
DECODING THE BRAIN, ENCODING THE LAW: A STUDY ON NEURO-TECHNOLOGY AND LAW

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ABSTRACT

In light of recent developments in the realm of artificial intelligence and brain-computer interfaces, neurotechnology seems to have a transitional phase from science fiction to reality. This paper takes a deep analysis and view of the legal and ethical challenges associated to neurotechnology while following neural data, such as EEG, fMRI and other devices. Neurotechnology could revolutionise our ability to manage neurological conditions, obviously enhance cognitive ability, e.g. gaming, and in some instances, potentially supplant imagery altogether. However, this also presents complex issues associated with the availability, nature and exploitation of consent, data privacy, and mental health autonomy.

In particular, this research exposes a new emerging issue which has surfaced with emerging tech, also there lie some conceptual gaps of classifying neural data within existing legal and political frameworks. More and more jurisdictions, particularly in the European and Asian region, are legislating to protect data privacy rights, in particular the General Data Protection Regulation (GDPR) and India's Digital Personal Data Protection Act (DPDP). This creates a comprehensive protection framework in respect of personal data, but it does not expressly consider the sensitive nature of brain-based data. The conclusion of the research is that given the highly sensitive nature of this data, particular care must be taken in relation it to being classified as it is with other forms of personal data. The paper reviews some of the most significant legislative provisions, key judicial outcomes (*Selvi v State of Karnataka*) and current legislation of emerging jurisdiction (notably Chile's reputable decision in *Girardi v Emotiv*), collectively underscore and bolster the need for some clear legislative action. The article also considers how existing models of informed consent, data deletion, and accountability fail to achieve and protect those objectives in the context of AI-embedded neurotech systems. The article's final sections set out some recommendations.

INTRODUCTION

Neuroscience and technology are leading to a newly recognized domain called neurotechnology. Brain-computer interfaces are changing the way we read brain signals, emotion-tracking headsets are aiding therapists in monitoring their clients' anxiety and instances of excitability, and devices are recording and manipulating brain signals. These devices are no longer imaginary or speculative; they are commercially available. Neurotechnology could result in meaningful transformations in health care, education, and personal development, but neurotechnology presents challenges to some of the most basic legal principles. For example, there are basic tenets of human dignity, informed consent; and data privacy issues that neurotechnology raises.

First, this paper looks at the legal regulation of neural data in neurotechnology. We first explain the development and functioning of neurotechnology hardware and software before examining relevant aspects of current laws, including the EU's General Data Protection Regulation (GDPR), India's Digital Personal Data Protection Act (DPDP) and a collective constitutional interpretation of neuro-rights drawn from case law. We will also cite the perspectives of international courts, including the Chilean case of *Girardi v. Emotiv*. The last sections will make some suggestions for developing neurotechnology in a manner that respects rights.

EMERGING NEUROTECH

“Neuralink a startup by Elon musk which has developed a brain computer interface device that is to be implanted in in a person’s brain.”¹ With ever evolving technology a new dynamics of technology has surfaced and that it is popularly referred to as Neurotechnology also known as brain technology. Neurotechnology is defined as “the field of devices and procedures used to access, monitor, investigate, assess, manipulate, or emulate the structure and function of the neural systems of animals or human beings.”² However this technology has not erupted fortnight the foundation could be found back to Human Brain Project by US during 1980’s when the discussion between neuroscientist and program directors started at National Institute of Health pondering to develop such technologies that could enable sharing data among various

¹ Karan Mahadik, *What’s new with Neuralink and how is the brain implant device progressing?*, INDIAN EXPRESS (AUGUST 10 2024) <https://indianexpress.com/article/technology/science/neuralink-brain-implant-device-progress-latest-updates-9502918/>

² Grace Kelley, *Neural Data Privacy*, DEL. GEN. ASSEMBLY, LEGIS. COUNCIL ISSUE BRIEF NO. 2025-IB-0008, at 1 (Feb. 17, 2025)

neuro investigators, the tools involving set of databases and analytical tools that fosters sharing of this data. HBP was created as a response to the initiative. This also gained momentum world wide and motivated by this the organisation of economic cooperation and development, mega-science forum also highlighted this as a great recommendation and also it was projected that world will soon enter into the new era of neuro technology, Indeed, in recognition of this, the OECD created a Neuroinformatics Working Group and later the International Neuroinformatics Coordinating Facility (INCF) headquartered at Karolinska Institute in Stockholm, Sweden”.³

