

A Study on Non-Invasive Neural Interfaces for Internal Speech Recognition

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Abstract

The brain coordinates the replica and understanding of internal speech. The processes of thinking given within the variety of internal speech. The perception of internal speech involves the first and secondary crust centers of analyzers, that record the corresponding waves, signals and rhythms and qualify them as language. this can be achieved in 2 ways: either use practical neuroimaging and alternative further analysis ways that enable localizing the structures presently functioning, or choose patients with harm to bound areas and conduct an in depth neurocognitive study compared with healthy individuals from the management cluster, deciding that functions during this lesion fall out.

The principal issue of internal speech analysis is languages. A lot of complicated question is that the study of the association of thinking, memory with internal speech. Now, particularly once neurologists take into consideration the malleability of the brain, practical relationships, general principles, pathways of excitation of larger interest. Technologists of non-invasive neurointerfaces use ways and technologies to localize structures that management the understanding and replica of internal speech, the communication between them, the stages of speech signal process and therefore the role of every structure at these stages. The introduction to the study highlights approaches and ways for distinguishing varied practical speech aspects. The vocabulary section discloses the linguistics element and therefore the grammar element, further because the perceived and consistent kinds of words of internal speech. The section holographic human consciousness describes aspects of storing life data. The pic of consciousness is that the main variety of storage of data concerning human life. within the section, holographic fixation of internal speech presents practical resonance pictorial representation targeted on daring result detection, that is these days the best tool for mapping somatic cell activity, a lot of exactly, the practical state of neural networks - the premise for visualizing our holographic pictures in real time. exploitation nano resonators with Fourier transducers, the brain activity of an individual's internal speech holographic image will fix mental noninvasive neurointerface in language kind by vocabulary.

Keywords: Vocabulary; Holographic consciousness; Neurointerface; Practical resonance pictorial representation

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Introduction

Internal speech is expounded to thinking: the fashionable position of scientific discipline is such while not internal speech, thinking, primarily abstract-logical, is not possible [1].

If the studies are supplemented by practical neuroimaging, they're additionally of explicit interest as a mirrored image of somatic cell malleability processes [2,3].

Electrophysiological studies use the strategy of evoked potentials.

the world within which the known potential is generated are often determined supported its severity in several leads.

The potential N400, negative, reaches the utmost amplitude four hundred ms when the presentation of the corresponding stimulant, most pronounced within the centroparietal zone, reflects the processes of linguistics analysis, that is, awareness of that means.

- LAN potential (front left negative wave), resembling a N400 in delay, however most pronounced in leads from the left frontal departments, responds to the employment of components of speech that don't work into the grammar structure of this sentence (for example, "soft toy" rather than "soft toy") [4].

The most renowned electrostimulation studies belong to Canadian graph "Language and Brain Mechanisms," still relevant for neurologists and psychological feature specialists [5].

This can additionally embrace studies exploitation deep brain stimulation [6] and transcranial magnetic stimulation, that began to be administrated comparatively recently.

Functional neuroimaging ways are presently leading ways within the study of the neuroscience of internal speech. allow us to choose that structures are acting at the moment:

- practical resonance imaging (fMRI) and antilepton emission imaging of bound brain regions;

- diffuse-tensor magnetic resonance imaging permits mental image of conducting brain pathways connecting these aras; magnetoencephalography (MEG) makes it potential to live and diagrammatically represent magnetic fields that are fashioned because of electrical activity of the brain.

The structure answerable for understanding speech is that the Karl Wernicke zone, the posterior a part of the higher convolution. This space is adjacent to the cortical area, specialized in sound perception and contains sensory pictures of words and their mixtures characteristic of the linguistic communication. The model additionally claims that sensory pictures don't carry linguistics content - this facet of speech can't be specifically localized within the brain, but, yet, within the method of signal process, there ought to be associate degree attractiveness to the "repository" of ideas - the linguistics units of our speech. There are links between the Karl Wernicke zones and therefore the "repository" of ideas [7].

The "double flow" model was receptive perception. when treatment within the cortical area of the lobe, the signal follows ventral and dorsal flows. Ventral goes to the lobe and is critical for distinguishing the article (answers the question "what?"), And dorsal goes to the lobe and is meant to acknowledge the spatial characteristics of the article, its position and potential ways in which of interacting with it (answers the question "how?")

