## Glyn Kendall

Contributions between 1-1-2018 and 1-7-2018

Number of characters added: 84109

Number of characters deleted: 4897

## Format of edits

Date and time	File name	Addition/Deletion
Content of edit		

## **Edit history**

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Deletion
Brain-computer-interfaces		

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Deletion
Electroencephalography		

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2018-04-18 13:23:00	Full SCI2010 Essay.docx	Deletion
Brain-computer-interfaces		,
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Real-time decoding of cover	t	
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Sentiment analysis using EEG		

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The appearance of unknown words				
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EEG based word familiarity	using			
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for research subjects and pa	atients, the probable benefit of research into a	nd		
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Neuroprosthetics are artificial				
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paradigm showed 93% and 91% a	accuracy in healthy volunteers and LIS patients	

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Electroencephalography (EEG)		

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Toward an Attention-Based Diagn	ostic Tool for Patients With	

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Ekanayake, J., Hutton, C., Ridgway, G., Scharnowski, F., Weiskopf, N. and Rees, G. (2018).		

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Prasad, D., Liu, S., Chen, S. and Quek, C. (2018). Sentiment analysis using EEG activities for		

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Khurana, V., Kumar, P., Saini,	R. and Roy, P. (2018). EEG based word fa	miliarity using
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Glannon, W. (2016). Ethical is	sues in neuroprosthetics. Journal of Neural	Engineering,
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Laureys, Steven		
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Soddu, Andrea		,
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References	

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Brain-computer-interfaces		

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Real-time decoding of covert		

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Advances in neural interfaces have demonstrated remarkable results in the direction of replacing		

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
are unable to speak or move due to brain injury.		

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ding a platform for communication in patients	who
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cess varied and therefore more versatile	
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g upto 70%. By utilising higher order mental	1
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significantly above chance, with individual	1
	Full SCI2010 Essay.docx ccess varied and therefore more versatile  Full SCI2010 Essay.docx g upto 70%. By utilising higher order mental

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
classification of brain activations. These were linked to the covert allocation		

of attention to real-world images presented at 4-quadrant locations. Accuracies

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
approach with quadrant-specific pa	arameter estimates, to achieve single-block	

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
attention. Using realtime fMRI, we	implemented an online winner-takes-all	

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
higher-order brain regions involved	d in complex cognitive processes such as	

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neuroimaging techniques. Here, w	re provide proof-of-principle for the use of	

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
motor and sensory brain regions,	using surgical implants or non-invasive	

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devices for communication. Until n	ow this has only been demonstrated in primary	

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(BCI) provide a means of using h	uman brain activations to control	

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visual areas		

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Real-time decoding of covert atter	ntion in higher-order	

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neurophysiological study, including	g implementation of connectivity features as BCI mod	dality.

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strengths and limitations of our de	sign and propose further steps on development and	

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investigation on spinal cord injured	patients' BCI control and brain connectivity. We disc	cuss

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arms, a study of motor imagery mo	odalities on healthy individuals' BCI performance, and	d a pilot

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system. Furthermore, we present	two illustrative experimental applications of the BCI-c	ontrolled

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development, BCI implementation	, and qualitative assessment of HRI characteristics o	f the

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arms for assistive technologies an	d rehabilitation applications. We account for robotics	

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our progress and goals towards d	eveloping off-the-shelf BCI-controlled anthropomorph	ic robotic

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(HRI) is	s increasingly important in r	ehabilitation robotics development. In this paper, we	present

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and can be implemented in neurorobotic applications. Moreover, social Human-Robot Interaction		Interaction

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importance. Off-the-shelf BCI syst	ems are based on fast, reproducible detection of mer	ntal activity

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investigating brain connectivity fea	atures for implementation of BCI control holds special	

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limitations. Taking into account the	e neurophysiological alterations of disabled individual	ls,

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cost, while recent advances aim	at improving past technological and neurophysiological	al

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interfaces (BCIs) are popular due	to considerable advantages including simplicity, safe	ty, and low

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and restoring lost sensorimotor function	in human patients. Noninvasive brain-compute	;r

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Advances in neural interfaces have demonstrated remarkable results in the direction of replacing		replacing

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Arms.		

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Rehabilitation Robotics: Off-the-Sl	nelf BCI Control of Anthropomorphic Robotic	

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Towards		

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comparative study with other popu	lar classification technique is also discussed.	

