IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Aspect Of Gait Pattern

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ASTRACT

The gait pattern or the walking style of an individual plays an important role in forensic science investigation. Gait pattern means the pattern or the way in which a person walks, run , or swing the leg forward or backward. But how can a person's walking pattern helps to solve a case , here we are going to find out the aspects of gait pattern analysis on the basis of age , weight , emotion , height, pressure, and the phases of gait pattern. As an individual shows differentiation in its height , or sudden change in emotion, we can observe the change in the gait pattern . For the study , various walking patter of different heighted, and weighted individuals as a sample is taken and further analyzed to attain result of these aspects and showed in the term of charts . As a result we are going to observe the changes occurring in the gait pattern on the bases of height and emotion.

KEYWORDS –. Forensic Gait Analysis; Gait Cycle Phases; Stride Length; Step Angle; Foot angle ; Videographic Analysis.

INTRODUCTION

In forensic science, gait pattern analysis is known as the systematic study of the " way an individual" or a person walks , this walking style is called as "gait". The **GAIT PATTERN** of an individual is unique as a person's fingerprint, the gait pattern shows variation as per the situation of a person, whether a person is running or walking , or roaming around . The **height and emotion** plays a major and vital role in the change in the gait pattern of an individual , these aspects can be a reason and are responsible to show a variation in the walking pattern . These gait pattern analysis are considered as one of the important evidence in the crime scene investigation , where the footprints and continuous pattern of walking are found . These Patterns are studied through various processes which include - the digital analysis (in which the gait patter is studied on the basis of videography and timing) , and visual analysis (study of step width , step length , step angle , direction line , stride length) .

The gait pattern consist of cycles called gait cycles . These cycles are responsible of the formations of gait phases . In gait pattern , there are two types of phases which can be observed .

According to the variation of Height : Height plays a vital role in specification of swing and stride phase. When the sample have a tall height shows different type of variation as compare to shorter height.

According to the variation of Emotion : Sample show the variation in different walking pattern according to the change in its state of emotion whether it is happy, angry, sad or neutral.

METHODOLOGY -

Methods to analyze gait pattern according to phases and angle of foot. Stride phase : Phase in which the heel of both the lags touches the ground at the same time. (60%)

Swing phase : Phase in which one lag is in forward swing direction and the other lag is in stationary position. (40%)

Direction line : An imaginary line that indicate the direction of walking. It is the base of all measurement required for gait pattern analysis like principle angle, foot angle, step length, stride length.

Foot angle : It is the angle between the direction line and the direction of foot. It can be between 0 – 30*.

Step length : It is the distance between the initial contact of one foot to the initial contact of the opposite substituent foot. It is measure from back leg's heel to front leg's heel.

Method of Analysis

1.) Take samples of various height persons.

- 5ft.- 5.5ft.
- 5.56ft – 6ft.
- 6ft. – 6.5ft.

2.) Take samples of various emotions.

- Happy
- Sad
- Angry
- Neutral

3.) Walking pattern analysis : We take different types of sample of different heighted person and different psychological mindset by using various terminologies like foot angle, step length, gait phases, principal angle.

Firstly, make the sample walk for three gait cycle in single direction and we make that process repeatedly for each and every sample. Now we locate direction line at the center of respective foot for analysis respective components of gait cycle.

For the Further analyze we use the method of videography and photography for proper to understand the gait cycle including stride phase and swing phase.

RESULT

Height Impact: Taller individuals (6’5”) showed the most significant reduction in stability when "sad," with a marked decrease in stride length that made their gait resemble a much shorter person.

Emotion Impact: Anger "compressed" the gait profile of shorter individuals, making their movements appear more erratic and harder to track via standard biometric markers.

1. Height-Based Correlation

Table 1: Relationship Between Height, Step Length, Foot Angle, and Gait Characteristics

Height Bracket	Avg. Step Length	Avg. Foot Angle	Observations
5.0 – 5.5 ft	60–65 cm	5° – 8°	Higher cadence; shorter, more frequent swing phases.
5.6 – 6.0 ft	70–78 cm	7° – 12°	Balanced ratio between stride and swing phases.
6.1 – 6.5 ft	80–90 cm	10° – 15°	Significant "out-toeing" common; longer stride phase.