Primary process relating to the phonologic composition and frequency-time characteristics happens within the back of the higher convolution and therefore the areas close the higher temporal furrow, for the foremost half this can be the Karl Wernicke zone. The ventral flow is directed to the front and middle components of the lobe, it participates within the actual recognition and lexical analysis of speech (understanding it's that means, correlating with ideas keep in memory). Dorsal participates in bodily function integration, that is, correlation with motor pictures of words, and includes 2 separate paths: each experience the temporal-parietal region, then the primary is directed to the lower convolution, and therefore the second to the anterior cortex. Presumably, one among them participates within the perception of internal speech, that is, controls the development of section sequences and provides a lot of complicated skills.

Hicoca-Popel claims that the perception of internal speech, through the functioning of the ventral flow, happens bilaterally, and therefore the intermediate center of dorsal flows operating solely within the dominant hemisphere is placed within the temporal-parietal zone on the sylvium groove, at the junction of the temporal platform and plate parietale [8].

In ventral flow, that is principally concerned in linguistics and grammar process, excitation additionally moves on many methods. The lower frontal-occipital tuft connects the lower cortical region and dorsolateral cortical region with the posterior a part of the temporal and lobe. It passes through the anterior leg of the external capsule into the lobe and provides branches to the center and lower convolution, further because the lobe [9]. once stimulating this beam, linguistics paraphasia's are ascertained within the experiment [10]. Dorsal flow, in turn, is expounded to extended syntax and is evolutionarily later and ideal [11].

In sound perception activation of interested structures is uneven [12-14]. variations were found within the activation of membrane bone and frontal centers: it's shown that the latter characterized by an outsized degree of lateralization, this indirectly indicates in favor of the potential bilateral activity of the ventral flow, which, however, because the level of treatment will increase to a lot of complicated one, is "interrupted" by a lot of lateralized dorsal. there's mutual activation between interchangeable speech structures of various hemispheres. what's ascertained in healthy patients as equilibrium. The cerebral hemisphere is logical, and therefore the right emotional and inventive, as an example, specifically shaped thinking, tasks associated with the manipulation of objects, images. The cerebral hemisphere is a lot of specialized for recognition of your time characteristics, and therefore the cerebral hemisphere is a lot of specialized for recognition of frequency characteristics. This distribution was shown for the anterior a part of the higher convolution, wherever data is processed instantly when the first cortical area. This can be confirmed, as an example, by recent tract graphic analysis.

Scientists at Carnegie Mellon University and North Star State University are ready to produce a nearly non-invasive technology which will enable unfit patients to manage mechanisms and robotic prostheses with the facility of thought. To do this, they'd to beat the most drawback of non-invasive neurointerface: in contrast to the implant, it receives a far a lot of howling signal, and so, the accuracy and speed of management decreases. With the assistance of the most recent sensors and machine learning, the researchers were ready to get signals from the depths of the brain, clear them of interference and for the primary time achieved top quality management by a robotic hand, On the Brain Bit neurointerface tape there are four dry encephalogram electrodes, reference and customary electrodes, further as a miniature electronic module.

This permits you to register knowledgeable graph with the simplest quality among the neurointerfaces obtainable on the market. The device amplifies and digitizes the received signal and transmits it exploitation the Bluetooth protocol to a laptop, smartphone or pill. in contrast to analogues, the position of the electrodes on the tape Brain Bit corresponds to the international arrangement of electrodes 10-20. Electrodes offer direct contact in areas of lobe T3 and T4, further as in os region O1 and O2. in keeping with advanced international studies, these zones are best for recording the amount of 4 main styles of brain waves. Brain Bit records electrical activity within the variety of "raw data" of encephalogram, that are bestowed as levels of the four main rhythms of the brain. All brain activity information obtained are often sent to the cloud for analysis and process by machine learning ways. The Brain Bit SDK contains a collection of tools for developers that enable you to get each raw encephalogram information and calculated values of brain activity rhythms. The SDK facilitates complicated processing and analysis by simplifying application development. the appliance will show the state of the user's brain supported color indicators. These graphical indicators complement qualitative and quantitative indicators demonstrating this state of the brain.

