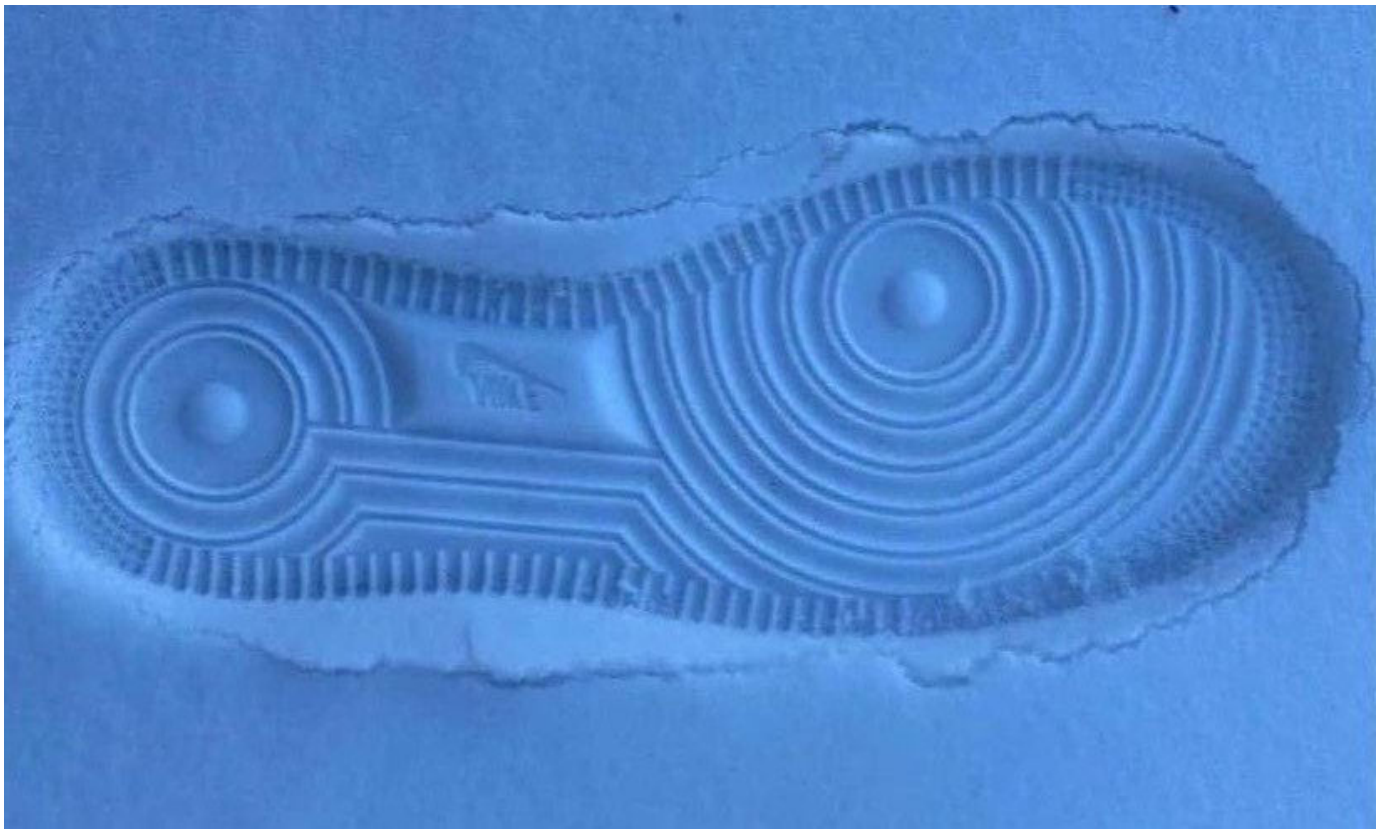
THE IDENTIFIER



INSIDE THIS ISSUE

Go Digital

"WE HAVE SEEN SUCH AN INCREASE IN IDENTIFICATIONS SINCE WE HAVE BEEN USING THE SOFTWARE.
WE LOVE IT...EVEN US OLD DINOSAURS :) "

-A SATISFIED CUSTOMER WHO HAS BEEN USING COMPARATOR FOR ALMOST A YEAR. PREVIOUSLY THEY DID NOT USE ANY SOFTWARE FOR FINGERPRINT COMPARISONS.

