Futuristic 3D scanning technology being pioneered in a West Midlands Police and University of Warwick partnership is helping convict killers by providing juries with microscopic evidence previously beyond the reach of forensic testing.

In April, Smethwick man Lorenzo Simon was sentenced to life in prison for the barbaric murder of a housemate whose body he chopped up and stuffed inside suitcases he later hurled into Birmingham Canal. Crucially detectives recovered part of the victim’s humerus from an oil drum in the couple’s garden - used as a furnace to destroy evidence - which experts proved was a seamless fit with a limb found in the case.

And the same 3D scanning technique - which provides image resolution 43,000 times more detailed than a hospital CT scan - also proved laceration links between a saw recovered from the canal-bed and marks found on other bones.

Such ‘micro-CT imaging’ has been used for some time in high-tech industries like aerospace and automotive - where atomic material failures can have catastrophic consequences - but West Midlands Police is the first UK force to embrace the science to support investigations.

Detectives have teamed up with University of Warwick’s cutting-edge research centre on four cases to date, including three murder trials, the most recent being the brutal killing of Michael Spalding at the Smethwick house he shared with Simon and Bird.

Nine pieces of bone were repeatedly x-rayed at a range of angles with the many thousands of images collated using specialist software to produce the 3D ultra-scans. They were then displayed on a virtual reality 3D video wall, allowing detectives, police forensic experts and crown prosecutors to examine the digital images in remarkable depth.

University of Warwick Professor Mark Williams said: “A black lump resembling a large piece of coal was found in the oil drum...and our scans revealed it contained the top part of the victim’s humerus fused inside a mass of molten debris.

“The bone had been sawn and snapped. After scanning body parts in the cases we found it was a perfect jigsaw fit to another piece of bone and could show in minute detail - down to 17,000th of a millimetre or half a hair’s breadth - the cuts on the bones.

“That helped officers match the serrated edge of the saw to many of the indents and showed they’d been inflicted with a blade width of 1.4mm. And we made exact 3D print replicas of the bone to demonstrate the evidence to the jury.

“This combination of micro computerised tomography scanning, 3D printing and 3D virtual reality truly makes the process a UK first.”

Unlike traditional post mortems carried out by pathologists the scanning is non-contact and can produce high-definition 3D scans of bones or organs without the need for an invasive procedure.

Such advanced technology doesn’t come cheap and, against a backdrop of continued police funding cuts, the multi-million pound scanning equipment and associated software is beyond the fiscal reach of forces.

However, the unique collaboration forged with University of Warwick gives West Midlands Police access not just to the technology but also some of the UK’s leading lights in the field of digital forensics.

In return the force funds a three-year Forensic PhD placement at the University of Warwick to look at further developing the science and expanding its capability.

Prof Williams, added: “It’s a perfect collaboration and hugely rewarding being involved in major crime investigations knowing our work is helping convict offenders and secure justice for grieving families.

“But it’s not about trying to prove someone is responsible for a crime...it’s about helping to understand a case and getting to the truth. The technology can show whether a death was accidental or murder.”

3D scanning evidence was also influential in convicting a Birmingham man who murdered his estranged wife.
sense that the actual timeline of an investigation is extremely important to the outcome of the case. The retrieval of evidence needs to be executed in the shortest possible time to ensure that nothing is missed in the evidence gathering process, and to ensure that the investigative team doesn’t run out of time when retrieving evidence.

There is also an issue with the records production rate of the cloud service providers due to the limited resources that these companies have to handle the large number of requests from law enforcement. In the UK, during the first half of 2014, Facebook and Google’s response rate was 70 per cent, while Twitter’s response rate was only at 40 per cent.

Another challenge is that of forensic data preservation. It is of vital importance that the case team retrieves and handles all private data sources with the upmost care and consideration. In the case of extracting evidential data from the cloud, investigators should feel confident that the information that was extracted from the cloud service provider is authentic, traceable and thus defensible in court.

However, the problem of accessing private cloud data in a timely manner for criminal investigations can be rectified with the use of mobile forensic technology. When a mobile phone is seized in criminal investigations, law enforcement can use technology such as the UFED Cloud Analyser, to access private-user cloud data by utilising login details that have been extracted from the mobile device of the suspect or victim. This private-user cloud data is extracted under the appropriate legal authority, be it a search warrant, written consent, or other authority as defined by legal counsel in the relevant jurisdiction.

The investigative process when using such technology to retrieve private-user cloud data involves a five step process:

1. Seize the mobile device and begin a forensic extraction of data
2. Decode cloud services login information from the extracted forensic copy of the device
3. Forensically preserve private user data using login information from the mobile device or manually provided credentials
4. Analyse and report data from different cloud data sources in a unified format
5. Deliver data to additional relevant law enforcement and justice officials

The analysis and reporting of retrieved data in a unified format is a very significant step in this process. The data that is retrieved has to be understood by a range of investigators and legal personnel, many of who may not be well-versed in mobile forensic data retrieval.

This data may also have to be presented in a courtroom, where a jury might be present that will have to understand and digest the data that is being put in front of them. Again, the data must be in a format that can be understood easily so that people with little or no understanding of mobile data forensics can easily make a decision based on the evidential data that has been displayed to them.

The importance of cloud data in so many areas of everyday life means that law enforcement agencies simply must consider the pool of evidence that is stored in the cloud during criminal investigations. A failure to contemplate this data could easily result in missed opportunities to convict, and during live investigations the consequences could be far worse.

The ever-increasing use of mobile phones to conduct criminal activity in correlation with the vast numbers of social media users worldwide, is a clear indication that criminal investigators must be equipped with the latest technology to timely retrieve cloud data and react to all types of criminal; who use and abuse different channels to exercise their criminal activity.

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