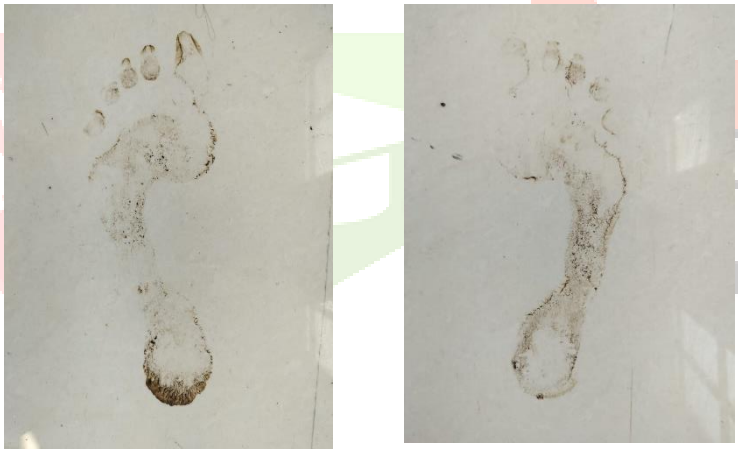

Figure 1: Footprint Pattern of an Individual with Height 5.11 ft

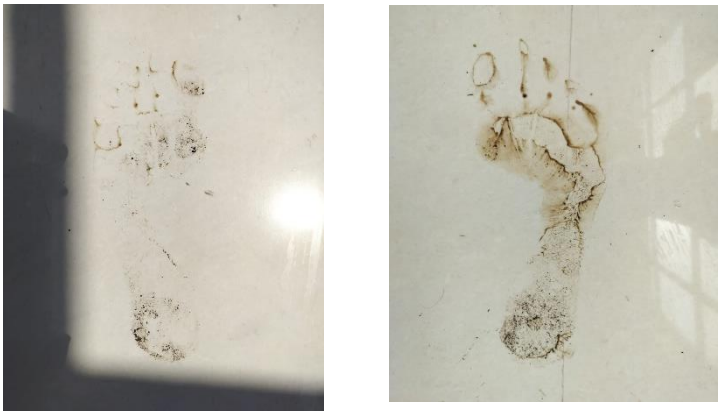

Figure 2: Footprint Pattern of an Individual with Height 6.1 ft

Figure 3: Footprint Pattern of an Individual with Height 5.8 ft

2. Emotion-Based Correlation

- **Angry:** Significant increase in **Step Length** and **Principal Angle**. The "Direction Line" showed more lateral deviation due to aggressive weight shifting.
- **Sad:** The **Swing Phase** was visibly slower. Foot angle decreased (approaching 0°), indicating a "shuffling" motion with minimal heel strike.
- **Happy:** The most "textbook" gait. **Step Length** was consistent, and the transition from stride to swing phase was fluid and rhythmic.