TAKE A CLOSER LOOK

WWW.CSIPIX.COM

LETTER FROM THE PRESIDENT

Hello SCIAI Members,

Hope everyone had a great Thanksgiving and are ready for the upcoming holidays right around the corner! We have had a busy fall as an organization with both of our fall workshops. I want to thank Southeastern Investigative Group for leading our Crime Scene Workshop in Shooting Reconstruction and I want to thank Melissa Gische and Michelle Machalka with FBI for leading our Latent Print Workshop. I think both classes proved very valuable for attendees and offered very affordable training opportunities to those who were able to attend.

The SCIAI is now kicking into gear for our upcoming 2023 Training Conference in Charleston, SC on May 9-11th 2023. Registration is now **OPEN!** We are excited to announce multiple speakers already lined up to include: Casson Reynolds from the North Carolina Justice Academy, Alice White from Evolve Forensics, and representatives from Orlando PD coming to present the Pulse Nightclub Shooting. More speakers will be announced as we confirm them but there is no doubt there will be 3 days of quality content.

Conference registration this year is $80 for members and $160 for non-members. Student members can attend for free (Student memberships are only $35)! We are striving to keep our conferences affordable while we continue to grow as an organization. This conference will have numerous training topics, a vendor exhibition hall, a welcome social Monday night, and an evening social Wednesday night. Both social events are included in your registration cost and will be a great time! Registration can be found at https://www.sciai.org/SpringConf.html

As this year in our organization is coming to its closing months I encourage all of you to consider running for office at the conference. This organization is only here because of past officers who have stepped up and grown this organization from the ashes. A lot of hard work has gotten us this far but we can only continue with continued efforts from members. Officer position descriptions can be found in the by-laws on the news page of our website (www.sciai.org).

Thanks for all that you do every day!

Stay Safe,

MEET THE OFFICERS

- **Luke Spratt — President**
- **Chris Wilson — 1st Vice President**
- **Anita Moore — 2nd Vice President & Historian**
- **Chris Gary — Secretary & State Representative**
- **Harold Bouknight — Sergeant at Arms**
- **Tyler Bucholtz — Treasurer**
- **Brittany Brown — Editor**
- **Jeffrey Scott — Vendor Representative**

SCIAI ANNOUNCEMENTS

- ALL MEMBERS are encouraged to review the SCIAI constitution and by-laws posted on the website located under the News tab.
- Submissions for case study features and Member Spotlights are open. We want to highlight our members and interesting or unique cases that you have personally been involved with. If you would like to see yourself, a coworker, or one of your cases featured, please contact the Editor at bribrown@greenvillecounty.org
- Have a topic you would like to see covered or have an article you would like to submit for future issues of *The Identifier*? Submit your proposals to the Editor at bribrown@greenvillecounty.org — guest authors are welcome!
- If you've taken a newsletter appropriate forensic related photograph that you would like to see featured in an upcoming issue of The Identifier — Please contact the Editor at bribrown@greenvillecounty.org!

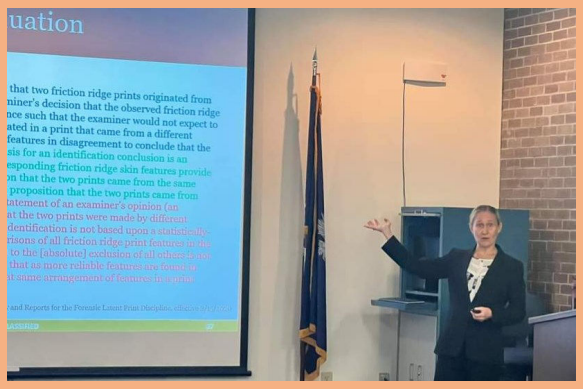
OFFICER MEETING RECAP

During the November 16th virtual meeting, attending officers discussed the success of the two single discipline workshops offered by the SCIAI. Recaps were given and it was established that the attendance for both workshops was high and the topics were beneficial to attendees. Future plans for the 2023 Spring Conference were discussed by attending officers. The three day conference will be held at the College of Charleston SSM building in Charleston, SC. The cost of registration was discussed to make the tickets more affordable for members and encourage non-members to sign up. Vendors and sponsorships opportunities were discussed to help cover the cost of events and refreshments/food. Keynote speakers are in the process of being secured for the conference. Officers discussed acquiring more signage for displays and to make the check-in and registration table more official. Ideas for SCIAI logo merchandise were also discussed.

