Data Article

Data extraction of the gray level Co-occurrence matrix (GLCM) Feature on the fingerprints of parents and children in Lombok Island, Indonesia

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A B S T R A C T

Fingerprint data of parents and children were taken directly from Lombok, Indonesia. This dataset was collected from 30 families consisting of father’s, mother’s, and child’s fingerprints. The data were collected from one family to another, with and without a kinship relationship. It was collected with a U are U 4500 SDK Digital Persona and extracted using the feature extraction method from the Gray Level Co-occurrence Matrix (GLCM). This dataset of parent and child fingerprint data can be used in research to determine the texture similarities of parent and child fingerprints. Furthermore, it can also be used in DNA processing, pattern similarity, and verification.

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Specifications Table

| Subject                  | Computer Science                               |
|--------------------------|-----------------------------------------------|
| Specific subject area    | Computer Vision and Pattern Recognition        |
| Type of data             | Table                                         |
| How data were acquired   | The data is taken directly from people in the Lombok region, Indonesia |
| Data format              | Raw and analyzed                              |
| Parameters for data collection | The data taken came from 30 families including the father, mother, and child fingerprints. The age range for data collection was 20-60 years for father and mother, while for children it was 5-25 years. The data collection process involved a total of 15 boys and 15 girls. |
| Description of data collection | This fingerprint data was taken from 30 different families, where each family was taken on the father, mother, and child. Therefore, the total number of fingerprints as a whole is 90. |
| Data source location     | A All data are in the Lombok region, Indonesia. |
| Data accessibility       | The data are available with this article       |

Value of the Data

- This dataset is important because it involves the fingerprints of parents and children from 30 different families, which includes the fingerprints of the father, mother, and child. The data were taken from different families without family ties between one family and another.
- The data will be useful for researches related to fingerprint image processing of parents and children, fingerprint patterns of parents and children, deoxyribonucleic acid (DNA), and verification.
- The details of this data can determine if the texture of the fingerprints of both parents and children are the same. This data can also be used to determine the similarity of fingerprint patterns between parents and their children. Furthermore, it can be extracted using the feature extraction and classification methods.

1. Data Description

Parent and child fingerprints have the same texture [1] and pattern [2]. The fingerprint data used were taken from the Lombok region, Indonesia using a U are U 4500 SDK Digital Persona Finger scanner. The data collection involved 30 families, each with 3 fingerprint samples consisting of father, mother, and child, and therefore the total fingerprints used was 90. This detailed fingerprint collection can be seen in Table 1. The family age range is 20-60 years for father and mother, while for children is 5-25 years. At the time of collecting the children’s fingerprint data, it involved a total of 15 boys and 15 girls.

2. Experimental Design, Materials and Methods

The parent's and children's fingerprint data were taken from one family to another before the extraction stage, and the fingerprints were cropped from their initial size of 154 × 192 pixels to

| No | Fingerprint Name                              | Amount             |
|----|----------------------------------------------|--------------------|
| 1  | Father’s Fingerprint                         | 30 Fingerprints    |
| 2  | Mother’s Fingerprint                         | 30 Fingerprints    |
| 3  | Children’s Fingerprint (15 boys and 15 girl) | 30 Fingerprints    |
Table 2
Child Fingerprint Extraction 0°.

| Family Name       | Correlation | Homogeneity | Energy   | Contrast   |
|-------------------|-------------|-------------|----------|------------|
| Child Family 1    | 0.46463     | 0.10975     | 0.00688  | 9337.06    |
| Child Family 2    | 0.39937     | 0.20868     | 0.03395  | 11653.8    |
| Child Family 3    | 0.63068     | 0.06955     | 0.00208  | 4232.91    |
| Child Family 4    | 0.35439     | 0.31187     | 0.07554  | 11575.9    |
| Child Family 5    | 0.55972     | 0.32424     | 0.08634  | 8800.91    |
| Child Family 6    | 0.47562     | 0.14708     | 0.01429  | 9443.82    |
| Child Family 7    | 0.33698     | 0.07944     | 0.00363  | 11063.6    |
| Child Family 8    | 0.33142     | 0.07574     | 0.00316  | 11086.6    |
| Child Family 9    | 0.33        | 0.09241     | 0.00489  | 11399.3    |
| Child Family 10   | 0.46612     | 0.14803     | 0.01475  | 9474.64    |
| Child Family 11   | 0.45277     | 0.15404     | 0.0354   | 10177.9    |
| Child Family 12   | 0.56049     | 0.09482     | 0.00474  | 7262.29    |
| Child Family 13   | 0.424       | 0.2761      | 0.06176  | 9972.34    |
| Child Family 14   | 0.45913     | 0.09649     | 0.0052   | 8859.55    |
| Child Family 15   | 0.49335     | 0.36044     | 0.11374  | 9661.41    |
| Child Family 16   | 0.48474     | 0.1135      | 0.00737  | 8846.07    |
| Child Family 17   | 0.55744     | 0.28774     | 0.06788  | 8738.97    |
| Child Family 18   | 0.64071     | 0.17604     | 0.02103  | 6648.86    |
| Child Family 19   | 0.38308     | 0.09475     | 0.0052   | 10461.4    |
| Child Family 20   | 0.47299     | 0.13745     | 0.01247  | 9383.67    |
| Child Family 21   | 0.40687     | 0.09927     | 0.00553  | 9931.27    |
| Child Family 22   | 0.38801     | 0.09084     | 0.00467  | 10553.6    |
| Child Family 23   | 0.53211     | 0.10143     | 0.00558  | 8012.68    |
| Child Family 24   | 0.4954      | 0.12685     | 0.00959  | 8876.51    |
| Child Family 25   | 0.45647     | 0.10807     | 0.00672  | 9377.61    |
| Child Family 26   | 0.44949     | 0.09763     | 0.00554  | 9261.83    |
| Child Family 27   | 0.50041     | 0.23825     | 0.04332  | 9760       |
| Child Family 28   | 0.41288     | 0.19606     | 0.02958  | 11137.7    |
| Child Family 29   | 0.31866     | 0.30015     | 0.0775   | 13552.2    |
| Child Family 30   | 0.47041     | 0.12981     | 0.01073  | 9525.15    |