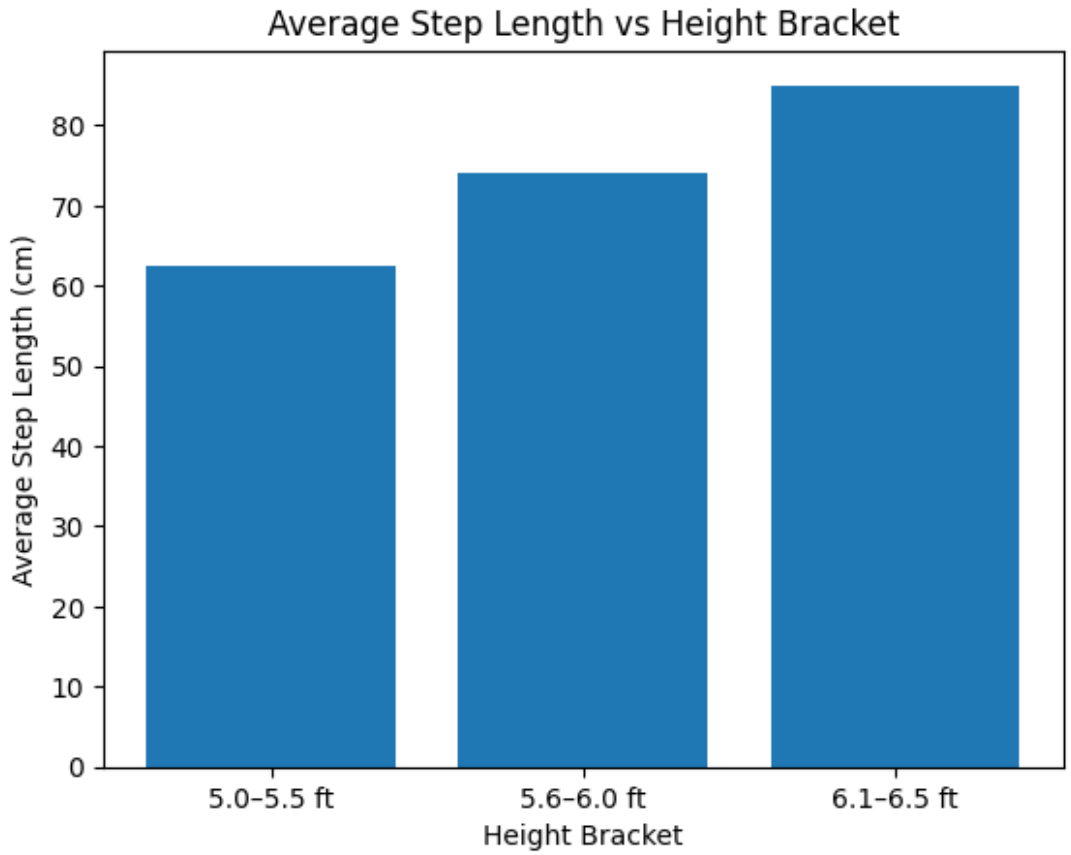

Figure 4: Variation of Step Length and Foot Angle with Height Bracket

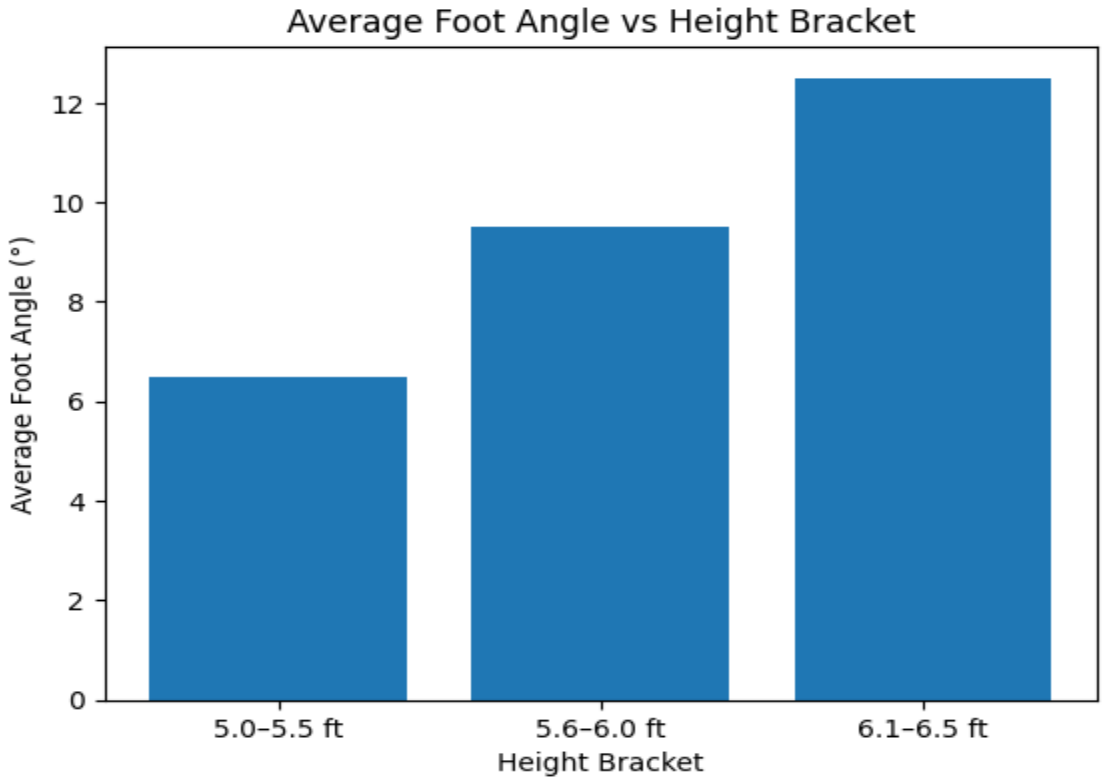

Figure 5: Gait Parameter Analysis Across Different Height Groups

The study confirms that **height** provides the mechanical framework for gait, but **emotion** acts as the primary modulator of that framework.

1. **Mechanical Constraint:** A taller individual (6.5 ft) cannot physically mimic the step length of a shorter person (5 ft) without significantly altering their **Foot Angle** and **Direction Line**.
2. **Emotional Modulation:** Emotion creates "biometric noise." For example, an **angry** person in the 5.5 ft bracket may exhibit a **stride length** normally reserved for a 6.0 ft person in a neutral state.
3. **Phase Variation:** The 60/40 ratio of Stride to Swing phase remains relatively stable across heights but fluctuates by $\pm 10\%$ based on emotional state, particularly in "Sad" samples where the Stride phase (contact with ground) increased.

CONCLUSION

Gait pattern analysis is a multi-dimensional forensic tool. While physical attributes like height and weight provide a "static" profile of a suspect, the psychological state provides a "dynamic" profile. This research demonstrates that:

- **Height** determines the *potential* of the gait (maximum step/stride length).
- **Emotion** determines the *execution* of the gait (velocity, force, and angle).

For forensic investigators, analyzing the **direction line** and **foot angle** from a crime scene can help estimate the height of a suspect, but these estimations must be adjusted for the likely emotional state of the individual (e.g., the high stress/anger state during a crime). This study successfully mapped these variations through digital and visual analysis, providing a blueprint for more accurate suspect profiling

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