Training Recap; Latent Print Training

Recent Trends in Fingerprint Evidence

On October 4, 2022, the SCIAI hosted an 8-hour Latent Print Workshop at the SC Criminal Justice Academy. The workshop focused on recent admissibility challenges, published analytical reports, and future policies and standards related to the Latent Print discipline. FBI Latent Print Lab Directors Melissa Gische and Michelle Machalka presented each criticism from these recent publications and then provided detailed scientific studies that support Latent Prints against those criticisms. The 18 latent print examiners that attended the Latent Print Workshop gained a significant amount of knowledge on how to handle challenges to latent prints in the courtroom, and be more transparent in our explanations to a jury.



The SCIAI would like to thank the SC Criminal Justice Academy for the venue, Foray Technologies for providing lunch for all attendees, and the FBI for providing travel and lodging for the instructors. Instructors like Melissa Gische and Michelle Machalka sharing their experience and knowledge with other practitioners is what increases the quality and effectiveness of our work product. The SCIAI was able to provide this training free of charge for members due to the generosity of these sponsors.

FORAY™ TECHNOLOGIES

Training Recap; Crime Scene Training Shooting Incident Reconstruction

On September 22, 2022, the SCIAI along with the Southeastern Investigative Group put on a Shooting Reconstruction workshop in Columbia at the RCSD firing range. 15 members participated in the hands-on workshop that included distance determination, live fire demonstrations, documentation of shooting scenes, trajectory and measurements. We want to thank those who participated as well as the Southeastern Investigative Group for putting on such a great workshop and BlueStar Forensics for providing lunch.

CONFERENCE INFORMATION

Location:

College of Charleston- Sciences and Mathematics Building

~ 202 Calhoun St., Charleston, SC, 29403 ~

Registration:

Registration open to Forensic Scientists, Crime Scene Investigators, Detectives, Law Enforcement, Attorneys/ Solicitors/ Judges, and Criminal Justice/ Forensic Science Students

Members: $80; Non-Members $160

($50 active/associate memberships-available on sciai.org)

Student Members: Free; Student Non-Members $50

($35 student membership-available on sciai.org)

Registration Link: https://forms.gle/HtuQMa1zfkXVeEyR8

HOTEL INFORMATION

Embassy Suites by Hilton Charleston Historic District

Address: 337 Meeting St., Charleston, SC, 29403

SCIAI Rate: $228/night (rate matches government rate: includes free breakfast and happy hour, parking is $25/night)

The Embassy Suites is within walking distance (3 blocks away) from the conference location. Rooms are suite style- bedroom separate from the living room area and come in 1 king or 2 queens.

Booking Link: www.hilton.com/en/attend-my-event/sciai-charleston-2023/

Room Rate/Block Expires 30 days prior to the event

SELECT PRESENTATIONS

"Pulse Night Club Shooting Case Study" – Orlando Police Department

"Scene Documentation Workshop" – Casson Reynolds, North Carolina Justice Academy

"Effects of Pityriasis Rubra Pilaris on Friction Ridge Skin" –Nova Grilli, Charleston PD – Alice White, Evolve Forensics

"Masked Minutia and False Minutiae and Tonal Transitions-Oh My!" –Alice White, Evolve Forensics

"Leadership Strategies for Targeting Forensic Retention" –Dr. Ashleigh Wojslawowicz, Charleston PD

SOCIAL EVENTS

Welcome Reception- Monday May 8th-7pm- TBD

Evening Reception/ Happy Hour- Wednesday May 10th- 5:30pm-TBD

Events and Presentations subject to change

Member Spotlight!

Submitted by Richland County Sheriff's Department

Help us congratulate Sergeant Sara Holt, who was recognized at the International Homicide Investigators Association's Annual Training Symposium in August 2022! She earned an award for excellence in Forensic Science and Technology!

Congratulations, Sergeant Holt! Thanks for your hard work!

If you would like to see yourself, a coworker, or one of your cases featured in a future issue of *The Identifier*, please contact the Editor at bribrown@greenvillecounty.org

IN THE NEWS

Published: July 1st, 2014

Performance Evaluation of Large 3D Fingerprint Databases

Prior to the large-scale deployment of any biometric system it is necessary to have a realistic estimation of its performance. In the domain of fingerprint biometrics, three-dimensional (3D) fingerprint scan technology has been developing very fast. However, there is no 3D fingerprint database publicly available for research purposes. To evaluate the matching performance of 3D fingerprints and the compatibility of 2D and 3D fingerprints comprehensively, a large fingerprint database using two commercial fingerprint sensors is established. The database consists of both 3D fingerprints and their corresponding 2D fingerprints. Several verification experiments using a commercial fingerprint identification software are carried out. The results serve as the performance criterion of the database, which will be released publicly together with the database in late 2014.