150 × 150 pixels. The data is filtered using the histogram equalization method after cropping to remove noise from the fingerprint. Furthermore, the fingerprint data is extracted using the Gray Level Co-occurrence Matrix (GLCM) method. The GLCM application is created using the C Sharp (C #) programming language. The GLCM features used for extraction are Correlation, Homogeneity, Contrast, and Energy [2]. GLCM has angled for the direction of the matrix calculation, including angles 0°, 45°, 90°, and 135° [3]. This dataset was extracted using 4 GLCM angles 0°, 45°, 90°, and 135°. Table 2 is GLCM extraction using 0° for children’s fingerprints. Table 3 is GLCM feature extraction of 0° for father’s fingerprints, Table 4 is GLCM feature extraction of 0° for mother’s fingerprints, and Table 5 is the extraction of the GLCM 45° features of the child’s finger. Table 6 shows the extraction of the GLCM 45° features of the father’s fingerprint, Table 7 shows the extraction of the GLCM 45° features of the mother’s fingerprint, Table 8 is the extraction of the GLCM features of 90° for children’s fingerprints, Table 9 is the extraction of the GLCM features of 90° of the fathers’ fingerprints, Table 10 is the extraction of features of GLCM 90° of the mother’s fingerprints, while Table 11 shows the extraction of GLCM 135° features in children’s fingerprints. Table 12 is Extraction of GLCM 135° features on father’s fingerprints, and Table 13 shows the extraction of GLCM 135° features on maternal fingerprints.
Table 3
Father Fingerprint Extraction 0°.

| Family Name     | Correlation | Homogeneity | Energy   | Contrast |
|-----------------|-------------|-------------|----------|----------|
| Father Family 1 | 0.49562     | 0.10895     | 0.00667  | 9024.28  |
| Father Family 2 | 0.436       | 0.1095      | 0.00677  | 9756.29  |
| Father Family 3 | 0.75657     | 0.11986     | 0.01049  | 3070.21  |
| Father Family 4 | 0.4101      | 0.31082     | 0.07409  | 10294.9  |
| Father Family 5 | 0.49059     | 0.11513     | 0.00757  | 8679.01  |
| Father Family 6 | 0.57068     | 0.10878     | 0.00654  | 7502.67  |
| Father Family 7 | 0.25551     | 0.07934     | 0.00358  | 12610.1  |
| Father Family 8 | 0.43444     | 0.30818     | 0.07116  | 9595.02  |
| Father Family 9 | 0.45102     | 0.10313     | 0.0062   | 9493.62  |
| Father Family 10| 0.52095     | 0.11723     | 0.0077   | 8267.06  |
| Father Family 11| 0.56101     | 0.07969     | 0.00359  | 6939.8   |
| Father Family 12| 0.38454     | 0.08825     | 0.00441  | 10476.3  |
| Father Family 13| 0.47049     | 0.27926     | 0.06061  | 9016.42  |
| Father Family 14| 0.46846     | 0.09896     | 0.00537  | 8906.03  |
| Father Family 15| 0.46599     | 0.1093      | 0.00684  | 9191.12  |
| Father Family 16| 0.50502     | 0.18437     | 0.02838  | 7563.9   |
| Father Family 17| 0.53316     | 0.39489     | 0.10974  | 8185.54  |
| Father Family 18| 0.59797     | 0.23203     | 0.04535  | 6413.74  |
| Father Family 19| 0.43326     | 0.10722     | 0.00657  | 10185.1  |
| Father Family 20| 0.40686     | 0.08932     | 0.00444  | 10021.6  |
| Father Family 21| 0.52729     | 0.09745     | 0.0054   | 7538.05  |
| Father Family 22| 0.37284     | 0.07622     | 0.00311  | 10326.2  |
| Father Family 23| 0.45958     | 0.08664     | 0.00421  | 9004.29  |
| Father Family 24| 0.46828     | 0.10029     | 0.00583  | 8982.41  |
| Father Family 25| 0.51836     | 0.11337     | 0.00736  | 8630.77  |
| Father Family 26| 0.62151     | 0.12468     | 0.00889  | 6775.14  |
| Father Family 27| 0.55558     | 0.11487     | 0.00758  | 7781.68  |
| Father Family 28| 0.47993     | 0.11457     | 0.00762  | 9197.23  |
| Father Family 29| 0.45703     | 0.10792     | 0.00681  | 9364.71  |
| Father Family 30| 0.51912     | 0.11134     | 0.00715  | 8583.62  |