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recorded using the proposed class	recorded using the proposed classifier combination approach. Finally, a	

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word for which the user has confus	sion in his mind. An accuracy of 82% has been	

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Similarly, the pattern of brain wave	es has been found to be different for the	

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be totally different from the pattern	when he is familiar with the word.	

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comes across an unknown word then the pattern of his brain waves comes out to		

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at the time of unknown word perce	ption can be detected, i.e., when the user	

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are reading 25 words. The results	show that the characteristics of brain waves	

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unfamiliar with the text. EEG datas	set of 12 users has been developed while they	

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been developed to provide the me	aning of the word when a user is found to be	

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used to boost the prediction perform	mance. A dictionary based pop-up window has	

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Random Forest (RF) classifier. Ne	ext, a decision fusion approach has also been	

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frequency bands. The prediction o	f word-familiarity has been performed using		

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Root Mean Square (RMS) a	and power have been computed from beta and	gamma
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decomposition technique ar	nd four features, namely mean, standard deviat	tion,
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reading the text. The record	ed signals have been processed using Wavele	et
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based on EEG signals from the us	sers brain waves has been developed.	

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particular, a word-familiarity predic	tion approach	

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(EEG). In		

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words which are unfamiliar to the	users while reading using	

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often disturbs communication and	reading. This paper focuses on detecting those	

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The appearance of unknown word	s	

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features and frequency bands con	nbination	

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
EEG based word familiarity using		

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techniques to better understa	and and treat brain disorders.	
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brains. These questions sho	uld shape the evolution and application of nov	rel
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will generate new ethical and	d philosophical questions about people and the	eir
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may be an ethical obligation	to conduct this research. Advances in neuros	cience
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can be ethically justified. De	pending on their neurogenerative potential, the	ere
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therapeutic applications of neuroprosthetics outweighs the risk and therefore

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for research subjects and pa	itients, the probable benefit of research into ar	nd
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. Provided that adequate pro	tections are in place	
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Significance		
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their lives.	,	'
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people affected by damaged	or dysfunctional brains and improve the quali	ty of
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their identity. Neuroprosthetics can maximize benefit and minimize harm for

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properties they had before injury or disease onset and thereby re-establish		

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also re-establish the connectedne	ss and continuity of the psychological	

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agency for people affected by neu	rological and psychiatric disorders. They can	

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with these circuits, neuroprosthetic	cs can restore varying degrees of autonomous	

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modulating dysregulation in neural circuits. As enabling devices that integrate		

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or improve motor and mental funct	ions in bypassing areas of injury or	

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. Neuroprosthetics can resto	ore	
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results		
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Main		
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patients' best interests.		
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to neuroprosthetic research	and balancing technological innovation with	
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	<u> </u>	<u> </u>

as how to establish and implement fair selection criteria in providing access

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these questions. It also inclu	udes consideration of social justice issues such	n
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. This review is an analysis	and discussion of	
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Approach	·	,
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identity.	<b>'</b>	<b>1</b>
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indicated. These include info	ormed consent, agency, autonomy (free will) a	nd
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goals of particular neuroprosthetics and the conditions for which they are

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psychological sequelae. Oth	er ethical questions are more specific to the th	nerapeutic
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altering neural circuits again	st the potential harm from neurophysiological	and
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raise general ethical questio	ns about weighing the potential benefit of	I
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thought and behavior. These	e direct and indirect interventions in the brain	
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people with these conditions to gain	people with these conditions to gain or regain varying degrees of control of		

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dysfunctional neural circuits, brain	injury and limb loss. They can enable		

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nterfaces and hippocampal	prosthetics can bypass, replace or compensa	ate for
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2018-04-18 13:23:00	Full SCI2010 Essay.docx ulation, brain-computer interfaces, brain-to-bra	

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neurodevelopmental and neurodegenerative disorders. Cochlear implants, visual		

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congenital anomalies, traumatic b	rain injury, infection, amputation or	

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cognitive affective and volitional fu	nctions that have been impaired or lost from	

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neurally mediated functions. These	e include sensorimotor, visual, auditory,	

devices or systems designed to generate, resto	O Essay.docx  Ore or modulate a range of
	ore or modulate a range of
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Neuroprosthetics are artificial	
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Ethical issues in neuroprosthetics	,
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using this system.	
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entropy system could detect a response to command in all healthy subjects and

