



Brain Fingerprinting

Ashmitha Gowda

Ramaiah Institute of Technology, MSR Nagar, Bengaluru, 560054

DOI: <https://doi.org/10.55248/gengpi.234.5.40436>

ABSTRACT

Brain fingerprinting is a computer based advanced technology which is used to collect strong evidence for crime investigation and terrorism. Its use in the medical field can also be seen for treating patients with Alzheimer's. Among 120 cases solved with the help of Brain fingerprinting has resulted in 100% accuracy. The time taken to perform the test is approximately 10 minutes. Its mechanism is based on the brain wave created by the subject's brain when presented with related and unrelated pictures, phases or words. The system reads for P300 MERMER (Memory and Encoding Related Multifaceted Electroencephalographic) produced by the subject's brain during the test. The concluding consequence is either "information found" or "information not found". The factor to be remembered is that brain fingerprinting doesn't deal with emotions or stress of the subject. It purely involves working with P300 MERMER produced by the brain of the subject.

1. INTRODUCTION

Brain fingerprinting is a lie detector with computer-based technology which uses brain waves for determining hidden information in an individual's brain. The electric brainwave response the individual's brain gives when presented with certain words, images or phases helps in determining if the individual possesses the needed information. It was invented by Lawrence Farwell. He hypothesized that the brain reacts to known information and unknown information differently. Farwell initially used P300 and later discovered P300 MERMER which resulted in better accuracy. In 2001 Brain fingerprinting technology was first ruled in the court of Iowa, a Midwestern US state. Brain fingerprints are measured by an EEG (electroencephalogram), P300 MERMER. We need to understand that Brain Fingerprinting doesn't deal with emotions, mental stress or lie. It only shows if the required information is stored in the individual's brain or not. When BF comes across P300 MERMER brainwave pattern while presenting the individual with words, images or any investigation related entity it results in concluding that the individual has certain information regarding the same. The brain fingerprinting computer results with "information found" or "information not found".

1.1 How does it work

1.2 Equipment Required

- Computer system
- A graphics card for driving two monitors
- A data acquisition board
- Software developed by the Brain Fingerprinting lab
- A four-channel EEG amplifier

Before conducting the test, the subject is interviewed to know about the information the subject has. The subject is shown photos or words (stimuli) related to the case. Unrelated pictures are shown as well. To avoid false results, the subject is asked if the stimuli displayed has personal significance. If any of the stimuli is significant to the subject but is unrelated to the case, the stimuli are eliminated. EEG data are collected from midline frontal, central, and parietal scalp sites. EOG (Electrooculography) data are collected from the forehead to monitor artifacts generated by eye movements. Data is amplified, digitized, filtered, and analyzed to obtain the final result. When a person commits a crime the event and the process of crime is recorded in the brain. This data stored in the brain can be used to determine and prove the crime with scientific evidence. The suspect would undergo the process and the report would be documented according to the results. The suspect would be shown a certain number of pictures or words related to the crime event. If the suspect's brain produces P300 MERMER signal which means there is a match in information in the brain and crime event, the suspect would be found accountable for the case.

2. Architecture of the system

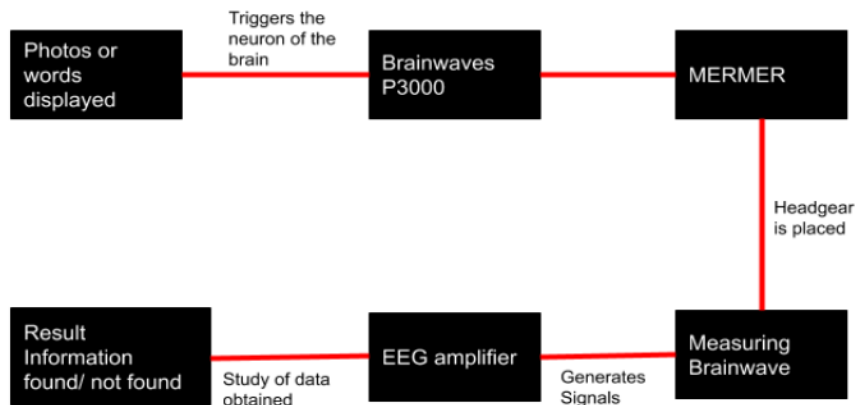


Fig. 1 - The flow of the system is displayed above. The subject wears a headgear. Photos and words are displayed, the brainwave information is collected and compared.

3. Why brain fingerprinting

3.1. National terrorism

Brain fingerprinting is put into use in the fields regarding terrorism. Using the technology strong evidence can be extracted about the suspect's involvement in attack or if the suspect is innocent. The terrorist would have to memory of planning, preparations and finally the act of terrorism. Using this technology, it can be determined if the suspect is a part of the act or innocent.