Table 4
Mother Fingerprint Extraction 0°.

| Family Name     | Correlation | Homogeneity | Energy   | Contrast |
|-----------------|-------------|-------------|----------|----------|
| Mother Family 1  | 0.53099     | 0.11514     | 0.0075   | 8240.13  |
| Mother Family 2  | 0.4613      | 0.13911     | 0.01235  | 9477.54  |
| Mother Family 3  | 0.75048     | 0.15908     | 0.01691  | 3298.77  |
| Mother Family 4  | 0.42156     | 0.35822     | 0.08423  | 10153.3  |
| Mother Family 5  | 0.60645     | 0.12835     | 0.00977  | 7027.3   |
| Mother Family 6  | 0.46311     | 0.16216     | 0.01808  | 9831.48  |
| Mother Family 7  | 0.5266      | 0.10042     | 0.00573  | 8116.66  |
| Mother Family 8  | 0.66967     | 0.20877     | 0.02756  | 4998.09  |
| Mother Family 9  | 0.43472     | 0.09273     | 0.00488  | 9880.65  |
| Mother Family 10 | 0.57624     | 0.38541     | 0.10629  | 7323.5   |
| Mother Family 11 | 0.56441     | 0.20897     | 0.03072  | 8175.21  |
| Mother Family 12 | 0.43295     | 0.09376     | 0.00481  | 9715.04  |
| Mother Family 13 | 0.45822     | 0.08699     | 0.00415  | 8795.94  |
| Mother Family 14 | 0.54136     | 0.11766     | 0.00779  | 7997.46  |
| Mother Family 15 | 0.45288     | 0.09506     | 0.00495  | 9116.65  |
| Mother Family 16 | 0.47743     | 0.10407     | 0.006    | 8862.65  |
| Mother Family 17 | 0.47085     | 0.34251     | 0.09444  | 9653.01  |
| Mother Family 18 | 0.65888     | 0.18097     | 0.02195  | 6353.69  |
| Mother Family 19 | 0.41759     | 0.0946      | 0.0049   | 9891.76  |
| Mother Family 20 | 0.41759     | 0.0946      | 0.0049   | 9891.76  |
| Mother Family 21 | 0.54437     | 0.11835     | 0.00821  | 7891.85  |

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### Table 4 (continued)

| Family Name       | Correlation | Homogeneity | Energy  | Contrast |
|-------------------|-------------|-------------|---------|----------|
| Mother Family 22  | 0.39248     | 0.07489     | 0.00284 | 9823.07  |
| Mother Family 23  | 0.45642     | 0.10012     | 0.00571 | 9368.48  |
| Mother Family 24  | 0.55421     | 0.10444     | 0.00592 | 7622.07  |
| Mother Family 25  | 0.48371     | 0.11751     | 0.00821 | 8986.45  |
| Mother Family 26  | 0.62281     | 0.12459     | 0.00886 | 6723.72  |
| Mother Family 27  | 0.49641     | 0.10199     | 0.00579 | 8659.23  |
| Mother Family 28  | 0.46047     | 0.10227     | 0.00588 | 9103.05  |
| Mother Family 29  | 0.52122     | 0.11333     | 0.00721 | 8290.58  |
| Mother Family 30  | 0.40412     | 0.10031     | 0.00569 | 10077    |

### Table 5

Child Fingerprint Extraction 45°.

| Family Name       | Correlation | Homogeneity | Energy  | Contrast |
|-------------------|-------------|-------------|---------|----------|
| Child Family 1    | 0.42137     | 0.12889     | 0.00938 | 10097    |
| Child Family 2    | 0.3151      | 0.21646     | 0.03676 | 13301.5  |
| Child Family 3    | 0.40583     | 0.03929     | 0.00061 | 6814.46  |
| Child Family 4    | 0.23453     | 0.27763     | 0.06476 | 13719.9  |
| Child Family 5    | 0.33863     | 0.23698     | 0.04558 | 12913.9  |
| Child Family 6    | 0.34691     | 0.1519      | 0.01559 | 11764.3  |
| Child Family 7    | 0.18466     | 0.08312     | 0.0038  | 13599    |
| Child Family 8    | 0.12572     | 0.07245     | 0.00294 | 14499.9  |
| Child Family 9    | 0.08914     | 0.08631     | 0.0043  | 15498.3  |
| Child Family 10   | 0.29652     | 0.1506      | 0.01547 | 12484.1  |
| Child Family 11   | 0.23382     | 0.1451      | 0.01463 | 14256.1  |
| Child Family 12   | 0.20451     | 0.07914     | 0.00339 | 13133.9  |
| Child Family 13   | 0.03938     | 0.18656     | 0.03111 | 16619.9  |
| Child Family 14   | 0.25946     | 0.09796     | 0.00545 | 12633.6  |
| Child Family 15   | 0.24739     | 0.29805     | 0.08207 | 14354.2  |
| Child Family 16   | 0.14375     | 0.10289     | 0.00648 | 14699    |
| Child Family 17   | 0.37672     | 0.28196     | 0.06728 | 12321.3  |
| Child Family 18   | 0.32839     | 0.16177     | 0.0188  | 12430.7  |
| Child Family 19   | 0.17233     | 0.09136     | 0.00487 | 14027.9  |
| Child Family 20   | 0.30118     | 0.13627     | 0.01246 | 12441.9  |
| Child Family 21   | 0.1328      | 0.09343     | 0.00528 | 14524    |
| Child Family 22   | 0.13954     | 0.08426     | 0.00416 | 14832.3  |
| Child Family 23   | 0.31238     | 0.099       | 0.00555 | 11774.7  |
| Child Family 24   | 0.16932     | 0.11268     | 0.00788 | 14613.2  |
| Child Family 25   | 0.17393     | 0.10648     | 0.00652 | 14251.1  |
| Child Family 26   | 0.09381     | 0.08481     | 0.00442 | 15231.5  |
| Child Family 27   | 0.24208     | 0.23028     | 0.04184 | 14822.9  |
| Child Family 28   | 0.21372     | 0.19203     | 0.02925 | 14920.9  |
| Child Family 29   | 0.17279     | 0.2982      | 0.07755 | 16495.4  |
| Child Family 30   | 0.15786     | 0.12147     | 0.00985 | 15152.1  |