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detect command-following in patie	nts with severe motor disabilities. The	

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present study provides evidence that an EEG-based measure of attention could		

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entropy could not distinguish indiv	idual VS/UWS patients from LIS patients. The	

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reached a lower accuracy than spe	ectral entropy. Resting-state EEG spectral	

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respectively. VS/UWS patients we	re at chance level. EEG rhythms classification	

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paradigm showed 93% and 91% a	ccuracy in healthy volunteers and LIS patients	

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classification. Spectral entro	py classification during the attention-rest	
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paradigm, and compared wi	th EEG rhythms (delta, theta, alpha, and beta	)
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state/unresponsive wakefulness s	yndrome (VS/UWS) were included. Spectral	

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volunteers, 6 LIS patients, and 10	patients with a vegetative	

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the issues of accuracy and training	g requirement. Data from 20 healthy	

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objective diagnostic tool for	patients with locked-in syndrome (LIS), answe	ring
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focal attention in order to de	evelop a motor-independent, portable, and	
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unconscious patients. We s	tudied the use of spectral entropy as a measur	e of
unconscious patients. We s	tudied the use of spectral entropy as a measur	e of
unconscious patients. We s	tudied the use of spectral entropy as a measur	e of
unconscious patients. We s 2018-04-18 13:23:00	Full SCI2010 Essay.docx	e of Addition
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Electroencephalography (EEG)		

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Locked-in Syndrome		

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Toward an Attention-Based Diagn	ostic Tool for Patients With	

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Abstracts:		

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169, pp.462-472.		

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decoding of covert attention in hig	her-order visual areas. Neurolmage,	

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Real-time		

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F., Weiskopf, N. and Rees, G. (2018).			
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Ekanayake, J., Hutton, C., Ridgwa	ay, G., Scharnowski,	

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pp.1-17.		

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International, 2017,		

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
Control of Anthropomorphic Robotic Arms. BioMed Research		

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Shelf BCI		

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Astaras, A. and Bamidis, P. (2017). Towards Rehabilitation Robotics: Off-the-		

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Athanasiou, A., Xygonakis, I., Pandria, N., Kartsidis, P., Arfaras, G., Kavazidi, K., Foroglou,		

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pp.33-48.		

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and frequency bands combination	. Cognitive Systems Research, 49,	

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features		

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Khurana, V., Kumar, P., Saini, R	. and Roy, P. (2018). EEG based word familiarity using	g

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Glannon, W. (2016). Ethical issues	s in neuroprosthetics. Journal of Neural Engineering,	

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122-135.		

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Neuroscience		

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EEG and		

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Clinical		

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Syndrome.		

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Toward an Attention-Based	Diagnostic Tool for Patients With Locked-in	
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(2018)		
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; et al	·	
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Laureys, Steven	<u>'</u>	,
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Soddu, Andrea	1	

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Chatelle Camille		
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potential uses for BCI utilisation.		

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connections. This shows that the non surgically invasive procedure of fMRI could hold		3

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the fMRI method was shown to ha	ve a high accuracy showing potential for BCI	

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functional Magnetic Resonance In	naging (fMRI). Through trials involving 8 participants	

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the investigation was to show that a BCI could be envisioned that uses real-tin		

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monitor real time decision making	and attention in the subjects brain. The purpose of	

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The investigation performed by Ek	anayake et al(2018) aimed at showing the ability to	

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NeuroImage, 169, pp.462-472.		

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Real-time decoding of covert attention in higher-order visual areas.			

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J., Hutton, C., Ridgway, G., Scharnowski, F., Weiskopf, N. and Rees, G. (2018).		

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Ekanayake,		

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enhance the subjects control.		

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that results and accuracy of control depend on the individual user and that training is required to

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in the optimisation of BCI systems	in how they control external peripherals. The study	also finds

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BCI is possible for both healthy su	bjects and injured subjects advancements still need	to be made

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suffering from spinal cord injuries.	The investigation finds that while use of robotic arm	s through

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where the subject was healthy as	well as an investigation into use of robotic arms by pa	atients

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for industrial and assistive use in e	everyday lives. The work involved applications of a re	obotic arm

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enhancing progress into creating r	obotic arm technologies for use as rehabilitation assi	istance and

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The aim of the investigation devise	ed by Athanasiou et all.(2017) was to aim at developi	ng and

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International, 2017, pp.1-17.		