As per UNESCO international bio ethics committee report neuro technology refers to the devices used to record human brain activity or directly influence brain activity. As evident from the above para that neuro tech is not something very new, since a very long time primitive forms of neurosurgery is being taken place in ancient society including pseudo-scientific technique that could lead to manipulation of tissues however neural process and underlying emotions at length were unobservable.⁴ “In 1878 Richard Canton discovered the transmission of electrical signals through an animal’s brain. Forty-six years later, the first human electroencephalography (EEG) was recorded.”⁵

To delve deeper there exist various forms of brain technology, which are brain gene transfer (BGI) AND brain implant neuro technologies. with the help of the technology, there exist a way to deliver genes and also activate them in brain and spinal cord which will help incredibly in the treatment of neurodegenerative diseases such as ALS, Parkinson disease and Alzheimer’s. However, such techs are not free from loopholes with such great tech comes risk using BGT and BCI pose defined risks like inserting new genes might lead accidentally causing harmful genetic changes even increasing unusual cell growth also putting new cells or materials might lead to permanent changes that can’t be reversed however there exist ways to even control this. However, Neurotechnology has not been limited to purely this, “it has expanded neurotechnology devices have expanded beyond medical and research purposes, appearing in sectors like education, human enhancement, and entertainment. Specifically, direct-to-consumer neurotechnology devices have gained popularity in recent years, ranging from

³ Judy Illes & Sofia Lombera, *Identifiable Neuro Ethics Challenges to the Banking of Neuro Data*, 10 MINN. J.L. SCI. & TECH. 71 (2009).

⁴ Kelley, *supra* note 2, at 4.

⁵ Marcello Ienca & Roberto Andorno, *Towards New Human Rights in the Age of Neuroscience and Neurotechnology*, 13 LIFE SCI., SOC’Y & POL’Y 5 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5447561/>.

neurogaming² and headsets or ear pods, to personal well-being or health devices.”⁶ Also there are wireless headset companies that collect process and interpret brain data, It is also possible to purchase a device with 14 electromagnetic sensors which record neural activities and transport such data through electroencephalogram (EEG)(this refers to a non-invasive test that measures electrical activity in the brain using small sensors placed on scalp and record brains waves that is patterns of electrical signals generated by neurons.). However, before the advent of AI this data was considered of no use as decoding such complex data was very difficult, however due to rapidly emerging artificial intelligence (AI) now it is possible to decode such data, it is possible to purchase software license to supported by artificial intelligence (AI) that would decode the data and supply it to suppliers. ⁷ Another technique is fMRI that is functional magnetic resonance imaging which is used to detect brain electric activity and this has been widely used in medical assessment either pre surgery or post-surgery.

However, such evolving technology and emerging Artificial Intelligence cast a serious doubt on the concepts like privacy laws and human rights, because with great tech also comes great responsibility to manage the tech and hence the next section of the article will deal with what are the laws and regulation prevailing currently globally for neural data.

LEGAL AND REGULATORY CHALLENGES

This section will delve deeper into three sects that the current existing GDPR regulations and their impact on neural data next it will also examine how Indian framework That is DPDP impact neural data.

Focused on that issue lets analyse the degree of protection General Data Protection Regulation (GDPR) attributes to neural data. The current problem with emerging tech is classification of neural data as EU has a fixed classification system of classifying data as personal data and sensitive personal data which indicates a legal gap to legitimise the processing of such data. If we were to ponder over the definitions of hat classify as neural data or what is neuro-privacy or Neural data processing, conventionally neuro-data refers to set of data recorded while

⁶ James Giordano, Neuroethical Issues in Neurogenetic and Neuro-Implantation Technology: The Need for Pragmatism and Preparedness in Practice and Policy, 4 Stud. Ethics L. & Tech. 1 (2010).

⁷ Sofia Frischenbruder Sulzbach, Protection of Neurodata in the European Union: Impacts of Emerging (Neuro)Technologies on the (Neuro)Privacy of the Data Subject, 3 Latin Am. J. Eur. Stud. 180 (June–Dec. 2023).

monitoring brain activities which share insights as to its structure and functioning in contrast to this also exist a term called mental data which people might confuse as brain data only but is quite different from brain data as brain data or neural data indicates the brain activity or neural activity and Mental data represents a larger set accessible even through behavioural observation.