### Table 6

Father Fingerprint Extraction 45°.

| Family Name       | Correlation | Homogeneity | Energy  | Contrast |
|-------------------|-------------|-------------|---------|----------|
| Father Family 1   | 0.30195     | 0.11281     | 0.00739 | 12492.1  |
| Father Family 2   | 0.26392     | 0.1154      | 0.00779 | 12737.5  |
| Father Family 3   | 0.62074     | 0.09829     | 0.0069  | 4776.34  |
| Father Family 4   | 0.38878     | 0.30558     | 0.07663 | 10668.3  |
| Father Family 5   | 0.28527     | 0.13283     | 0.01122 | 12602.4  |

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Table 6 (continued)

| Family Name     | Correlation | Homogeneity | Energy | Contrast  |
|-----------------|-------------|-------------|--------|-----------|
| Father Family 6 | 0.24496     | 0.09942     | 0.00586| 13198.9   |
| Father Family 7 | 0.26796     | 0.09576     | 0.00496| 12397.9   |
| Father Family 8 | 0.17604     | 0.23716     | 0.04574| 13976.2   |
| Father Family 9 | 0.18235     | 0.09667     | 0.0056 | 14135.8   |
| Father Family 10| 0.31856     | 0.12278     | 0.00866| 11764.1   |
| Father Family 11| 0.33164     | 0.07266     | 0.003  | 10561     |
| Father Family 12| 0.43356     | 0.11487     | 0.00717| 9707.24   |
| Father Family 13| 0.20745     | 0.21332     | 0.03817| 13492     |
| Father Family 14| 0.27698     | 0.10274     | 0.00587| 12115.7   |
| Father Family 15| 0.41315     | 0.12782     | 0.0094 | 10099.6   |
| Father Family 16| 0.45867     | 0.17988     | 0.02672| 8268.57   |
| Father Family 17| 0.34794     | 0.33243     | 0.08421| 11435.6   |
| Father Family 18| 0.31948     | 0.17505     | 0.02612| 10850.2   |
| Father Family 19| 0.29359     | 0.11435     | 0.00783| 12695.9   |
| Father Family 20| 0.38598     | 0.10953     | 0.00655| 10375.1   |
| Father Family 21| 0.34267     | 0.09403     | 0.0055 | 10470.4   |
| Father Family 22| 0.30503     | 0.0856      | 0.00408| 11438.4   |
| Father Family 23| 0.28931     | 0.09195     | 0.00483| 11840     |
| Father Family 24| 0.23007     | 0.10011     | 0.00587| 13007.3   |
| Father Family 25| 0.51341     | 0.13717     | 0.01081| 8720.87   |
| Father Family 26| 0.29224     | 0.11531     | 0.00786| 12613.3   |
| Father Family 27| 0.32194     | 0.11176     | 0.00749| 11874     |
| Father Family 28| 0.33107     | 0.12882     | 0.00958| 11832.3   |
| Father Family 29| 0.17874     | 0.10406     | 0.00643| 14163.9   |
| Father Family 30| 0.2204      | 0.10348     | 0.00654| 13918     |

Table 7

Ekstraksi GLCM 45° Mother.