Introduction

Fingerprint biometrics has been extensively adopted in both forensic and commercial applications [1] (e.g. criminal investigation, access control and e-commerce) since the late 1980s. Conventionally, fingerprints were captured using contact-based methods, e.g. ink, thermal, optical, capacitive, ultrasonic etc. In these cases, the subjects have to press or roll their fingers against a solid surface with force to obtain the two-dimensional (2D) fingerprint images. As a consequence, these capturing schemes often introduce degraded images due to skin deformation, non-uniform pressure and residue left on the sensor's surface. To overcome these problems, touchless fingerprint imaging technology has been proposed; in particular, the 3D fingerprint acquisition techniques have attracted more and more attention recently. TBS North America [2] has developed a 3D fingerprint system that uses shape from shading and stereovision-based technique to obtain 3D fingerprints in a non-contact fashion. Another representative system was developed by Flashscan3D LLC [3] and the University of Kentucky. Their system uses a structured light illumination technique and can capture the 3D ridge-valley details of fingertips. All these 3D fingerprint sensors produce unravelled 2D equivalent fingerprints that are compatible with legacy 2D fingerprints.

Despite the development of 3D fingerprint technology, preliminary experiments have been carried out with limited individually collected samples [4, 5], instead of a publicly available 3D fingerprint database. This is a great barrier to the experimental validation and the comparison of algorithms in the 3D fingerprint biometric research area. We have therefore built a fingerprint database with 3D fingerprints as well as their corresponding 2D fingerprints from 150 volunteers (subjects). The large size of the database we have established will provide meaningful statistical analysis and a truthful assessment of the performance of the state-of-the-art algorithms in this area. In addition, our database can serve as a standard database for developing identification techniques for 2D to 3D fingerprint images. The resolution of these identification issues will require an innovative approach which will significantly advance research in the area of biometrics. It will also lead to the improvement and development of important commercial products.

(Continued on page 13)

IN THE NEWS

Performance Evaluation of Large 3D Fingerprint Databases

Acquisition devices and samples

The 3D fingerprints were collected using a fingerprint scanner developed by TBS North America, which uses a 3D fingerprint acquisition technology called the surround imager [6]: the device is a cluster of three cameras located on a semicircle and pointing to its centre, where the finger has to be placed in a correct position so that it is completely contained in the field-of-view of the cameras at the same time during the acquisition. Moreover, the device contains a set of green LED arrays and the large size has also been chosen to dissipate the heat generated by the light system. All 10 fingers of each subject were scanned twice using this 3D fingerprint scanner and the output images unravelled 2D equivalent fingerprints in the BMP format. There are in total 3000 (150 × 10 × 2) 3D fingerprints in the database.

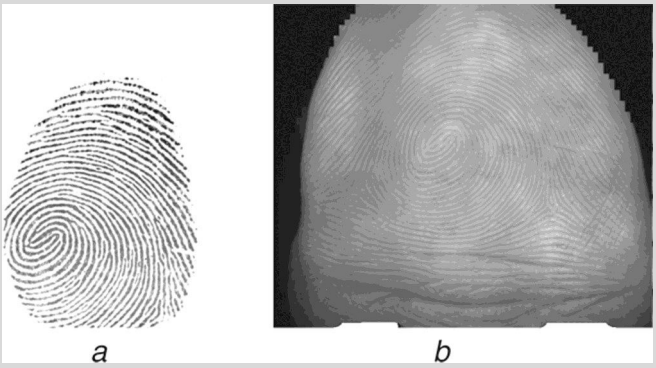


FIG 1 Fingerprint examples of same finger in database
a 2D sample *b* 3D sample

The corresponding 2D fingerprints (BMP format) were captured by a contact-based optical sensor CROSSMATCH Verifier 300 LC 2.0, and all 10 fingers of each subject were captured four times. There are in total 6000 (150 × 10 × 4) 2D fingerprints in the database.

