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Toeprint class distribution analysis

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Abstract
Toeprints may be used in place of fingerprints for leprosy patients who may not have good fingerprints to recognise or vote with. To minimise the average matching period, the Toeprint or fingerprint must be classified into different groups. From 140 individual lepers from nine colonies, 1183 successful toeprints were taken. The 140 individuals Toeprints were meant to be 1400; however, due to the poor toes on certain individual lepers, the number was reduced to what it is today (1183). For the experiment, the Toeprints were scanned at 600 dpi and saved using the Bitmap image compression algorithm. The photographs were opened on a 21-inch panel for classification, with the fingerprint classification definition serving as a functioning algorithm. Toeprints had the following characteristics: double loop, left loop, right loop, whorl, arch, and tented, much like fingerprints. The population of the Lepers toeprint loop is 73.54 percent, led by whorls with a population of 27.9 percent, the lepers arch with a population of 10.8 percent, and the tented arch with a population of 2.9 percent, arch's party is the least. Toeprints, including fingerprints, include features that can be used to identify a person.

Keywords: Leprosy, purdah, arch, tented arch, classification, toeprint

1. Introduction
Toe printing creates an image of the papillary ridge of the toes for identifying purposes [1-2]. The available biometric modes have a racial factor epidemic and a database shortage in Africa. The Toeprint, as it is, has little or no online library for scholars to study with. Existing biometric modes, such as fingerprints, have online databases for testing and analysis. This database is distinguished by demographic distribution, class grouping, etc. When we expose Toeprint, we must expand the study beyond data collection alone, which necessitates classification and dissemination. Equating the acquired distribution with current distributions on related subjects, such as fingerprints, is critical.
While dactylics have not studied the Toeprint extensively, it is clear that the toe, like the fingers, has ridges that could be tested. Sir Francis Galton, an English physicist interested in heredity, is said to have amassed the first large number of fingerprint data late in the nineteenth century. He conclusively identified the two fundamental facts on which fingerprint recognition is based after extensive investigation: one, the ridge arrangement on every finger of every individual is distinct, and two, the ridge arrangement stays constant throughout one's existence [3]. This evidence may be traced back to previous studies, but they could not come to such a firm conclusion as this. Since the toes have identical features to the fingerprint, they may even be used for personal recognition. Figure 1 depicts the division of toeprints.

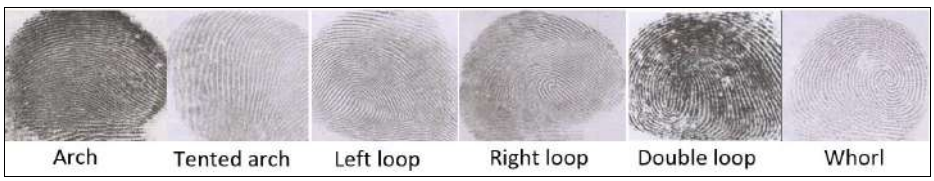
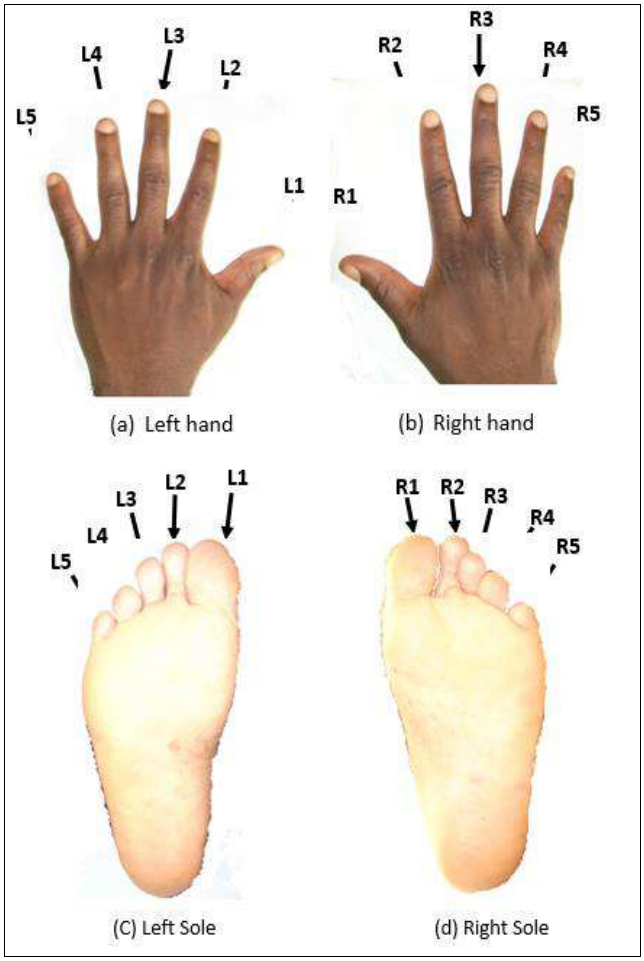


Fig 1: Sample Toeprint Classification

The positional name is used to identify the digits. For example, the thumb is the smallest and thickest finger that stands separately from the other four, preceded by the index, centre, ring, and eventually the little. We still have the five toes. As seen in Fig 2, these are the main toe, the index toe, the middle toe, the fourth toe, and the little toe.