3.2. Crime investigation

Using the technology justice can be provided. It has proven to be very efficient compared to other lie detectors used. Around 99% of the data extracted during brain fingerprinting is absorbed to be true.

3.3. Medical application

Patients suffering from Alzheimer's can be helped by recording the pattern of their brain's reaction to events or person to check if they have memory of the same which would help doctors to treat them much efficiently.

4. Procedure

The person to undergo brain fingerprinting has to wear a headband. This special headband has electronic sensors attached to them. These sensors are placed in many parts of the scalp. The sensors measure the electroencephalography produced through the scalp. The person is then shown a series of relevant information and followed by a series of irrelevant or vice versa. The brain would react differently to each of these series of information allowing the tester to determine if there is a required information match.

The brain wave information would be presented in three ways.

- Red- represents the information the subject is expected to be aware of.
- Green- represents the information not known to the subject.
- Blue- represents the information which only the person involved in the event would know.

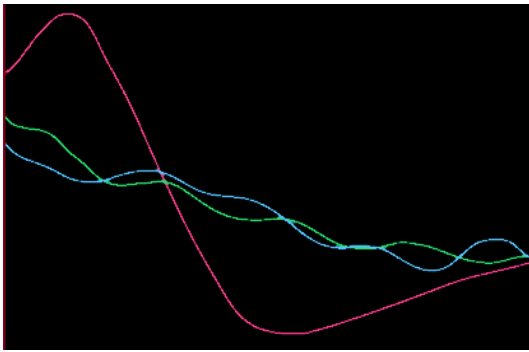


Fig.2 When the blue line and green line are found much closer together, it implies as information has no match or information not found.

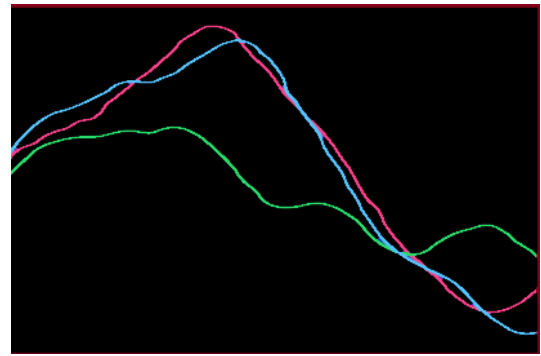


Fig.3 Whereas when the red line and blue line are found much closer, it implies that the subject has the information and is involved in the event.

5. Phases of brain fingerprinting

5.1 Collection of the crime scene evidence

An expert collects the evidence from the crime scene and examines. Information are determined which would be only know to the person involved in the crime.

5.2 Collection of brain evidence

A specialist presents the suspect with series of known and unknown information. The results are matched with the evidence from the crime scene and the subject is determined to be innocent or connected to crime scene accordingly.

5.3 Analysis of the computer evidence

In this process the computer makes a mathematical determination as to the information is stored in the brain or not.

5.4 Scientific result

This step gives the final outcome of the whole purpose by determining if the subject has information match or not. In other words, if the subject has information stored in his brain (guilty) or not (innocent).

6. Advantages

- it is mainly used regarding crime events but it can be used in the field of medicals. Currently it is not effectively used across the globe but it can be used for patients from Alzheimer's and for other psychological issues.
- it has high accuracy rate reaching as far as 99% accurate.
- doesn't use emotional or physical factors like sweating or heart rate and many more factor. It only uses the stored information in the brain.

7. Disadvantages

- the installation products of the brain fingerprinting system increases the cost price of the final working system.
- not available widely or openly reachable for everyone. Therefore, not everyone can use it prove their innocence
- There may be an exceptional situation when the suspect was just a third person who noticed the activity of the event or witnessed. This would make the brain store information regarding the event. As brain fingerprinting only works with brain wave the suspect who is innocent would have a "information found" result if even not being involved in the event directly.

8. Conclusion

Brain fingerprinting is one of the extraordinary inventions introduced to mankind. With increasing rage and criminal acts in the world, brain fingerprinting can help provide scientific evidence regarding the subject's act. With 100% accuracy it can save so many innocent lives from harsh punishment because the lack of evidence. Even with its limitation brain fingerprinting has not only helped with solving criminal and terrorism cases, it has also contributed in the field of medical. This is a technology which has been performing well and contributing to the society in spite of its drawbacks.

Acknowledgements

I am grateful to everyone with whom I have had the pleasure to learn and work during the process of the paper. Each member has provided me immense personal, educational and professional guidance and taught me a great deal about research and process and life in general. I would like to convey my heartfelt thanks to everyone who accompanied me in my journey.

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