Examples of a 2D fingerprint image and its corresponding 3D fingerprint image are shown in Fig. 1. It is obvious that the 3D fingerprint area usable for recognition is wider than the one captured by traditional contact-based acquisition techniques and the 3D image is a negative polarity representation of the fingerprint because the ridges appear to be brighter than the valleys. In addition, the contrast between ridges and valleys of the 3D fingerprint is lower than that of the 2D fingerprint image.

Verification experiments

For the experimental evaluation of the fingerprint database, we have carried out a series of tests on a subset of the database using a commercial fingerprint identification software VeriFinger SDK [7], in particular both 2D and 3D images of the first and second captures of six fingers (right thumb, right index, right middle finger, left thumb, left index and left middle finger) of each subject were chosen. For all tests, we adopted the equal error rate (EER) as a measure of the verification performance. EER is the value where the false match rate (FMR) and the false non-match rate (FNMR) are equal and is the best single description of the error rate of an algorithm. The lower the EER, the better the performance.

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IN THE NEWS

Performance Evaluation of Large 3D Fingerprint Databases

Verification using raw images

In this Section, we report the testing of the performance of fingerprint verification using the raw 3D fingerprint images without post-processing.

2D fingerprint verification: To obtain a reference standard of the performance, we first tested the performance of 2D to 2D fingerprint verifications using a modified 1vs1 protocol [8]: the first 2D template of each finger is compared against the second 2D one of the same finger to obtain the FNMR, and the first 2D template of each finger is compared against the second 2D template of the remaining fingers to determine the FMR. There are in total 900 (6 × 150) comparisons that should be genuine match as, 150 each for the right thumb, right index, right middle finger, left thumb, left index and left middle finger, and there are in total 134 100 (6 × 150 × 149) comparisons that should be false matches, 22 350 each for the right thumb, right index, right middle finger, left thumb, left index and left middle finger. As shown in Table 1, the EER for each group of 2D fingerprints is very low and the average EER for all 2D fingerprints is about 0.06%.

	2D against 2D (%)	3D against 3D (%)	2D against 3D (%)
Right Thumb	0.07	0.07	3.22
Right Index	0.07	0.72	5.32
Right Middle	0.07	0.59	2.69
Left Thumb	0	0.20	2.56
Left Index	0.07	0	8.48
Left Middle	0.07	1.38	11.63
Average	0.06	0.49	5.65

Table 1. Performance (EER) using raw images

3D fingerprint verification: Similar to 2D fingerprint verification, the first 3D template of each finger is compared against the second 3D one of the same finger to obtain the FNMR, and the first 3D template of each finger is compared against the second 3D template of the remaining fingers to determine the FMR. There are in total 900 (6 × 150) comparisons that should be genuine matches and 134 100 (6 × 150 × 149) comparisons that should be false matches. As is also shown in Table 1, the EER for each group of 3D fingerprints varies a lot and the average EER for all 3D fingerprints is about 0.49%, which is larger than that of the 2D fingerprint verification.

(Continued on page 15)

IN THE NEWS

Performance Evaluation of Large 3D Fingerprint Databases

2D to 3D fingerprint verification: For 2D to 3D fingerprint verification, the first 2D template of each finger is compared against the first 3D capture of the same finger to obtain the FNMR, and the first 2D template of each finger is compared against the first 3D template of the remaining fingers to determine the FMR. There are also 900 (6 × 150) comparisons that should be genuine matches and 134 100 (6 × 150 × 149) comparisons that should be false matches. We can see from Table 1 that the EER for each group of fingerprints in this test is much larger than those of both 2D and 3D fingerprint verification, and the average EER is 5.65%.

Verification using post-processed images: Testing on enhanced images

As is mentioned earlier, the contrast of the 3D fingerprint images is low compared with contact-based 2D fingerprint images; we therefore enhanced the contrast of the 3D fingerprint images by transforming the contrast values using the contrast-limited adaptive histogram equalisation (CLAHE). Using CLAHE, the contrast enhancement can be limited in order to avoid amplifying the noise which might be present in the image. Then we tested the performance of 3D to 3D fingerprint verification and 2D to 3D fingerprint verification using the enhanced 3D fingerprints.

Testing on cropped images: Since the fingerprint images produced by the 3D scanning device are larger than those of the traditional 2D sensor, we cropped all the 3D fingerprint images by removing the peripheral regions. The size of the cropped 3D images is about 480 × 560. Then we tested the performance of 3D to 3D fingerprint verification and 2D to 3D fingerprint verification using the cropped 3D fingerprints.

