

**Fig. 1.1. Gait Motion**

## II. REVIEW OF RELATED WORKS

Gentiane Venture [1], discussed about the emotion characterization of human by their gait. The Vicon motion capture system is used to capture the gait signals by using 41 marker set. There are 4 persons were involved in this study. The neutral, joy and anger emotions were targeted to identify through gait signals. The similarity

index was found for each emotion and compared. At last this study proved the emotion characterization of each sample gait signals.

Destephe [2] studied about the emotional intensity on happiness and sadness on walking. The cortex motion capture system was used to capture the gait motions. The parameters used in this study were step height, step length, stride length, stride phase, stance phase, cadence and velocity. The 2 samples were involved in this study. To analyze the behaviors an evolution of the low emotive intensity to the high emotive intensity was calculated and the intensity values were compared.

Masahiro TOBA, Kazuki INOVE [3], developed a stress analyzer to analyze a person's stress level through the speed of walking. They evolve this study by involving the teachers when they were close to their teaching job. They have measured their walking speed before and after commitment of their class teaching. They found the decreasing of speed after their teaching. And they clearly stated that the increasing stress level automatically decrease the speed of walk.

Saša Radovanović, Milica Jovičić, Nadja P. Marić,Vladimir Kostić [4], discussed about the alteration in motor and cognitive functioning of the depressed patients. They have explored the gait parameters and variability of patients with major depressive disorder in dual task walking situations. Eight patients with 20 health controls performed motor, mental and combined motor + mental task while walking.

The parameters used by them are cycle tie, stride length, swing tie, double support time and their coefficients of variation (CV). To analyze the differentiations between the patients and controls like age, gender and years of education, the t-test, Fisher's exact test and Mann-Whitney U test are used. The pair wise comparisons are made, such as: base vs. mental, base vs. motor, motor vs. mental and mental vs. combined task performance. The association between severity of depression and gait parameters were analyzed using Pearson correlation coefficient. Hence the gait variability is having differences while involved in dual task.

Thus the study proved the gait characteristics are affected by the emotions. They suggested that, it is possible to make use of the tool in differential diagnosis of psychiatric and neurological disorders based on gait pattern, as well as monitoring response to therapy.

Ritta Baddoura and Gentiane Venture[5] discussed about the human motion characteristics in relation to feeling of common or anxious during a make known short interface with a proactive humanoid. They proved that, Emotions have a certain impact on body travels and attitude of the person who is experience them. This effect is reflected in both interior physiological transform and outside physical expressions (Frijda 1986).

As per the above authors' research, the experiment involves a triad: a robot and 2 participants (X and Y) at a time. The participants are only invited to answer a questionnaire (in their own language to avoid ambiguity) on the perception of robots. They are informed that the set is filmed and the IMU (Inertial Measurement Unit) are used for each participant and placed around their head and wrist for motion capture. They do not know about the robot's intervention. The only instruction given to them is to answer a questionnaire. The experiment's scenario was validated by the ethical committee. To identify the motion characteristics the Principal component Analysis (PCA) is used. Hence they proved that certain body movements and gestures can be closely associated to affective states and that the arm and head motions of a human interacting with a humanoid partner are strongly correlated to emotional experience.

| S. No. | Author | Year | System | Dataset | Targeted Emotions | No. of Samples | Computational Methods |
|---|---|---|---|---|---|---|---|
| 1 | Gentiane Venture | 2010 | Vicon Motion Capture System | 41 – Marker set in a human body | Neutral attitude, joy, anger and sadness | 4- 2 M, 2 F | Found the Similarity Index |
| 2 | Matthieu Destephe | July 2013 | Cortex Motion Capture System | Parameter Measurements(Step height, Step Length, Stride length, stride phase, stance phase, Cadence and velocity, 425 data records | Happiness, sadness, anger and fear | 1 M, 1 F- 2 Nos. | Behavior analysis<br>• An evolution from the low emotive intensity to the high emotive intensity or a stagnation of the characteristics.<br>• Comparing the percentage value and different intensities of walking |
| 3 | Masahiro TOBA, Kazuki INOVE | June 2011 | Commercial video Camera(CCTV) | Video capturing system | Mental stress | 376 persons | Calculating the speed of the walk |
| 4 | Sesa, Milica | 2014 | GaitRite mat | Depressive symptoms- rated using Hamilton Rating Scale for Depression(HAMD), | Depression | 20 controlled subjects and uncontrolled subjects | • Temporal spatial gait parameters acquired- cycle time, step length, single and double support time and variability of those parameters.<br>• Coefficient variability is calculated<br>• rmANOVA has been used |
| 5 | Ritta Baddoura, Gentiane Venture | 2014 | Inertial Measurement Units (IMU) sensors are placed around their head and wrist | Motion intensity frequency and smoothness were calculated | Fear and anticipation | 40 subjects, humanoid | • Frequency analysis – FF<br>• Angular velocity<br>• motion smoothness<br>• Correlation coefficients between pairs of variables were calculated |
| 6. | Shigeru Kuriyama, Yoshimi Kurihara, Yusuke irino and Toyohsia Kaneka | 2002 | Human model | Pattern generator | - | - | • Geometrical model of a human was generated<br>• ellipsoid model of human body has been adopted |