Mental Lexicon

A vocabulary may be an assortment of word data that features the particular that means of a word, a linguistics element, a grammar element, further as perceived and consistent kinds of words [2]. Within the mental vocabulary, the brain finds and learns what we tend to ourselves are progressing to fish. we tend to are attempting to appear wherever our thought processes come about into the vocabulary [2].

Firstly, morphemes are thought of its smallest unit - token meaning-containing units [2]. These are roots, suffixes, prefixes. At an equivalent time, the vocabulary will have many levels, and on one among them the minimum unit are going to be a word. A vocabulary may be an assortment of word data that features the particular that means of a word, a linguistics element, a grammar element, further as perceived and consistent kinds of words

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Secondly, it's not an inventory that's consecutive viewed, however a network wherever every unit is related to several others. The essence of such a corporation is that words connected in that means are usually utilized in an equivalent mental scenario, and if internal speak is concerning one, it'd be wise keep the remainder rigorously. A lot of usually words are used along, the stronger the association between them, a lot of inclined it's to maneuver on this association throughout the associative method. Freud's fictitious thought technique confirms this.

The noesis is central to the organization of internal speech. every word is gift within the "library" altogether grammatical forms, as an example, the days of verbs or the genera of adjectives. thanks to this, linguistics and grammar info is extracted at the same time at the lexical access stage. once line the word "red," the names of alternative colors, red objects et al related to it activated within the linguistics network (Figure 1).

Lexical choice is that the stage at that, among all activated word forms, the foremost appropriate is chosen. Lexical integration is that the combination of all words into larger structures: phrases, sentences, up to whole internally connected texts. The preparation of texts includes macro and small designing.

Communication is a method to influence the atmosphere. Therefore, communication, like several action, is subordinate to the psychological feature sphere and might be geared toward meeting the requirement or eliminating inconvenience. On the instance of instructive expressions, this will be seen particularly clearly, however our alternative statements appear to possess identical goal, as a result of their merely no alternative sources of motivation. Thus, any statement ought to be developed supported the result that we wish to receive - this side of the preparation of the message is termed macroplanning. once microplanning, the question is developed however the data ought to be presented: that cluster of words to use, within which relationships to place them. once making ready the message at the output, a "concept" is obtained, the final that means of the entire sentence.

The noesis may be a specific construct, and it manages smaller, additional formal units than the "repository of ideas." equally, solely folks is the bearers of concepts that actually perceive them, and though all the made sort of expressions for these concepts are hold on within the library, solely books that scan them "animate."

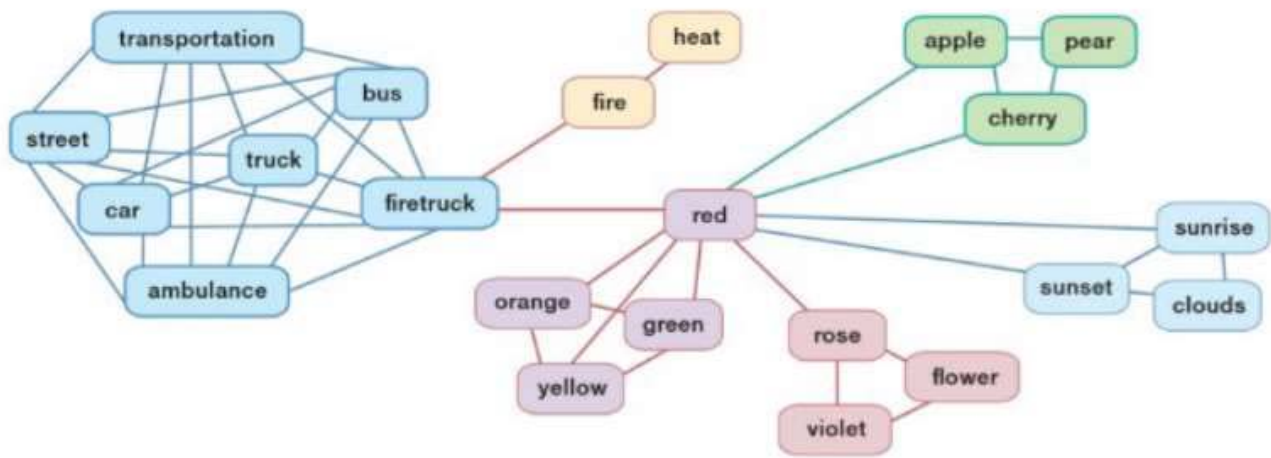


Figure 1: Semantic principle of mental lexicon organization.