Key to Fig 2: (a) Left Hand (L1 = Thumb, L2 = Index, L3 = Middle, L4 = Ring, L5 = Little), (b) Right Hand (R1 = Thumb, R2 = Index, R3 = Middle, R4 = Ring, R5 = Little) (c) Left Sole (L1 = Big Toe, L2 = Index Toe, L3 = Middle Toe, L4 = Fourth Toe, L5 = Little Toe), (d) Right Sole (R1 = Big Toe, R2 = Index Toe, R3 = Middle Toe, R4 = Fourth Toe, R5 = Little Toe)

Fig 2: The Comparison of Fingerprint and Toeprint by name

The FBI (USA) website contains reports of Caucasian fingerprint distribution. According to the types, the distribution shows the information by the percentage of the three (3) key fingerprint groups. This will allow for indebted fingerprint analysis and a faster storage/retrieval device pace for the large fingerprint database.

The percentage was constant for any random fingerprint collection depending on location or localisation throughout the United States [4-5]. That is, if a certain state is searched, the percentage in the result would be comparable to every other state in the same USA for Caucasian fingerprint photographs.

The FBI (USA) fingerprint distribution for Caucasians reveals that loops are 65.5 percent, with left loop 33.8 percent and right loop 31.7 percent (no records for double loop on the details accessible to me), whorls are 27.9 percent. Arches are 6.6 percent, with 3.7 percent for arch and 2.9 percent for tented arch [6-9].

This percentage association has been constant for over a decade [10]. As a result, if photographs of fingerprints are obtained in large numbers within a locality, it is essential to distribute them for proper records and, most importantly, to equate them to the normal FBI (USA) records so that the examination may be absolute.

Table 1: Percentage Fingerprint Distribution of Caucasians (USA)

Percentage fingerprint distribution of caucasians (USA)	
Class	**Percentage %**
Left loop	33.8
Right loop	31.7
Whorl	27.9
Arch	3.7
Tented arch	2.9

2. Methodology

Toeprint Data Acquisition Employed

The ink dabbed method is used in the acquisition of toeprint records. The whole toes whose prints are to be taken will be rubbed against the stained platen surface simultaneously in this situation. The stained toes are then dabbed on the room provided for them inside the already constructed card prototype, as seen in fig 3.

The toe print is best taken with the entity seated in a chair, the "personnel" squatting before him, and the rolled platen on the floor in front of him. Until staining, a towel can be used to clean the hand. Figure 4 is an image from one of our toe capture sessions

Fig 3: Toeprint card template

Fig 4: Toeprint Capture process

3. Result and Discussion

3.1 Toeprint Class Distribution Analysis

For the experiment, 1183 successful Toeprints were obtained from 140 person lepers from 9 colonies. The 140 individual Toeprints were meant to be 1400; however, due to the poor toes on certain individual lepers, the number was reduced to what it is today (1183). Of the data gathered, 35 major toes were found to be in poor health, along with 25 index toes, 10 middle toes, 17 fourth toes, and 130 little toes. Unsurprisingly, the number of poor toes on the little was so huge. Because of their age, the little toes experience the most during the decay phase of the disease (Mycobacterium leprae disease) and recovery.

A total of 217 toes were in poor condition and could not be analysed.

Table 2: Toeprint Distribution

Lepers Toeprint Distribution (1183)	
Class	**Number**
Left loop	428
Right loop	380
Double loop	62
Whorl	128
Arch	110
Tented arch	75

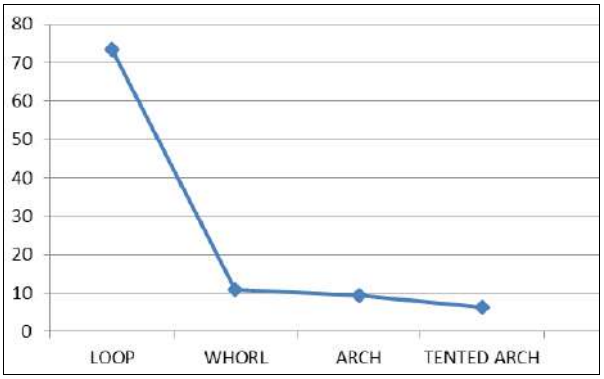


Fig 5: Toeprint chart

3.2 Comparison of Caucasian Fingerprint Distribution and the Lepers Toeprint Distribution.

The FBI (USA) website's Caucasian fingerprint distribution was downloaded and linked to the leper's toeprint distribution. The object of the analogy is to demonstrate the earlier suggestion that toeprints will easily substitute fingerprints for voting purposes for those who do not have fingerprints.