As also highlighted before, Brain data could have been even recorded earlier however there existed no practical solutions as to how to decode such complex data however emerging Artificial Technology, Machine learning and deep learning methods have made this possible due to which processing of personal data has become easier. Currently there is no explicit mention of neural data as any of two. The processing of personal data in EU is governed by GDPR which defines personal data as any and all information relating to an identified or identifiable person, given this an interpretation it means that any data that reveals or identifies any person and also allows identification based on its association with other data” and hence this implies that data should be considered as personal data. There also exist two theories related to personal data first is abstract data which considers the identification of person from large chunk of information and concrete theory that argues that personal data is only that information which allows identification in certain circumstances.⁸ If abstract theory is to be considered then GDPR personal data can be considered to include neural data however classifying the data is also not easy raw neural data like brain waves does not remain static and varies every time with changed circumstances also neural data does not only tells or identifies the person but also reveals a great amount of info apart from this which makes it difficult to apply restrictions and also there is no clear consensus to both theory currently and has been left to EU interpretation.

Lets ponder over other Articles of GDPR, Article 35 of GDPR Which deals with Rights and freedom of identified person RIGHTS AND FREEDOM OF IDENTIFIED INDIVIDUALS) is a mandate when data processing might lead to a high risk to the rights and freedoms of individual. This relevant for emerging tech like neuro technology. There also various mandatory RIGHTS AND FREEDOM OF IDENTIFIED INDIVIDUALS situation under article 35(3) of GDPR that is automated processing with legal or significant effects on the data subjects second is large scale processing of sensitive data or data related to criminal convictions

⁸ Id.

and also systematic monitoring of public areas on large scale.⁹ However currently GDPR does not explicitly categorise neural data. This cause a legal ambiguity it may be treated as common data as under article 6 or sensitive data under article 9 of GDPR. To avoid weakening subject rights it must be treated as sensitive data under ensuring compliance to legal procedures as to consent or legal justification.

Proceeding further as to how DPDP and Indian framework deals with this. As far as neural data is considered there as such no explicit clarity as whether neural data classifies as to personal data or not, as per DPDP act 2023 section 2(t) defines personal data “personal data” means any data about an individual who is identifiable by or in relation to such data; ¹⁰also 2(u) “personal data breach” means any unauthorised processing of personal data or accidental disclosure, acquisition, sharing, use, alteration, destruction or loss of access to personal data, that compromises the confidentiality, integrity or availability of personal data.¹¹ Hence it implies that if any data that identifies a person may be deemed as personal data, however classification of neural data and interpretation on this matter has not been sought or underlined in anywhere. Section 6 of the said act touches upon the very significant aspect that is of consent as per section 6 of the said act the the data principal that the data providers consent must be free, specific, informed, unconditional and unambiguous with a clear affirmative action, and shall signify an agreement to the processing of her personal data for the specified purpose and be limited to such personal data as is necessary for such specified purpose¹²

As suggested by the section the consent needs to be without any coercion or pre condition, related to a clearly defined purpose, based on full understanding and not tied or unrelated terms. This definition aligns with the spirit of global standards as that of GDPR. However in neurotech obtaining “informed”, ”specific” consent might be extremely difficult as individual might not fully comprehend the implication of sharing brain data, emotional patterns or memory based signals, moreover even if the consent is revoked but the data has been processed or integrated into machine learning algorithms it may not be practically erasable. Section 8 of the act outcomes core responsibility of data fiduciary including ensuring accuracy security and purpose-based processing of personal data. These obligations are accompanied with

⁹Id.

¹⁰ Digital Personal Data Protection Act, No. 22 of 2023, § 2(t) (India).

¹¹ Digital Personal Data Protection Act, No. 22 of 2023, § 2(u) (India).

¹² Digital Personal Data Protection Act, No. 22 of 2023, § 6(India).

accountability even when processing takes place through third party (sub section 1 and 2).on the topic of neuro tech this section is very relevant as ultimately brain data is processed using external AI models the scope of the act lacks appropriate guidance for hyper sensitive neural data as per the DPDP act implied equality of neural data with normal personal data. Sub section 7 requires data to be erased when the purpose is completed however, once the neural data is fed into the algorithms of the machine it becomes difficult to erase them.

JUDICIAL FRAMEWORK

Apart from DPDP and data privacy concerns, rising neuro-tech would also cast a question on criminal procedures being followed, in the context of Indian criminal procedure the debate around scientific technique and constitutional right was sharpened in *Selvi vs state of Karnataka* the case dealt with the legality of tech used during Criminal investigation. The techs used are Polygraphy test which is basically lying detection test these record physiological changes that such as heart rate breathing and perspiration to detect stress associated with deception. BEAP BRAIN ELECTRICAL ACTIVATION PROFILE, brain mapping that measures the brain electrical responses to familiar stimuli to understand whether criminal recognise crime related cues.

