

# Estimating Human Height from Footprint for Application in Forensic Investigation

Teerapohn Sugul, Ratchapak Chitaree and Kwan Arayathanitkul Department of physics, Faculty of science, Mahidol University, Bangkok, Thailand e-mail: teerapohn.sug@student.mahidol.edu

The trasological traces studied in this project were footprints. This study of trace is expected to offer important benefits in forensic science, such as crime scene reconstruction and identification of suspects.

Experimental procedure

Collecting evidence from the crime scene must begin with an overall observation, followed by a thorough and detailed collection of various types of evidence. Traces of evidence are another important piece of evidence that can identify the characteristics of individuals who may involve in the case. The evidence such as footprint can be collected by taking photographs and then analyzing the images using analysis software (such as Adobe Photoshop).



## Objectives

Introduction

1. To study shape identification from footprints using photographic techniques and then analyze the data by a software.

2. To investigate the factors that affect footprint analysis.

3 . To develop a predictive model for estimating an individual's height based on foot length.

## Results & discussion

In this study, linear equations were developed using data from 15 male and 15 female participants, as shown in Fig.1–6. An additional group of 10 males and 10 females was used to test the accuracy of these equations. The test samples are



### represented as dots in the figures.

The average height was  $172 \pm 6$  cm for males and  $157 \pm 5$  cm for females. The average foot lengths were  $25 \pm 1$  cm for males and  $22 \pm 1$  cm for females.

Based on the figures, equations derived from left foot measurements (Fig.1 and Fig.3) estimate human height more accurately than those based on right foot measurements (Fig.2 and Fig.4). This is indicated by the lower mean absolute difference (MAD) values. The lower accuracy of the right foot equations may be due to asymmetrical growth patterns, as most individuals are right-handed and tend to use their right foot more frequently. This increased use may lead to irregular growth, which in turn introduces larger errors in height estimation based on right foot measurements.

In real-world situations, it is not always possible to determine whether a footprint belongs to a male or a female. In such cases, agender equations are valuable for estimating height. However, the data used for the agender (Fig. 5–6) covers a height range of only 150 cm to 185 cm. Applying these

## equations outside this range may result in significant estimation errors.

Fig2: Male height from right foot length

Fig4: Female height from right foot length

### Fig6: Agender height from right foot length

## Conclusions

- The analysis on the left side is more accurate than the one on the right.
- It is possible to estimate height from foot length even without knowing the individual's sex.
- The equation is only applicable to specific groups, as population diversity affects the analysis of the relationship between height and foot length.
- A complete footprint is required for the analysis to be valid.

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