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|---|---|---|---|---|---|---|---|
| 7 | Tianxiang Zhang (P), and Gentiane Venture (P) | 2011 | Optical motion capture-Vicon system | 41 marker set – 20 motions are obtained | Neutral attitude, joy, anger and sadness | 4 samples | • Feature vector with angular information<br>• PCA<br>• Emotions cluster calculated from least square method |
| 8 | Melanie B.Cluss, Elizabeth A.Crane, M.Melissa Gross and Barbara L.Fredrickson | 2001 | 6 Video Cameras | Questionnaire, A 5-item Likert scale | Neutral, joy, Anger, Sad, Content, Pride, Fear, Surprise, Disgust, None. | 26 Under Graduate Students (15 – F, 11 – M) | • Coordinated data filtered at 6 Hz<br>• Gait parameters were calculated using Visual 3D software.Linear Model Pair-wise comparisons by Tukey's Honest Signif icant Difference test. |

**Table 1.1 Comparison of Existing Methods**

Shigeru Kuriyama,Yoshimi Kurihara,Yusuke Irino and Toyohisa Kaneko [6] proposes a control methodology for human gait with a pattern generator. The pattern generator generates cyclic signals via a couple of mutually inhibited neurons, and drives a proportional derivative controller that supplies joint angles of a virtual human. The state of the pattern generator is entrained by the signal of the controller, and such mutual feedback stabilizes the generation of rhythmic signals for variable conditions. Legs and arms can automatically synchronize their periodical movements without using a central supervisor because the corresponding neural oscillators mutually feed their output signals. Their system generates various gaits in a common mechanism with a small number of parameters, which is well suited for real-time, interactive and on-the-fly controls. Moreover, the movements obtained from motion capture data can be controlled by introducing adjustable non-linear filters.

In order to extract a set of features describing the body of a person that performs an action, a geometrical configuration of human body must be considered. Since the aim of the research is to increase robustness of gesture classification by embedding human body configuration information in our data analysis loop while keeping real-time performance, an ellipsoid model of human body has been adopted. In spite of this fairly simple approximation compared with more complex human body models.

Tianxiang Zhang (P), and Gentiane Venture (P) [7] have justified that there is a possibility of recognizing the emotions from gait data. Nearly 4 candidates have been involved in this study. The gait data was collected from the Vicon - optical motion capture system using 41 marker set. They used a systematic method based on the 3D position of the passive optical reflective marker. For each candidate, 34 degrees of freedom (DOF) model has been used. Based on the PCA results the algorithm based on cluster analysis was developed that systematically recognize the emotions. They proved that the possibility of emotions recognition with a mean rate of 80%.

Melanie B.Cluss, Elizabeth A.Crane, M.Melissa Gross and Barbara L.Fredrickson [8] suggested that the emotion identification by gait data by using 25 under graduate students, and their emotions were identified by the questionnaire with a 5-item likert scale. Their gait was observed by the observers and identified their emotions. The features were coordinated and it was filtered at 6 Hz and the gait parameters were calculated using Visual 3D software. Stride length and velocity were normalized by body height. A general linear model was fitted using PROC GLM in SAS to determine the effects of emotion and gender on the dependent variables. Multiple pair-wise comparisons of the means were performed using Tukey's Honest Significant Difference test.

## III. CONCLUSION

Thus the above metaphors show the awareness about the emotional identifications on gait motions. There is a possibility to evolve the emotions through one's gait posture. The gait signals were received on the pre defined environment like floor sensor or wearable sensor systems, and statistical approaches were used to classify the captured features. Too many approaches were adopted like creating a similarity index, geometrical models creation, frequency analysis and angular velocity. The targeted emotions in the above studies are Neutral, Anger, Sad, Surprise and Disgust. All studies have been proved the possibility of emotional identification on gait in various performances.

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