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Robotics: Off-the-Shelf BCI Contro	ol of Anthropomorphic Robotic Arms. BioMed Resear	ch

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
Foroglou, N., Astaras, A. and Barr	nidis, P. (2017). Towards Rehabilitation	

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
A., Xygonakis, I., Pandria, N., Kart	sidis, P., Arfaras, G., Kavazidi, K.,	

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
Athanasiou,		

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
word.		

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implementation of a dictionary device returned an accuracy of 82% in determining an unknown		nknown

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displayed on a screen for the reac	ler. The team involved found that this method and	

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the investigation was able to devise a system where the unknown word and its meaning were		g were

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across a word that they are unfamiliar with or do not know the meaning of. Through this reading		is reading	

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measuring device. The investigati	on found a difference in brain waves when the subje	ct comes

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investigation involved 12 participants who were required to read text while connected to an EEG		o an EEG

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when the subject is reading and determining whether the user knows the meaning of a word. The		word. The

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Khurana et all.(2018) devised an investigation into a method of reading a subjects brain waves		

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Cognitive Systems Research, 49, pp.33-48.		

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features and frequency bands combination.				

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V., Kumar, P., Saini, R. and Roy,	P. (2018). EEG based word familiarity using	

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
Khurana,		

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need of Neuroprosthetics to impro	ve their quality of life.	

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outweigh any potential risks while	also working to minimise the potential for harm of sul	bjects in	

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proper protections and safeguard	ls in place the benefits and advantages of the devices	far

2	2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
(	Glannon concludes that while ther	e can be real dangers and issues with Neuroprosthe	tics with

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from potential harm caused by the prosthetics to the subjects free will and how it will be affected.

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ethical situations. The situations r	elating to the ethical questions raised from augmenta	ation range

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out to review the issues facing the	advancement and usage of Neuroprosthetics in a ra	nge of

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progress is made in the field the q	uestions of ethical responsibilities only increase. Gla	annon sets

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With Neuroprosthetics and Brain C	Computer Interfaces becoming more advanced and a	s more

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p.021002.		

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W. (2016). Ethical issues in neuro	prosthetics. Journal of Neural Engineering, 13(2),	

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Glannon,		

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unresponsive or vegetative even if	there are no other visible signs or responsiveness.	

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diagnosis LIS severity as well as h	nelp ensure that patients aren't inaccurately deemed	

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patients are given instructions or c	commands. The results found that this method may h	nelp better

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better diagnosis of severity of LIS	by measuring eye movement and EEG responsivene	ess after

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syndrome (VS/UWS). The aim of t	he research was to investigate the viability of spectra	al entropy in

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6 Patients suffering from LIS and	10 patients in a vegetative state/unresponsive wakefu	ılness

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vegetative/unresponsive subjects.	The research trials were carried out on 20 Healthy	Volounteers,

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Locked in syndrome(LIS) and how	they compared too healthy and completely	

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Leesenfants et al.(2018) set out in	this investigation to research the brain waves of vict	ms of

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122-135.		

2018-04-18 13:23:00	Full SCI2010 Essay.docx	Addition
doi		

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Vol. 49, Iss. 2		

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; Wheaton		

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Neuroscience		

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Clinical EEG and		

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Syndrome.			

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for Patients With Locked-in		·
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Toward an Attention-Based	Diagnostic Tool	
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; et al (2018)		
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Laureys, Steven		,
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;		-
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Soddu, Andrea		l

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Chatelle Camille		<u>'</u>
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Habbal Dina 2018-04-18 13:23:00 Damien;	Full SCI2010 Essay.docx	Addition
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cal Signals, External System	
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troencephalography,	,
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	,
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devices directly into the users brain.	
Full SCI2010 Essay.docx	Addition
	Full SCI2010 Essay.docx  Full SCI2010 Essay.docx  troencephalography,  Full SCI2010 Essay.docx  Full SCI2010 Essay.docx  devices directly into the users brain.

signals whilst Invasive BCI's usually involve complex surgeries to implant a

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BCI's are usually wires implanted	under the skull but above the brain to record	d
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the connection can differ. Semi ir	nvasive	
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and semi invasive BCI's connect of	directly to the brain however the severity of	
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infection or complications howeve	r produce less accurate readings. Invasive	1
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surgery to connect to the subject	and carry less risk of injury through	
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common. These systems do not require

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Non invasive forms of BCI us	ually refers to EEG as this are the most	·
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categories relate to how the u	ser or person is connected to an external de	vice.
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Glannon (2018)). These		
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Walter	<b>'</b>	-
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invasive classifications(		I
	Full SCI2010 Essay.docx	Addition

BCI's have different categories such as invasive, non invasive and semi

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through an invasive implant in the	brain.	