Results

Fig. 2 shows the performance comparison of 3D to 3D fingerprint verification using the original raw 3D images, contrast enhanced 3D images and cropped 3D images. We can see that the performance for all fingerprints except the left index fingerprints is improved after contrast enhancement, especially the right index fingerprints, the left thumb fingerprints and the left middle fingerprints and the average EER for 3D to 3D fingerprint verification using the contrast enhanced images is comparable to that of the 2D to 2D fingerprint verification. However, as shown in Fig. 2, cropping 3D images cannot improve the performance of 3D to 3D fingerprint verification, because the EER for 3D to 3D fingerprint verification using the cropped 3D images is much larger than that of using the original raw 3D images.

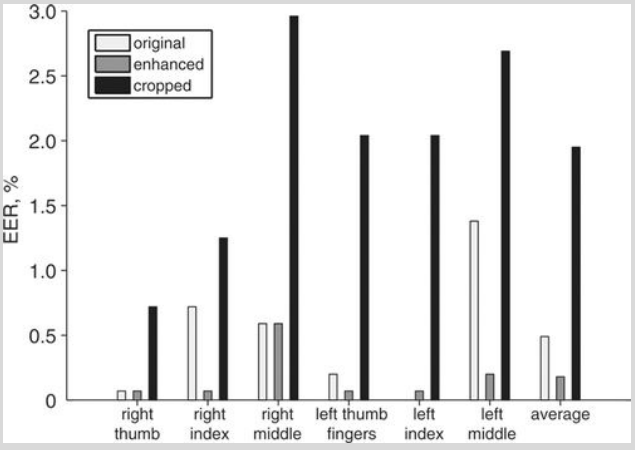


Fig 2; Performance of 3D to 3D fingerprint verification

(Continued on page 16)

IN THE NEWS

Performance Evaluation of Large 3D Fingerprint Databases

Fig. 3 shows the performance comparison of 2D to 3D fingerprint verification using the original raw 3D images, contrast-enhanced 3D images and cropped 3D images. It is obvious that both contrast enhancement and cropping cannot improve the performance of 2D to 3D fingerprint verification too much, and compared with the performance of 2D to 2D fingerprint verification and 3D to 3D fingerprint verification, the performance of 2D to 3D fingerprint verification using the VeriFinger is far from satisfactory. Therefore, complex post-processing algorithms for 3D fingerprint images as well as more sophisticated 3D fingerprint matching algorithms will be needed to improve the performance of 2D to 3D fingerprint verification.

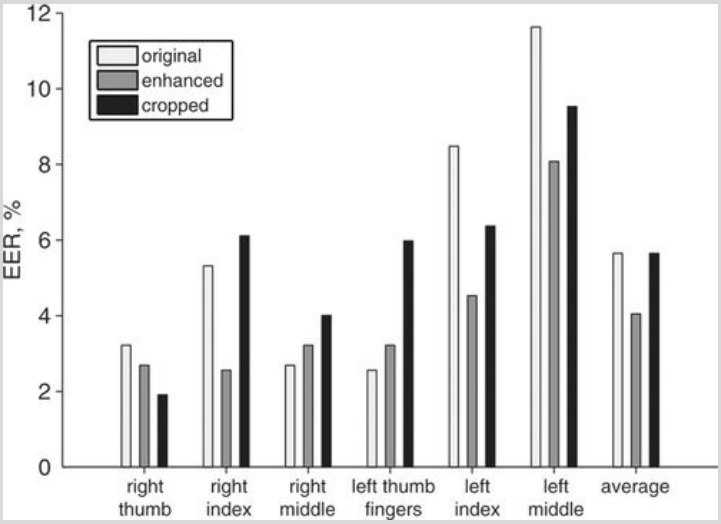


Fig 3; Performance of 2D to 3D fingerprint verification

Conclusion

We have conducted a series of evaluation experiments on our newly established fingerprint database. The database consists of both 3D and corresponding 2D fingerprints captured using two commercial fingerprint sensors, and its scale is large enough for prior evaluation of 3D fingerprint imaging technology. We plan to release this database publicly in late 2014 and it can serve as a benchmark database in the area of fingerprint biometrics. Experimental results show that the performance of 3D to 3D fingerprint verification is comparable to that of the traditional 2D to 2D fingerprint verification after enhancing the contrast of 3D fingerprint images. In the future, more work will be carried out to improve the compatibility between 2D and 3D fingerprint images.