The Caucasian fingerprint loop population is approximately 65.5 percent, while the Lepers toeprint loop population is approximately 73.54 percent. The population of Whorls is 27.9 percent Caucasian fingerprint and 10.8 percent for the leper's Toeprint, which is the second most populous. The tented arch is 2.9 percent of Caucasians' fingerprints and 6.33 percent in Lepers' toeprints, the lowest in both concentrations. The arch for a leper's Toeprint is (9.3 percent) and for a Caucasian fingerprint is (3.7 percent).

Table 3: Percentage by Comparison of Caucasian (USA) Fingerprint Distribution and Lepers Toeprint Distribution (9 Colonies in Nigeria).

Class	Caucasian %	Lepers%
Left loop	33.8	36.2
Right loop	31.7	32.1
Double loop	Not revealed	5.24
Whorl	27.9	10.8
Arch	3.7	9.3
Tented arch	2.9	6.33

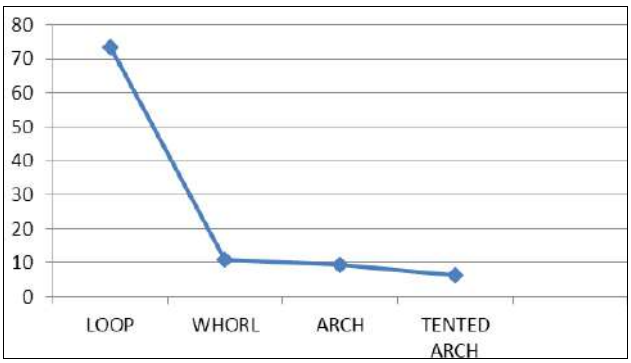
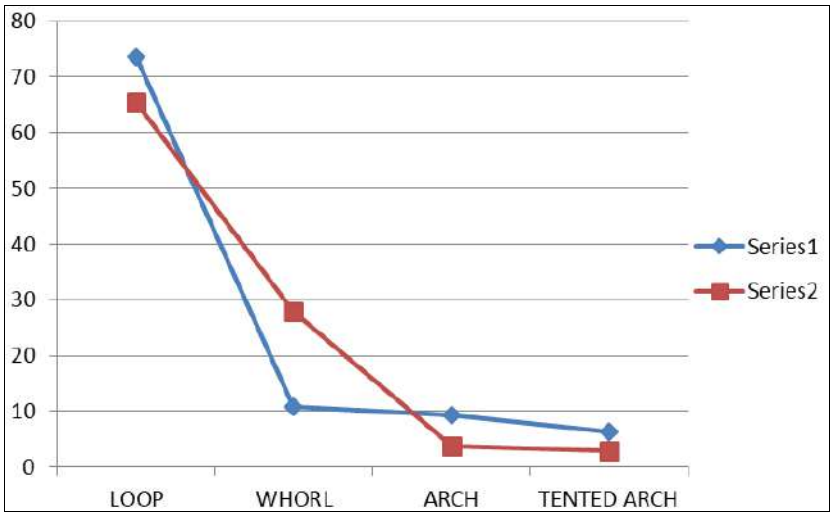


Fig 6: The Caucasian Fingerprint Distribution Plot

Fig 7: The Lepers Toeprint Distribution Plot



Legend
1. Series 1 – Lepers Toeprint
2. Series 2 – Caucasian Fingerprint

Fig 8: Comparison of Caucasian Fingerprint and Lepers Toeprint Percentage

4. Conclusion

By observation, the population distribution for the Caucasian fingerprint (USA) and the Lepers Toeprint (9 Leprosy Colonies in Nigeria) continues to adopt the same pattern. Loops of Caucasian fingerprints and lepers' toeprints are the most common in the population, accounting for roughly two-thirds of all databases obtained. The whorl is the second most populous, followed by the circle, and the tented arch is the least populous. The Toeprint contains many fingerprint groups and minutia points used by specialist programs for image detection and recognition. With this, I would like to infer that the Toeprint can easily substitute the fingerprint for people who lack the fingerprint as a mode of personal identity, especially for voting purposes (lepers and accident victims who have no fingerprints).

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