In the *Selvi* judgement Supreme court of India rules that use of such techniques is against the constitution right of self-incrimination provided through article 20(3) of the constitution.¹³ The courts recognise that compelling an individual to undergo such test amounts to testimonial compulsion especially when the data extracted is not consciously and or not voluntarily provided, This judgment also expanded the scope of article 21 of the constitution protecting mental privacy and bodily integrity of the accused. This reasoning holds a great water even today with great emerging neuro tech, with the advancement in tech including brain computer interface and neural implants and cognitive monitoring devices may soon lead to detection and recognition interfering intent or even extracting mental imagery. Thus, *Selvi* Judgment forms a constitutional shield against potential is of neurotech.

While the whole world is juggling with the potential threat of privacy in the era to great advancements of tech and AI and neuro tech CHILE s judiciary delivers first worldwide

¹³ *Selvi & Ors. v. State of Karnataka*, (2010) 7 SCC 263 (India).

judgment on EEG tech. The landmark case is known as GIRARDI VS EMOTIV.

Emotiv a neurotech company used EEG tech and manufactured the headsets which records brain activity, senator Girardi used the brainwave monitoring headset made by the us tech companies after discontinuing use and deleting the account Girardi discovered that emotive continued to store and process the data and hence this case in front of Chile's Supreme court where the petitioner claims that it violates his right to privacy as per article 19 of the Chile constitution.

The court ruled that Emotive practice is violative of article 19 of chiles constitution which grants right to privacy and psychological integrity, Emotiv's retention of brain data in their cloud system even after account deletion without any consent is violative of the rights of the consumer also according to emotive policy data retained could be used by third parties also violates the principle.¹⁴ In 2021, "The bill to amend the constitution to defend brain rights or "neuro-rights" was passed by the Senate. The Chamber of Deputies examined and approved the constitutional amendment in September of the same year. It is now expected, however, that the president will promulgate the bill into law. Thus, should the process be finalized, Chile becomes the first country worldwide that enshrines laws for mental privacy, free will, and non-discrimination in the access of citizens to neurotechnology. The purpose is to give personal brain data the same status as that of an organ so that it may not be bought or sold or trafficked in target operations."

SUGGESTIONS

Neuro technology is something that is not going to stop with emerging trends and tech this dynamics will also occupy great place in the world framework while emerging neuro tech can be a great advantage to many unsolved medical problems it might also lead to great medical disasters and hence the biggest need of the hour is proper clear guidelines onto neural data and its use even by medical science and also commercial use. The existing regulation do not clearly articulate upon neuro data and neuro data are the most sensitive personal data that brings great threat with it hence the global frameworks as that of GDPR needs to ponder over this problem

¹⁴ Quinyon Nave, Chilean Supreme Court Sets Precedent in Brain Data Privacy Case: The Urgent Need for Brain Data Privacy and Security Laws, Nave Sec. (Aug. 2024), <https://navesecurity.com/chilean-supreme-court-sets-precedent-in-brain-data-privacy-case/>.

and needs to come up with the solutions. Hence some of the suggestions are:

- 1) Explicit recognition of Neural data – there is a urgent need for domestic and international laws to classify neural data as a distinct category from general personal data given its capacity to reveal complex data.
- 2) Mandating Neural data impact assessment – just as GDPR mandates Data protection impact assessment for high risk data there needs to be similar mechanism for neural data processing.
- 3) Revisiting the concept of informed consent – law must evolve to redefine what qualifies as valid, informed consent as traditional consent model fails to meet the need the requirements needed for a valid consent to hold in neuro tech.
- 4) Compliances of erasing the data – as seen currently there is no mechanism which protects the data processing even after deletion of accounts and hence a need for stricter regulation on this side is also needed.

COCLUSION

As neurotechnology develops, the legal landscape must develop at a different pace and level of complexity. The current legal frameworks are mostly sound in terms of regulating general personal data, however neural data is nuanced and not covered by the same level of regulatory rigour. By failing to explicitly define and protect brain-derived information individuals become subject to unbounded risks, including mental manipulation and irreversible inclusion of an individual's private thinking into algorithmic systems.

Through the comparative analysis of GDPR, DPDP, and patterns of global case law this paper has provided evidence of both urgency and viability for reform. Recognising neurorights, mandating neural data impact assessments, and reimagining consent processes are not pie-in-the-sky aspirations - nor are they a long way off. While neurotechnology can have immense value for society, it needs to be accompanied by ethical clarity and legal responsible.