Zhou, W., Hu, J., Wang, S., Petersen, I. and Bennamoun, M. (2014), Performance evaluation of large 3D fingerprint databases. Electron. Lett., 50: 1060-1061. https://doi.org/10.1049/el.2014.1927

COMING SOON!

SCIAI Merchandise

Available for purchase

At the 2023 Conference

To include NEW

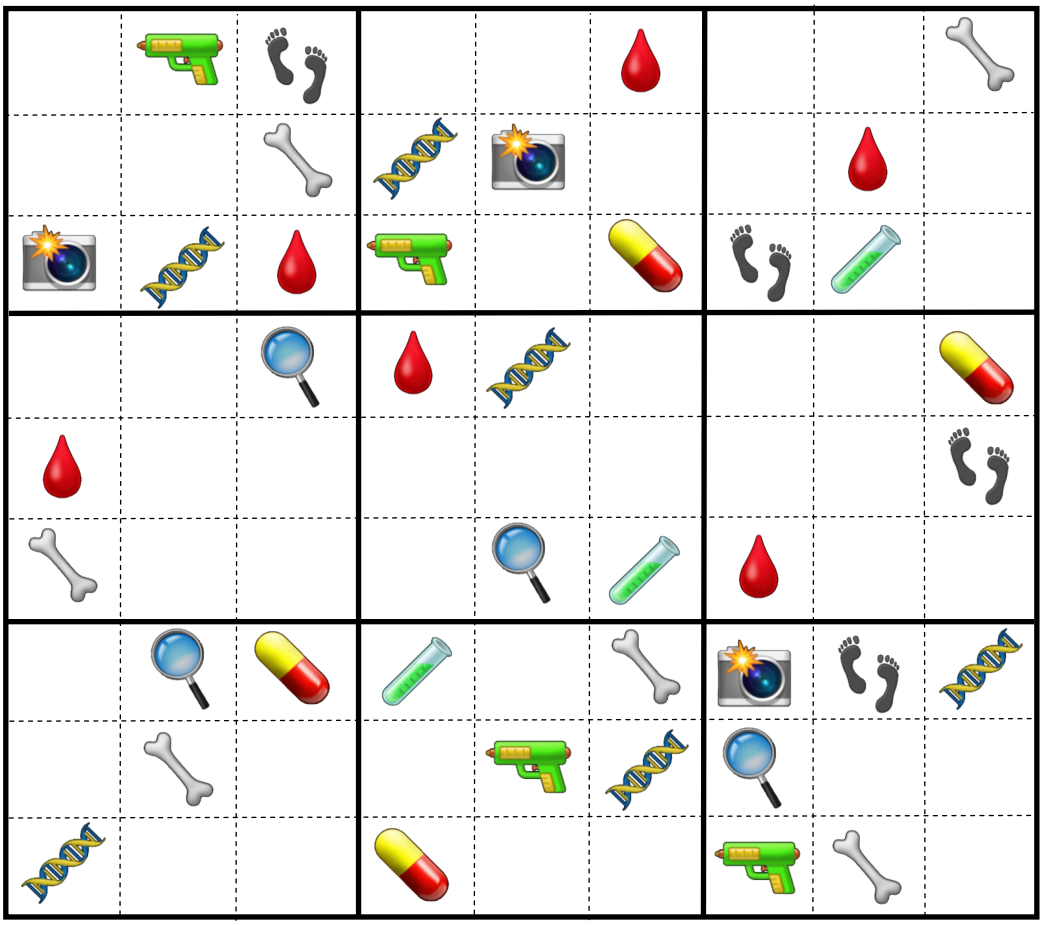
SCIAI Challenge Coins

Stay tuned for more items!

FUN WITH FORENSICS

Frequently in the field of Forensics, we, as a whole, deal with a variety of difficult and demanding scenes, tough scenarios, and are often placed in stressful situations. This panel is designed for you to have the opportunity take a quick mental break, refresh your mind, and also to have a little fun. ☺

Forensic Emoji Sudoku



This Sudoku puzzle challenges you to use the forensic related emojis provided below to fill in the blank squares so that each emoji appears only once in every Column, Row, and Block of the completed puzzle.