| Family Name     | Correlation | Homogeneity | Energy | Contrast  |
|-----------------|-------------|-------------|--------|-----------|
| Mother Family 1  | 0.43314     | 0.12979     | 0.00955| 9958.1    |
| Mother Family 2  | 0.46868     | 0.15786     | 0.01572| 9347.97   |
| Mother Family 3  | 0.54215     | 0.10266     | 0.00758| 6050.51   |
| Mother Family 4  | 0.17926     | 0.26625     | 0.05762| 14406.3   |
| Mother Family 5  | 0.51083     | 0.13629     | 0.01124| 8708.89   |
| Mother Family 6  | 0.42386     | 0.17491     | 0.02096| 10556     |
| Mother Family 7  | 0.29615     | 0.1012      | 0.00567| 12067.3   |
| Mother Family 8  | 0.43516     | 0.1735      | 0.02485| 8540.53   |
| Mother Family 9  | 0.32065     | 0.10717     | 0.00638| 11874.6   |
| Mother Family 10 | 0.25594     | 0.28823     | 0.06555| 12854.8   |
| Mother Family 11 | 0.40529     | 0.21205     | 0.0328 | 11168.9   |
| Mother Family 12 | 0.24321     | 0.2957      | 0.07112| 13416.9   |
| Mother Family 13 | 0.19036     | 0.0781      | 0.00347| 13139.8   |
| Mother Family 14 | 0.24304     | 0.10922     | 0.00684| 13201.7   |
| Mother Family 15 | 0.28902     | 0.09831     | 0.0054 | 11848.1   |
| Mother Family 16 | 0.21477     | 0.09928     | 0.00564| 13320.3   |
| Mother Family 17 | 0.30233     | 0.29686     | 0.07483| 12726     |
| Mother Family 18 | 0.54927     | 0.18894     | 0.02432| 8399.1    |
| Mother Family 19 | 0.17865     | 0.09395     | 0.00501| 13947.7   |
| Mother Family 20 | 0.17865     | 0.09395     | 0.00501| 13947.7   |
| Mother Family 21 | 0.29922     | 0.11411     | 0.00777| 12136.3   |
| Mother Family 22 | 0.23984     | 0.07797     | 0.00329| 12287.8   |
| Mother Family 23 | 0.28438     | 0.10638     | 0.00638| 12329.3   |
| Mother Family 24 | 0.22848     | 0.09338     | 0.00485| 13189.3   |
| Mother Family 25 | 0.21026     | 0.11146     | 0.00767| 13750.5   |
| Mother Family 26 | 0.21463     | 0.10123     | 0.00635| 13604.5   |
| Mother Family 27 | 0.25235     | 0.09812     | 0.00535| 12857     |
| Mother Family 28 | 0.1242      | 0.0883      | 0.00451| 14776     |
| Mother Family 29 | 0.11425     | 0.09897     | 0.00582| 15344     |
| Mother Family 30 | 0.31201     | 0.11106     | 0.00712| 11633.6   |
Table 8
Child Fingerprint Extraction 90°.

| Family Name       | Correlation | Homogeneity | Energy  | Contrast |
|-------------------|-------------|-------------|---------|----------|
| Child Family 1    | 0.66329     | 0.12532     | 0.00846 | 5872.69  |
| Child Family 2    | 0.51127     | 0.21627     | 0.03542 | 9485.12  |
| Child Family 3    | 0.62737     | 0.06088     | 0.00135 | 4270.93  |
| Child Family 4    | 0.53817     | 0.36923     | 0.10014 | 8274.02  |
| Child Family 5    | 0.58489     | 0.24906     | 0.0486  | 8101.84  |
| Child Family 6    | 0.55834     | 0.15193     | 0.01471 | 7951.5   |
| Child Family 7    | 0.65314     | 0.10412     | 0.00554 | 5786.68  |
| Child Family 8    | 0.68137     | 0.09838     | 0.00501 | 5282.85  |
| Child Family 9    | 0.55987     | 0.10552     | 0.00596 | 7485.52  |
| Child Family 10   | 0.57583     | 0.15488     | 0.01554 | 7526.25  |
| Child Family 11   | 0.4825      | 0.15283     | 0.0153  | 9626.01  |
| Child Family 12   | 0.45965     | 0.08069     | 0.00341 | 8928.41  |
| Child Family 13   | 0.52082     | 0.30557     | 0.07269 | 8295.17  |
| Child Family 14   | 0.61918     | 0.10735     | 0.0063  | 6493.48  |
| Child Family 15   | 0.45213     | 0.35422     | 0.10811 | 10450.4  |
| Child Family 16   | 0.51819     | 0.11601     | 0.00772 | 8266.56  |
| Child Family 17   | 0.59277     | 0.29208     | 0.07014 | 8043.64  |
| Child Family 18   | 0.67824     | 0.17533     | 0.0201  | 5957.15  |
| Child Family 19   | 0.6181      | 0.1116      | 0.00701 | 6472.31  |
| Child Family 20   | 0.61241     | 0.14584     | 0.01315 | 6900.13  |
| Child Family 21   | 0.63669     | 0.11742     | 0.00729 | 6087.11  |
| Child Family 22   | 0.42197     | 0.09113     | 0.00458 | 9959.04  |
| Child Family 23   | 0.58208     | 0.09928     | 0.00531 | 7153.9   |
| Child Family 24   | 0.50505     | 0.12363     | 0.00906 | 8700.48  |
| Child Family 25   | 0.56401     | 0.11425     | 0.00733 | 7513.92  |
| Child Family 26   | 0.47005     | 0.09806     | 0.00548 | 8913.07  |
| Child Family 27   | 0.47379     | 0.23554     | 0.04216 | 10275.8  |
| Child Family 28   | 0.54232     | 0.20398     | 0.0308  | 8680.92  |
| Child Family 29   | 0.56667     | 0.31403     | 0.08181 | 8620.64  |
| Child Family 30   | 0.36166     | 0.11943     | 0.00921 | 11485.6  |

Table 9
Father Fingerprint Extraction 90°.