The typeulation of expressions is to allow the sentence a selected form, grammatical and phonetic, prepared for pronunciation. The construct obtained within the 1st stage interacts already with the mental lexicon; the primary factor to make your mind up on is a component of internal speech. At the output, we have a tendency to get the corresponding lemma - the initial sort of the word. many alternative word forms are related to lemma. per the grammatical principle, lexical choice of word forms happens. Then there's linguistic unit analysis. The ensuing word can ought to be known as, preparation that is descriptive linguistics analysis: analysis of the quantity of syllables and also the position of stress within the word.

There is very little neurobiology proof that addresses the difficulty of mental lexicon; they create it potential to form a holistic image. Elizabeth Warrington and colleagues investigated the matter of selective things happiness to just one class, and the way they'll relate to long-term memory. It clothed that long-term memory is split into "categories." In our mental vocabulary, not each word is connected with every in order that you'll be able to return thereto in a very totally different way; some quite division, spread remains there. Warrington known such groups: living beings, that are principally related to terms describing their look and alternative properties perceived by the senses; and artificial objects - they're typically delineate by the operate that they perform.

Human Holographic Consciousness

Human consciousness, sort of a holograph, contains everything that's in a very multiple change system from finite shifting professions. The holograph of consciousness is that the basis for storing info concerning human life.

The principle of the holograph "everything in every part" permits a basically new approach to the difficulty of organization and order.

The holograph shows that some things cannot be investigated by associate associatealytical method: to dissect an object and study its constituent components. If we have a tendency to dissect something on the holograph, then we are going to not get the components of that it consists, however we are going to get identical, however with less accuracy.

Our ability to quickly notice the correct info from the huge volume of our memory is provided by a brain that works on the principle of a holograph. Indeed, one among the foremost wonderful properties of human thinking is that every piece of knowledge is instantly and reciprocally related to the opposite - another property inherent within the holograph. Memory location isn't the sole neuroscience mystery that has become additional resolvable within the light-weight of Pribram's holographic brain model. the opposite is however the brain is in a position to translate such associate avalanche of frequencies that it perceives by numerous sensory organs (frequencies of sunshine, sound frequencies, and then on) into our specific plan of the globe.

Frequency writing and secret writing is strictly what the holograph handles best. even as the holograph is a sort of lens, a sending device capable of turning an apparently nonsensical frequency interfere into a coherent image, that the brain, per Pribram, contains such a lens and uses the principles of optics to convert frequencies from the senses into the inner world of our perceptions.

Pribram's concept that our brains construct solid reality by looking forward to input frequencies has conjointly received experimental confirmation. it's been found that any of our sensory organs incorporates a massive frequency vary of susceptibleness. especially, the researchers found that our visual organs are liable to sound frequencies, that our sense of smell depends somewhat on what's currently known as diffusion frequencies, which even our body cells are sensitive to a good frequency vary. this can

be the work of the holographic a part of our consciousness, that converts separate chaotic frequencies into continuous perception.

The holographic model conjointly shows that consciousness isn't a operate of the brain, but, on the contrary, the neural networks of the brain controlled by consciousness, which, therefore, doesn't die if the brain dies. In holographic reality, thought is as real as consciousness.

A single universe has projections within the sort of a discretely updated frequency wave-like structure - a holograph, the most content of that is consciousness, that is its copy. distinct update of the projection by consciousness means that the looks of durations, that qualifies as time.

A single universe enters time by means that of its own projection within the sort of a frequency wave-like structure - a holograph, forming its own time and at identical time - the final of the complete structure of being thanks to its holographic essence (the whole and half coincide). The active living within the holographic projection of the one, repetition fragments of the passive from the one, a combined with them severally and as an entire, and thru themselves type the present time, house and things in motion.

The conversion of wave matter (packets of information) from the holographic projection of the one in any living creature, as well as in man, into his atmosphere, is meted out by him now not within the sort of pictures, however within the sort of material objects {of different|of numerous} "density" and various forms victimization the corresponding matrices (shaping abilities), making each the living being itself and its atmosphere among the framework of quadruple time, that is that the consequence of the action of one consciousness in a very combined set of living beings. The formation of objects of varied forms in accordance with the mass-forming skills (matrices) of a living creature is meted out per the kind of labor of a 3D printer.