FUN WITH FORENSICS

Frequently in the field of Forensics, we, as a whole, deal with a variety of difficult and demanding scenes, tough scenarios, and are often placed in stressful situations. This panel is designed for you to have the opportunity take a quick mental break, refresh your mind, and also to have a little fun. ☺

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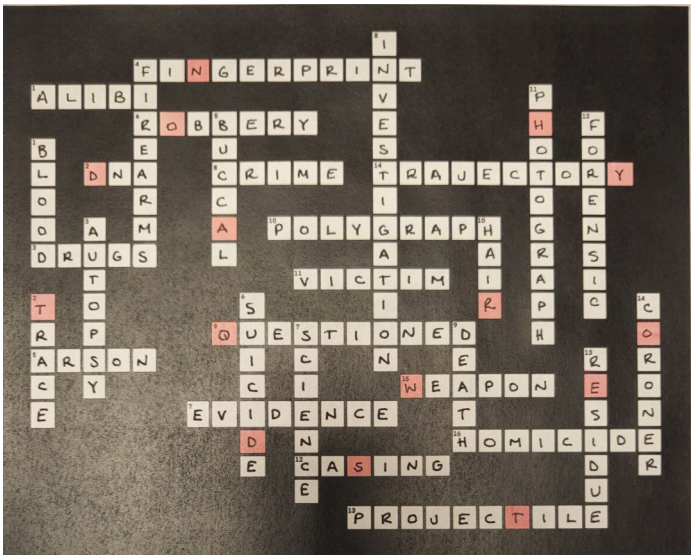
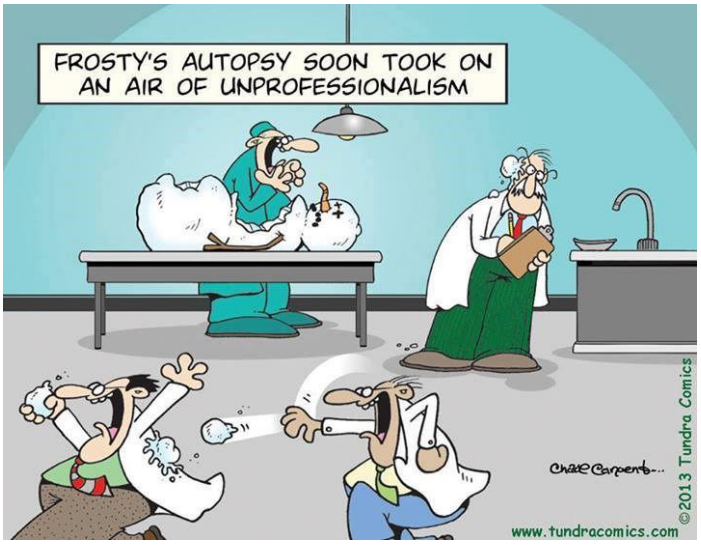
Solution for crossword puzzle featured in the Fall Issue





Hidden Message from crossword puzzle:

DON'T (2A 6A 4A 13A) SAY (12A 5D 14A) THE (2D 11D 13D) "Q" (9A) WORD! (15A 14D 10D 6D)

UPCOMING TRAINING/EVENTS

Feb 1st—2nd, 2023: Logical Latent Analysis by Mack Brazelle, CLPE

16-hour, 2 day course; Cost $400, Albuquerque Police Department, Albuquerque, NM

March 14th, 2023: ForenScope Demonstration in Columbia, SC

9am-5pm; Hilton Columbia Center—No cost to attend

May 9th—May 11th, 2023: SCIAI Spring Conference

3 day, College of Charleston SSM Building, 202 Calhoun St, Charleston, SC

November 6th—10th, 2023: Forensic Supervision by GAP Science LLC

40-hour, 5 day course, Cost $775, Aloft Greenville Downtown, 5 N Laurens St, Greenville, SC

If you have upcoming training that you would like advertised in the newsletter, contact the Editor with course information and details!

Ron Smith and Associates is requesting any interested parties for the following courses to contact them to gauge interest for future potential training in South Carolina in 2023!

Contact John Black johnb@ronsmithandassociates.com

Detection, Documentation and Recovery of Footwear & Tire Track Evidence

Contact Nova Grilli grillin@charleston-sc.gov: Training would be held in Charleston, SC

Understanding exclusion and sufficiency decision

EMPLOYMENT OPPORTUNITIES

Greenville County: Forensic Evidence Technician

North Charleston: Forensic Pathologist

Editor: Brittany Brown bribrown@greenvillecounty.org