| Family Name       | Correlation | Homogeneity | Energy  | Contrast |
|-------------------|-------------|-------------|---------|----------|
| Father Family 1   | 0.6499      | 0.11829     | 0.00762 | 6264.11  |
| Father Family 2   | 0.66958     | 0.12357     | 0.00825 | 5710.21  |
| Father Family 3   | 0.85674     | 0.17901     | 0.01538 | 1810.41  |
| Father Family 4   | 0.6063      | 0.3742      | 0.10189 | 6869.93  |
| Father Family 5   | 0.62972     | 0.14044     | 0.01172 | 6524.14  |
| Father Family 6   | 0.6033      | 0.10679     | 0.00632 | 6930.11  |
| Father Family 7   | 0.70662     | 0.11318     | 0.00662 | 4965.1   |
| Father Family 8   | 0.57926     | 0.3549      | 0.08843 | 7134.23  |
| Father Family 9   | 0.53455     | 0.1051      | 0.00632 | 8045.53  |
| Father Family 10  | 0.62943     | 0.12444     | 0.00849 | 6395.92  |
| Father Family 11  | 0.67846     | 0.09304     | 0.00408 | 5083.83  |
| Father Family 12  | 0.61145     | 0.10555     | 0.00569 | 6658.08  |
| Father Family 13  | 0.59751     | 0.31788     | 0.07674 | 6849.75  |
| Father Family 14  | 0.58083     | 0.10576     | 0.00599 | 7022.49  |
| Father Family 15  | 0.58879     | 0.11701     | 0.00768 | 7073.52  |
| Father Family 16  | 0.57689     | 0.23086     | 0.03544 | 6474.14  |
| Father Family 17  | 0.63242     | 0.42838     | 0.12654 | 6442.67  |
| Father Family 18  | 0.64278     | 0.27203     | 0.05219 | 5698.34  |
| Father Family 19  | 0.57345     | 0.11529     | 0.0075  | 7665.03  |
| Father Family 20  | 0.59991     | 0.10398     | 0.00576 | 6758.71  |
| Father Family 21  | 0.68853     | 0.10688     | 0.00641 | 4970.81  |
| Father Family 22  | 0.60586     | 0.09021     | 0.00421 | 6488.34  |

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Table 9 (continued)

| Family Name | Correlation | Homogeneity | Energy | Contrast |
|-------------|-------------|-------------|--------|----------|
| Father Family 23 | 0.43232 | 0.07996 | 0.00362 | 9449.9 |
| Father Family 24 | 0.5611 | 0.10232 | 0.00582 | 7412.66 |
| Father Family 25 | 0.60128 | 0.11658 | 0.00753 | 7137.8 |
| Father Family 26 | 0.60359 | 0.11556 | 0.00761 | 7061.15 |
| Father Family 27 | 0.58738 | 0.11386 | 0.00734 | 7225.64 |
| Father Family 28 | 0.66862 | 0.12736 | 0.00926 | 5854.8 |
| Father Family 29 | 0.56942 | 0.11299 | 0.00728 | 7418.97 |
| Father Family 30 | 0.57075 | 0.10986 | 0.00688 | 7654.77 |

Table 10
Mother Fingerprint Extraction 90°.

| Family Name | Correlation | Homogeneity | Energy | Contrast |
|-------------|-------------|-------------|--------|----------|
| Mother Family 1 | 0.66835 | 0.12272 | 0.0085 | 5819.11 |
| Mother Family 2 | 0.64711 | 0.1539 | 0.01441 | 6206.59 |
| Mother Family 3 | 0.75344 | 0.15845 | 0.01624 | 3257.92 |
| Mother Family 4 | 0.53868 | 0.37364 | 0.10057 | 8095.64 |
| Mother Family 5 | 0.54952 | 0.11663 | 0.00825 | 8014.15 |
| Mother Family 6 | 0.60932 | 0.17361 | 0.01966 | 7157.06 |
| Mother Family 7 | 0.65806 | 0.1081 | 0.00656 | 5862.96 |
| Mother Family 8 | 0.59317 | 0.21743 | 0.03371 | 6145.58 |
| Mother Family 9 | 0.53597 | 0.10093 | 0.00562 | 8106.42 |
| Mother Family 10 | 0.56284 | 0.38803 | 0.10505 | 7553.71 |
| Mother Family 11 | 0.66032 | 0.21265 | 0.03129 | 6371.88 |
| Mother Family 12 | 0.62823 | 0.42117 | 0.12492 | 6592.19 |
| Mother Family 13 | 0.47413 | 0.09769 | 0.00547 | 8867.54 |
| Mother Family 14 | 0.57709 | 0.11674 | 0.00756 | 7368.17 |
| Mother Family 15 | 0.6082 | 0.10238 | 0.00554 | 6527.98 |
| Mother Family 16 | 0.62694 | 0.10965 | 0.00672 | 6324.98 |
| Mother Family 17 | 0.61429 | 0.3893 | 0.11646 | 7034.98 |
| Mother Family 18 | 0.58983 | 0.17204 | 0.02026 | 7635.91 |
| Mother Family 19 | 0.53396 | 0.09893 | 0.00541 | 7911.73 |
| Mother Family 20 | 0.53396 | 0.09893 | 0.00541 | 7911.73 |
| Mother Family 21 | 0.62467 | 0.12271 | 0.00851 | 6499.32 |
| Mother Family 22 | 0.52516 | 0.0816 | 0.00339 | 7672.77 |
| Mother Family 23 | 0.60953 | 0.1103 | 0.00643 | 6724.71 |
| Mother Family 24 | 0.45303 | 0.09258 | 0.0048 | 9339.47 |
| Mother Family 25 | 0.53064 | 0.11759 | 0.00797 | 8170.53 |
| Mother Family 26 | 0.52494 | 0.10526 | 0.00641 | 8226.1 |
| Mother Family 27 | 0.45288 | 0.09247 | 0.00476 | 9409.8 |
| Mother Family 28 | 0.47413 | 0.09769 | 0.00547 | 8867.54 |
| Mother Family 29 | 0.43667 | 0.10041 | 0.00588 | 9757.95 |
| Mother Family 30 | 0.60203 | 0.11341 | 0.00717 | 6729.27 |

