Tongue Print Identification: An Emerging Biometric Forensic Tool

Paul Neville*

Department of Forensic Odontology, Gujarat Forensic Sciences University, Jammu and Kashmir, India

DESCRIPTION

As traditional biometric systems are discovered to be prone to forgery, the demand for additional biometric features is growing. Nowadays, tongue print is becoming more popular as a biometric feature, particularly in forensics. The tongue is a critical organ that is well protected and has complex structural patterns. The extraction of discriminating elements from the tongue print is critical to its success as a biometric tool. Deep neural network advancements and the availability of high-end computer settings have enabled tremendous advances in the field of image recognition. To extract feature maps that highly characterize the training data, CNN uses hierarchical learning. However, collecting a large enough tongue print dataset to train a CNN for recognition is quite difficult.

Alternatively, finely tuned pre-trained CNN models to be used as classifiers with the fresh input dataset and class labels to conduct tongue-print image recognition can be done using one of two ways. Another efficient way is to extract features from the input tongue dataset using a pre-trained CNN model as a feature extractor and then perform image identification using a state-of-the-art classifier. In this research, we addressed three major factors in the deployment of tongue-print as a biometric instrument. Because there is no publicly available tongue-print dataset, our first goal was to construct a tough tongue-print dataset. Following that, investigation and comparision of various state-of-the-art CNN architectures for image recognition is done.

The tongue is a critical organ that serves a variety of functions, including speech articulation, taste perception, and food bolus production. The palate on the superior aspect, the floor of the mouth on the inferior aspect, the mandibular teeth on the lateral aspects, the pharyngeal area posteriorly, and the lips anteriorly protect it from the external environment. Its distinctiveness is demonstrated by the fact that, as an internal organ, it serves as a proof of life, indicating whether the individual is alive or not. Second, analysing shape, texture, and colour exposes observable distinctions between individuals making it an effective tool for personal identification.

Tongue prints and other biometric systems

Fingerprints, retinal scans, skin colour, voice checks, palm prints, face scans, signature checks, and other biometric technologies are used for security purposes. Each of these systems has its own set of benefits and drawbacks. Each system's limitations render it prone to security breaches and make identification difficult. Fingerprints are not stable since they can be eroded, changed due to work, altered by surgery, and exposed to injuries and burns. Sicknesses like the common cold and cough have an impact on the voice. There is a risk of misspoken phrases in severe emotional situations. The retina scan is quite sensitive. It is dependent on the user and can be harmed by intense light as well as disorders like cataracts and astigmatism.

Skin colour is another sort of biometric system, but it has difficulty with consistency because there are significant variances with age, burns, diseases, and the use of skin creams or drugs. Tongue print has a number of advantages over other biometric systems like fingerprints, voice checks, and retinal scans.

The form and surface texture of the tongue are unique to each individual. It can be easily exposed for investigation because it is an internal organ, and the exposed surface has the necessary information. The texture and shape of the human body remain unchanged. It is highly shielded from the outside world and hence is unaffected by external influences. It also serves as a dependable indicator of life. Tongue print has gained popularity as a biometric authentication tool in recent years.

Tongue print collection and identification

Tongue prints can be made in a variety of methods. A simple visual examination of the tongue shows various characteristics such as colour, movement, surface textural changes, and any other particular traits that may be present. The tongue can be photographed digitally and compared to a database for verification. They can also be used to determine the tongue's shape. The tongue's form is created by connecting three reference points. An alginate impression, followed by cast preparation, can be used to examine the tongue. This aids in

capturing the distinguishing features and duplicating them on a cast that can be used for research.

Digital software has been developed that autocorrects for colour and hue, as well as positional modifications and camera settings, before analysing the tongue for colour and texture to match with its database and result in positive identification. Much research has gone into developing a proper tongue image analysis method. Because the tongue is a non-rigid organ, other ways have been tried, such as collecting video of the tongue and extracting images from it. Sublingual vein analysis, which is one of the most prevalent procedures used in tongue diagnosis, is an alternative way. To examine tongue function, an ultrasound approach was used by using an ultrasound transducer inserted in the sublingual area. An evaluation of the tongue's histology is also possible.

CONCLUSION

Tongue prints can be used to authenticate biometrically. The study's approach is simple and straightforward, and dentists can apply it on a regular basis. Large-scale research is needed to confirm the findings and to identify other tongue traits that could be employed in forensics and biometric verification.