The holographic image of living beings permits them to be separate, living every time their own life, having their own time, their own being, and at identical time in their totality - to be one being that's eternal each in its singularity and in every of its own. As for the ordination, it's supported a program derived by consciousness in a very projection from the Unified to the molecular chains of the ordination in accordance with its existing shaping skills for every specific case. info is associate activity property. while not material objects carriers, as well as consciousness itself, info doesn't exist. for every person, distinct info is mechanically (with the assistance of one consciousness) regenerate into things, images, meanings, feelings, that also are quite material elements of every individual consciousness, entailing later actions of the carrier of consciousness. Living beings are concerned within the info method. With the assistance of knowledge process centers, they're able to immerse themselves in a very inhabitable atmosphere.

All human achievements are connected within the sort of noninheritable expertise during this field, existing information and skills with bound target focus. Within the sort of light-weight and sound, someone will approach the harmony of his own wave basis of the best, that is really the holographic basis of someone.

The time of any living creature, especially, and man, is associate info method throughout that material objects are recognized by consciousness by scanning the atmosphere by the process centers at its disposal. The informational (impulse) nature of your time formation is uneven (one-sided), differing from the same old real or energy interactions of objects therein a living being unilaterally scans the encircling one, consecutive repetition the information recognized and classified by it.

This high-frequency complete update of 1 position of successive, etc., especially, doesn't enable you to travel back or run forward thanks to the spatiality (one-sidedness) and completeness of the update of every position. Therefore, it looks to every person who time flows in one direction: from the past to the long run through this. thanks to the entire change of 1 position by another, that is, irretrievably and infinitely, within the sort of associate infinitely updated ultra-high-frequency wave-shaped holographic projection within the sort of intermittent moments-durations (pulses of information). For humans, info passes each moment to brain neurons from totally different human sensory organs within the sort of sequences of nerve impulses; every of the pulses contains corresponding info. like a shot once the heart beat generation, the fiber is within the so-called refractor state, and can't be reactivated for 1-2 milliseconds, that is, the fiber is in a position to conduct nerve pulses with a frequency not more than five hundred hertz. The period of the heart beat itself passing through the fiber may be a fraction of a msec in every moment.

A pause between nerve impulses containing info means they are doing not go unendingly. However, this pause is below the edge of perception by her consciousness and thus doesn't constitute it. especially, the motion picture for human consciousness is provided by associate interval between the dry run sequential frames of concerning zero.04 seconds, that is alleged threshold. Its period, as you'll be able to see, is quite associate order of magnitude longer than the period of the pause. Therefore, the ensuing distinct sequent moments (in every of them there's associate update of the "reality") of a person's own time, that contain in their sequence all the paintings and every one the events of life for someone, merge into a nonstop, indivisible flow in his mind. everybody, ranging from the instant of birth, selects through sensations from a various atmosphere solely that info which will be deciphered, or info, in accordance with the achieved level of consciousness development (shaping abilities). The holographic approach to the structure of consciousness totally reflects the connections of varied regions of the brain.

Holographic Recording of Internal Speech

Magnetic resonance imaging (MRI) nowadays is employed not just for medical specialty, however conjointly for mapping the useful state of neural networks, permitting you to virtually see the brain's add real time. the flexibility to directly observe the dynamics of psychological feature (cognitive) brain activity appeared solely with the introduction of useful resonance imaging technology into analysis observe.

A little over twenty years past, workers of the yankee analysis organization AT&T Bell Laboratories delineated the principle of visualizing the activity of brain zones in real time exploitation resonance imaging (MRI). A dynamic study of active zones of brain structures at the time of their activity was 1st tested on someone 2 years once the primary publication. magnetic resonance imaging (magnetic resonance imaging) may be a process supported the impact of nuclear resonance.

Trendy magnetic resonance imaging techniques enable not solely to examine organs with prime quality, however additionally to research their perform. thanks to the absence of radiation, this technique is often used while not restrictions and continual studies area unit repeatedly applied. It follows that the relative magnitude of the magnetic resonance imaging signal will function a live of the activity of brain zones. Moreover, the results obtained underneath the management of electroencephalography on the cortical region of the primate open brain counsel that the magnetic resonance imaging signal may be a linear response to the electrical activity generated by the active neural ensemble. purposeful magnetic resonance imaging targeted on daring impact detection is nowadays the optimum tool for mapping vegetative cell activity, additional exactly, the purposeful state of neural networks - the premise for visualizing our holographic pictures in real time.