Table 11
Child Fingerprint Extraction 135°.

| Family Name | Correlation | Homogeneity | Energy | Contrast |
|-------------|-------------|-------------|--------|----------|
| Child Family 1 | 0.26818 | 0.11215 | 0.00719 | 12770.3 |
| Child Family 2 | 0.22192 | 0.2092 | 0.03446 | 15111.1 |
| Child Family 3 | 0.35102 | 0.03529 | 0.00054 | 7443.34 |
| Child Family 4 | 0.23507 | 0.27884 | 0.06343 | 13710.2 |
| Child Family 5 | 0.4136 | 0.24623 | 0.04853 | 11450 |
| Child Family 6 | 0.25189 | 0.14423 | 0.01432 | 13476.1 |

(continued on next page)
### Table 11 (continued)

| Family Name           | Correlation | Homogeneity | Energy   | Contrast |
|-----------------------|-------------|-------------|----------|----------|
| Child Family 7        | 0.26355     | 0.08983     | 0.00441  | 12283.2  |
| Child Family 8        | 0.32867     | 0.09282     | 0.00477  | 1134.1   |
| Child Family 9        | 0.27424     | 0.10404     | 0.00617  | 12348.9  |
| Child Family 10       | 0.30669     | 0.15368     | 0.01589  | 12303.5  |
| Child Family 11       | 0.27061     | 0.15016     | 0.01549  | 12371.8  |
| Child Family 12       | 0.32055     | 0.09071     | 0.00436  | 11218.1  |
| Child Family 13       | 0.41157     | 0.27507     | 0.0631   | 10180.4  |
| Child Family 14       | 0.43245     | 0.11713     | 0.00773  | 9683.29  |
| Child Family 15       | 0.23763     | 0.29527     | 0.08107  | 14540.5  |
| Child Family 16       | 0.42477     | 0.13287     | 0.01003  | 9874.9   |
| Child Family 17       | 0.43727     | 0.28612     | 0.06899  | 11124.3  |
| Child Family 18       | 0.6677      | 0.19486     | 0.02516  | 6150.44  |
| Child Family 19       | 0.35581     | 0.10777     | 0.00689  | 10918.1  |
| Child Family 20       | 0.38478     | 0.14664     | 0.01412  | 10953.2  |
| Child Family 21       | 0.43399     | 0.11937     | 0.00813  | 9479.81  |
| Child Family 22       | 0.22853     | 0.09293     | 0.00507  | 13298.3  |
| Child Family 23       | 0.40585     | 0.10815     | 0.00656  | 10174.1  |
| Child Family 24       | 0.36487     | 0.13285     | 0.01074  | 11172.9  |
| Child Family 25       | 0.38917     | 0.12503     | 0.00874  | 10537.8  |
| Child Family 26       | 0.36695     | 0.10958     | 0.00695  | 10640.5  |
| Child Family 27       | 0.34622     | 0.2378      | 0.04442  | 12786.1  |
| Child Family 28       | 0.33075     | 0.20027     | 0.03116  | 12700    |
| Child Family 29       | 0.32862     | 0.31123     | 0.08248  | 13387.9  |
| Child Family 30       | 0.21591     | 0.12414     | 0.01023  | 14107.5  |

### Table 12

Father Fingerprint Extraction 135°.

