NIST Special Database 18
Mugshot Identification Database

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1.0 Introduction

This document describes the updated web released *NIST Special Database 18*, which contains 3 248 8-bit gray scale images of mugshot photographs in PNG format. The original CD-ROM released *Special* Database18 was NIST IHEAD formatted images using a modified JPEG lossless [1] compression algorithm. The IHEAD header had the metadata that was provided in the AN2 file and can be found in the metadata txt file included in this new release of the database.

This database is being distributed for use in developing and testing of mugshot identification systems. The database contains images of 1573 individuals (cases) with a total of 3248 images stored in PNG format. The mugshots are mainly of male cases, with the database containing 1495 male cases and 78 female cases. The gender and age of each individual are stored in a text file that accompanies each image.

The database images consist of both front views and side views (profiles), although not every case has both a front and profile. Looking at the front views and profiles separately, there are 131 cases with two or more front views and 1418 with only one front view. There are 89 cases with two or more profiles and 1268 with only one profile. In cases that have both fronts and profiles, there are only 89 cases with two or more of both fronts and profiles, 27 with two or more fronts and one profile, and 1217 with only one front and one profile.

The size of each image varies, because the mugshot photographs vary in size from 1" - 2 1/2" in height. Rather than storing an image that was more than 50% background pixels, some of the background was discarded. All of the images except for 43 were scanned at 19.685 pixels per millimeter (ppmm) (500 dots per inch (dpi)). The 43 that weren't scanned 19.685 ppmm (500 dpi) were full front views of the individual. In order to get sufficient facial information, the heads of these image were scanned at 39.37 ppmm (1000 dpi).

1.1 Data converted to PNG

The *Special Database 18* NIST IHEAD formatted images and data were converted to ANSI/NIST (AN2) [2] formatted files that contained a single grayscale mugshot image per file. Information and images are extracted from the AN2 file using NIST Biometric Image Software (NBIS) [3] (e.g. an2ktool) and Netpbm packages and converted into Portable Network Graphics (PNG) [4] images and corresponding (metadata) TXT files. The naming of the "AN2" files is set up as 00001_1.an2. The first number in the filename is for the subject number. The number after the underscore in the filename is the instance of the subject view (e.g. there could be multiple facial views of the same individual). The SD18 data directory contains for each subject, a PNG

file and corresponding “TXT” (metadata) file for each image. Below are the steps taken to convert the original database images to the updated web version.

1.2 Image File Conversion

a. The NBIS An2ktool was used to extract Type-1, Type-2, and Type-10 record information and images from an ANSI/NIST file. Each image file was renamed with original AN2 file name and either F for frontal view of the subject or R/L for either the right or the left side view of the subject at the end of the filename. The file has an extension of PNG (00117_1_R.png).

b. The NBIS Djpegl program was used to convert the JPEGL file into a) a raw image and b) a NISTCOM (NCM) [3] text file which contains the image height and width information.

c. The Netpbm Rawtopgm program, along with the height and the width of the image was used to convert the raw image into a PGM (Netpgm grayscale image) file.

d. The Netpbm Pnmtopng program was used to convert the PGM to a PNG (e.g., crd_0001f_01.png) file.

1.3 Text file creation

1. There is no information from the Type-1 record that was extracted for the metadata text file.

2. The Type-2 record contains the field (2.024) that has the gender of the subject in the AN2 file. The gender information was extracted and put into a metadata file with the same naming as the “PNG” image file but with the “TXT” extension.

3. The Type-10 record holds the image for the subject and some information pertaining to the image. The field (10.200) has the History value e.g., "History: f0001_01.pct", field (10.013) has the age of the individual “Age 20” and field (10.20) has the position of the face “Position R” which are extracted and put into the existing metadata file with the Gender value.

4. The resulting files are stored in a hierarchy of directories similar to that of the source files.

2.0 Database Scanning Procedures

The images were scanned using a Kodak MegaPixel1 [[1]] camera [5] and lighting powered by a direct current (DC) power supply to eliminate light flicker. In order to scan images of consistent quality the reflectance and focusing were checked approximately every two hours using the procedures described in the next two sections.

2.1 Database Reflectance Calibration

The reflectance for the images scanned in *NIST Special Database 18* was calibrated using two reflectance charts. The first one consisted of continuous gray tones from black to white and the second contained only 64 gray levels from black to white partitioned into distinct blocks. The lighting intensity was adjusted so that the charts, when scanned, produced gray levels from 38 to 255. The range of 217 gray levels was the maximum range the camera was able to distinguish.

2.2 Camera Focusing

The focusing procedure used a target image which consisted of equally spaced, alternating black and white lines. Using a software tool, the standard deviation of the gray level values on a line perpendicular to the black and white lines in the target image was calculated. The procedure used was to adjust the camera focus so that the standard deviation of the cross-section was maximum. The maximum standard deviation is the point at which there is the least "blurring" in the transition regions between the white and black lines thereby focusing the camera.

The zip file contain the mugshot images stored in a set of subdirectories as shown in Figure 1. The directory multiple contains all of the cases for which there are two or more photos of an individual from the same view (front or profile). In the multiple directory: fm_pm contains all cases for which there are two or more images of both the front and profile views, fm_p1 contains all cases with two or more images of the front view but only one image for the profile view, and fm_p0 is all files with two or more front views and no profiles. The single directory is divided in much the same manner with: f1_p1 containing all the images having only one front and one profile view, f1_p0 is for one front view and no profile view, and f0_p1 is no fronts and one profile. Since f1_p1 contained 2434 images it was divided into subdirectories (sing01-sing24) with each containing 50 cases, except for the first (sing01-68 cases) and last (sing24-49 cases).