Closely associated with MRI technology is that the biological science technology "of the brain-computer interface. we have a

tendency to area unit talking regarding the likelihood with the assistance of associate degree EEG to get a show of a stable photograph of the bioelectric activity of the brain, fastening it to the perform of brain structures and therefore the formation of latest stable neural ensembles in them. The EEG may be a supply of data on neural structure events.

At identical time, MRI makes it doable to examine the \$64000 temporal and spatial dynamics of the brain. If you in short describe the foremost general route of activation of brain structures throughout internal speech, then once the beginning, the broad plant tissue fields of the brain area unit 1st concerned within the work, and therefore the psychological feature route within the neural structure ends. psychological science is one in all the foremost promising areas of use of neuroimaging technology by FMRT, as a result of this scientific field is much empty concepts regarding the localization (in the anatomical sense) of psychological feature functions.

In one in all the works of yankee researchers, an endeavor was created to answer the question of the localization of brain structures designed to classify such psychological feature classes as equality and potency. It clads that the emotional assessment of the "effectiveness," "justice" and "general benefit" of the choice is applied by 3 totally different brain structures. The brain department, known as the "shell" (lat. Putamen), is to blame for potency, the bark of the "islet" (lat. Insula) protects the interests of justice, a accumulative live of potency and difference, that is, utility, assesses the septate organ (lat. Septum), whereas alternative area unites of the brain are concerned within the process. the event of cognit ology, a direction of neurosciences that studies the fundamental mechanisms of the brain's work: "mental methods," their localization, dynamics, ways that of exploitation and up in existence, additionally parades nice prospects. The alleged "interactive stimulation" makes it doable to prepare coaching feedback directly through the "interested" brain structure (Figure 2).

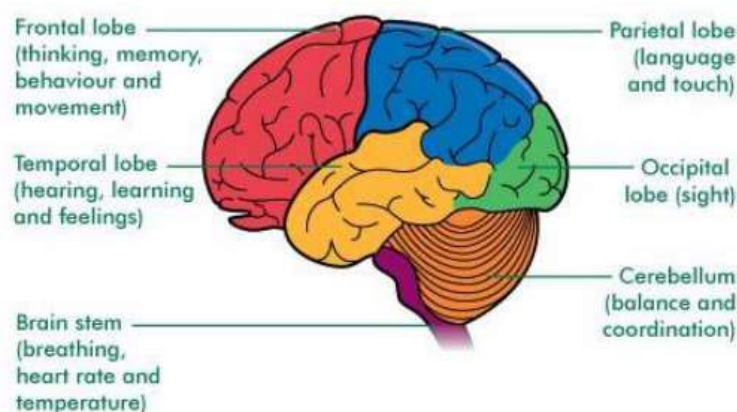


Figure 2: Brain functions.

By visualizing the gyrus cinguli or hippocampus, you get an opportunity of “direct conversation” with the brain. Knowing however the brain is activated, you'll be able to restore the holographic image of internal speech by a resonant energy trace. exploitation nano resonators with Fourier transducers, brain activity of human internal speech holographic image will fix mental noninvasive neurointerface in language kind by vocabulary.

Conclusion

Thanks to the event of holographic strategies, technologies and therefore the creation of sensible neurointerfaces, within the coming back years humanity will move to a very totally different world during which everything is going to be technological. the majority modes of transport are going to be controlled through neurointerfaces with sensible AI. Human thinking is going to be a form of hybrid of biological and non-biological. we have a tendency to area unit considering the prospect of connecting to the cloud from the human cortex. Already, we are able to connect a laptop to the human brain and so convey feelings and emotions to the web. it'll be doable to scan recollections and impressions from the human brain, transmit them over the web or perhaps transfer them to the brains of others. this may open the thanks to turning the net into a brain-net, that is, a brain-net. you'll be able to share your recollections and cargo them into a break-no, then adored ones with their eyes and heart knock via sensible neurointerface can survive your events and knowledge joy. Neurointerfaces with intelligent AI and technological singularity area unit already in demand within the industrial and social spheres. particularly in environments and things incomprehensible to the consciousness of specialists, wherever large risks arise.

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