| Family Name           | Correlation | Homogeneity | Energy   | Contrast |
|-----------------------|-------------|-------------|----------|----------|
| Father Family 1       | 0.46417     | 0.12987     | 0.00947  | 9589.08  |
| Father Family 2       | 0.3867      | 0.12652     | 0.00914  | 10612.7  |
| Father Family 3       | 0.6822      | 0.10764     | 0.00775  | 4002.37  |
| Father Family 4       | 0.17745     | 0.24581     | 0.05006  | 14356.6  |
| Father Family 5       | 0.45511     | 0.15063     | 0.01369  | 9607.66  |
| Father Family 6       | 0.55401     | 0.13204     | 0.0097   | 7796.45  |
| Father Family 7       | 0.11956     | 0.0846      | 0.00414  | 14911.5  |
| Father Family 8       | 0.36421     | 0.28597     | 0.06524  | 10784.6  |
| Father Family 9       | 0.3545      | 0.11387     | 0.00745  | 11159.5  |
| Father Family 10      | 0.42882     | 0.13119     | 0.00964  | 9860.34  |
| Father Family 11      | 0.49129     | 0.08606     | 0.00404  | 8038.06  |
| Father Family 12      | 0.17133     | 0.08684     | 0.00417  | 14200.9  |
| Father Family 13      | 0.43997     | 0.27169     | 0.05952  | 9533.69  |
| Father Family 14      | 0.30701     | 0.10419     | 0.00605  | 11612.5  |
| Father Family 15      | 0.21749     | 0.1056      | 0.0067   | 13467.3  |
| Father Family 16      | 0.11443     | 0.11413     | 0.01156  | 13526.3  |
| Father Family 17      | 0.36686     | 0.33668     | 0.08783  | 11037.7  |
| Father Family 18      | 0.4741      | 0.20916     | 0.03723  | 8384.88  |
| Father Family 19      | 0.30022     | 0.11846     | 0.00811  | 12576.7  |
| Father Family 20      | 0.17802     | 0.0878      | 0.00431  | 13888.7  |
| Father Family 21      | 0.43146     | 0.09953     | 0.00593  | 9056.13  |
| Father Family 22      | 0.20218     | 0.07824     | 0.00327  | 13131.2  |
| Father Family 23      | 0.14961     | 0.07809     | 0.00349  | 14168.2  |
| Father Family 24      | 0.35821     | 0.10876     | 0.00684  | 10842.3  |
| Father Family 25      | 0.25221     | 0.11206     | 0.00747  | 13402.2  |
| Father Family 26      | 0.57704     | 0.14521     | 0.01216  | 7537.66  |
| Father Family 27      | 0.42818     | 0.12146     | 0.00846  | 10013.4  |
| Father Family 28      | 0.38919     | 0.13176     | 0.00994  | 10804.1  |
| Father Family 29      | 0.39031     | 0.12911     | 0.00823  | 10515    |
| Father Family 30      | 0.48569     | 0.13394     | 0.00963  | 9181.76  |
Table 13
Mother Fingerprint Extraction 135°.

| Family Name   | Correlation | Homogeneity | Energy   | Contrast |
|---------------|-------------|-------------|----------|----------|
| Mother Family 1 | 0.37402     | 0.12273     | 0.00866  | 10996.6  |
| Mother Family 2 | 0.21242     | 0.13209     | 0.01167  | 13856.4  |
| Mother Family 3 | 0.60318     | 0.12535     | 0.01088  | 5244.04  |
| Mother Family 4 | 0.34425     | 0.31249     | 0.07701  | 11510.4  |
| Mother Family 5 | 0.28795     | 0.11782     | 0.00838  | 12676.8  |
| Mother Family 6 | 0.26268     | 0.15954     | 0.01784  | 13509.2  |
| Mother Family 7 | 0.49051     | 0.12029     | 0.00803  | 8735.03  |
| Mother Family 8 | 0.36339     | 0.15133     | 0.01834  | 9626.01  |
| Mother Family 9 | 0.22665     | 0.09693     | 0.0053   | 13571.4  |
| Mother Family 10 | 0.45821    | 0.34447     | 0.0908   | 9360.24  |
| Mother Family 11 | 0.44088     | 0.21409     | 0.03371  | 10500.4  |
| Mother Family 12 | 0.42761     | 0.34714     | 0.09555  | 10147.7  |
| Mother Family 13 | 0.32837     | 0.08954     | 0.04449  | 10900    |
| Mother Family 14 | 0.50507     | 0.13748     | 0.01068  | 8631.46  |
| Mother Family 15 | 0.29065     | 0.09886     | 0.00547  | 11820.9  |
| Mother Family 16 | 0.48178     | 0.12695     | 0.00893  | 8790.66  |
| Mother Family 17 | 0.37503     | 0.31571     | 0.08291  | 1140     |
| Mother Family 18 | 0.36874     | 0.17197     | 0.02058  | 11763.3  |
| Mother Family 19 | 0.34183     | 0.10978     | 0.00657  | 11176.9  |
| Mother Family 20 | 0.34183     | 0.10978     | 0.00657  | 11176.9  |
| Mother Family 21 | 0.49586     | 0.13507     | 0.01043  | 8730.83  |
| Mother Family 22 | 0.22168     | 0.07645     | 0.00306  | 12581.7  |
| Mother Family 23 | 0.33037     | 0.11065     | 0.00679  | 11537    |
| Mother Family 24 | 0.3461      | 0.10589     | 0.00631  | 11178.4  |
| Mother Family 25 | 0.34132     | 0.12344     | 0.00915  | 11468.4  |
| Mother Family 26 | 0.31047     | 0.11082     | 0.00739  | 11944.4  |
| Mother Family 27 | 0.28679     | 0.10259     | 0.00606  | 12265    |
| Mother Family 28 | 0.35214     | 0.11058     | 0.00683  | 10930.3  |
| Mother Family 29 | 0.37856     | 0.12161     | 0.00845  | 10765.2  |
| Mother Family 30 | 0.2254      | 0.10301     | 0.00616  | 13098.1  |

Ethics Statement

The local government has approved to carry out this research. All participants involved in fingerprinting had given their consent to participate in this research.

CRediT Author Statement

**Lalu Darmawan Bakti**: Conceptualization, Methodology; **Bahtiar Imran**: Software, Validation; **Erfan Wahyudi**: Formal analysis, Investigation, Resources; **Dwinita Arwidiyarti**: Data curation, Writing - original draft; **Emi Suryadi**: Writing - review & editing, Visualization; **Muhammad Multazam**: Project administration, Supervision; **Maspæni**: Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests, commercial, associative or personal relation-ships that could have appeared to influence the work reported in this paper.

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