The file naming structure consist of a five-digit number, a single digit number, a letter and a ".png" extension. The five digit (for example 00001) number is a "case" sequence number; all files with the same case sequence number are different images of the same person. The second number is separated from the case sequence number by a "_" symbol. This second number is used to distinguish between multiple mugshots of the same case, with the mugshot of the person at their youngest age first (_1) and older age mugshots following in order, by age (_2, _3, ...).

[1] The Kodak MegaPixel is identified in order to adequately specify or describe the subject matter of this work. In no case does such identification imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the equipment is necessarily the best available for the purpose.

The letter is an F (front) or R/L (right or left profile) indicating what view of the individual is contained in the image. If a front and profile right/left profile have the same case number and the final digit is the same it means the images were taken at the same “sitting” with one pose being a front and one being a profile. Not all front views have an accompanying profile.

The text file for each image has the Gender, Age, and Position of profile of the individual in the image and the History of the image. If the letters **na** (not available) appear in the age field, it means there wasn’t enough information to calculate the age.

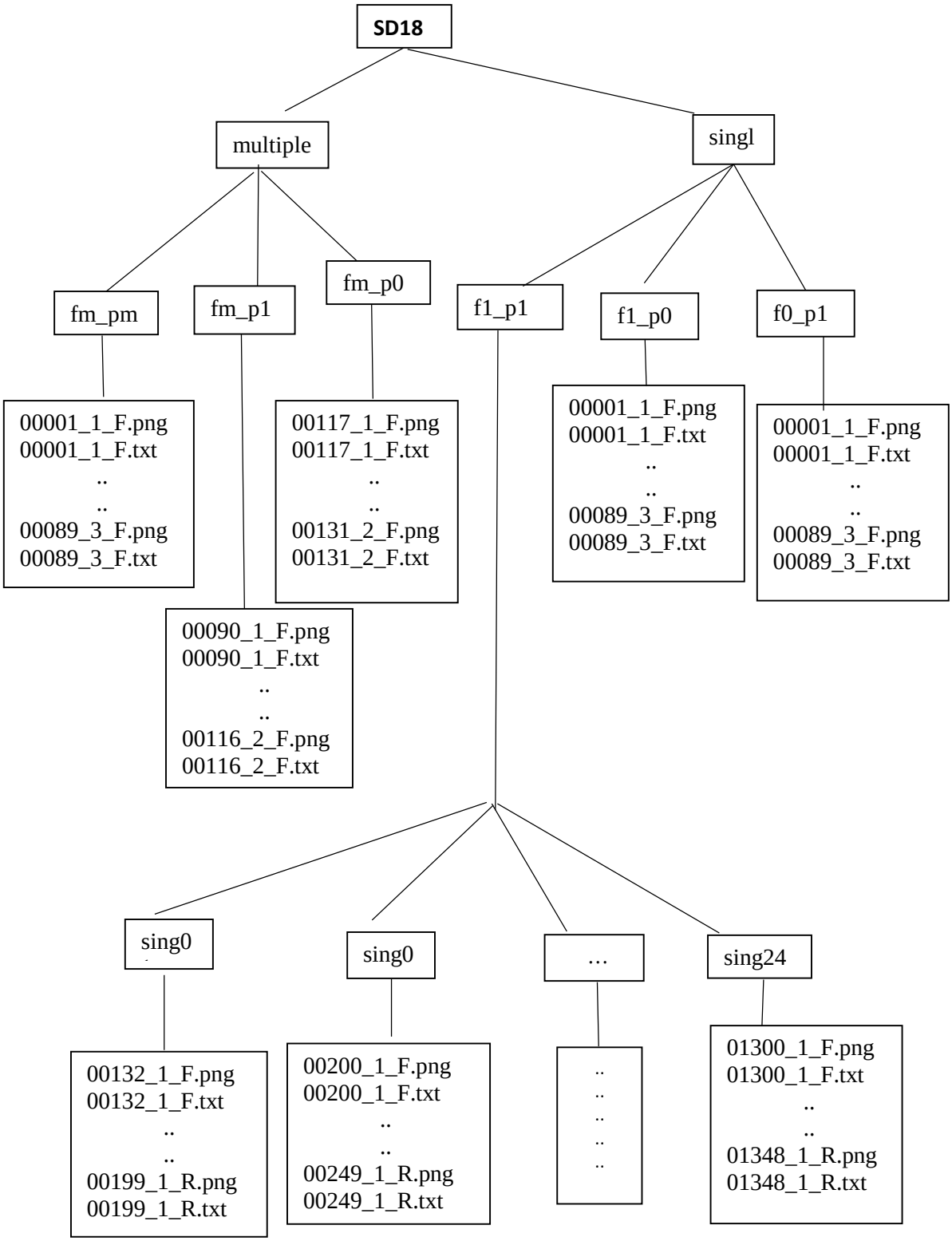

Figure 1: Arrangement of files for *NIST Special Database 18*

3.0 References

[1]"Information technology -- Lossless and near-lossless compression of continuous tone still images: Baseline," International Organization for Standardization/International Electrotechnical Commission, ISO/IEC 14495-1:1999.

[2] K. Mangold Ed., "Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information," American National Standard, ANSI/NIST-ITL 1-2011:2015.

[3] C. Watson et al., "User's Guide to NIST Biometric Image Software," National Institute of Standards and Technology ITL/IAD/Image Group, October 2004.

[4] "Information technology -- Computer graphics and image processing -- Portable Network Graphics (PNG): Functional specification," International Organization for Standardization/International Electrotechnical Commission, ISO/IEC 15948:2004

[5] The camera used was a Kodak MegaPixel Model 1.4.