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records electric signals within the	orain. To restoring a person's sight	

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Electroencephalography(EEG) wh	ich is a monitoring method that non invasively	

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devices can range from simple bra	ain wave recorders i.e	

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external device. The uses for thes	se	

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signals in the brain and uses these	e signals to directly interact with an		

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specific task. BCI's operate	under the principle of measuring electrical	
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brain to an external system,	usually a computer of some kind programmed	I for a
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Computer Interface(BCIs) is	the technical term for a device that connects t	he
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2018-04-18 13:23:00 Brain	Full SCI2010 Essay.docx	Addition
	Full SCI2010 Essay.docx	Addition
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Brain		
Brain 2018-04-18 13:23:00		
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Comparing the Possibilities of Future Technological Human				
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Final				
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are unable to speak or move	e due to brain injury.	·		
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information, potentially providing a platform for communication in patients who				
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processes, cognitive BCIs a	ccess varied and therefore more versatile			
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decoding accuracies reaching upto 70%. By utilising higher order mental

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in three target regions were significantly above chance, with individual			

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of attention to real-world images p	resented at 4-quadrant locations. Accuracies	

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classification of brain activations.	These were linked to the covert allocation	

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approach with quadrant-specific p	arameter estimates, to achieve single-block	

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attention. Using realtime fMRI, we	implemented an online winner-takes-all	

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higher-order brain regions involved	d in complex cognitive processes such as		

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neuroimaging techniques. Here, w	re provide proof-of-principle for the use of	

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motor and sensory brain regions,	using surgical implants or non-invasive	

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devices for communication. Until r	now this has only been demonstrated in primary	

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(BCI) provide a means of using he	uman brain activations to control	

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attention in higher-order visual areas		

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more than 70%.		

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waves in EEG channels rela	ated to memory can provide classification accur	racy of
		<del>,</del>
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experience or conditioning.	Quantitatively, our results indicate that the beta	a
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the brain signals are more d	discriminatory in participants with no prior	
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beneficial in discriminating b	petween genuine and hoax suicide notes and the	hat
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prior experience or conditior	ned training in detection of suicide notes is not	
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is studied. Our study provides an i	mportant and interesting conclusion that	

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perusal is studied. Also, the discriminatory role of alpha waves and beta waves			
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emotion, attention, and memory in	detection of suicidal ideation through		
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which may indicate genuine suicion	which may indicate genuine suicide attempt or a hoax suicide note. The role of		
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ideation through data analysis of I	EEG signals elicit by reading of text notes,	•	
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utility of EEG signals in suicidology, particularly for detection of suicidal			
<u> </u>			
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activities for suicidology

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comparative study with other popu	lar classification technique is also discussed.	

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recorded using the proposed class	sifier combination approach. Finally, a	

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word for which the user has confu	sion in his mind. An accuracy of 82% has been	

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Similarly, the pattern of brain wave	es has been found to be different for the	

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be totally different from the pattern	when he is familiar with the word.	

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comes across an unknown word th	nen the pattern of his brain waves comes out to	

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at the time of unknown word perce	eption can be detected, i.e., when the user	

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are reading 25 words. The results	show that the characteristics of brain waves	

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unfamiliar with the text. EEG datas	set of 12 users has been developed while they	

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been developed to provide the me	aning of the word when a user is found to be	

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used to boost the prediction perform	mance. A dictionary based pop-up window has	

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Random Forest (RF) classifier. Ne	xt, a decision fusion approach has also been	

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frequency bands. The predic	ction of word-familiarity has been performed u	sing
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Root Mean Square (RMS) a	nd power have been computed from beta and	gamma
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decomposition technique an	d four features, namely mean, standard devia	tion.
		·
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Word-familiarity refers whether a u	user is familiar with the word or not while	

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based on EEG signals from the us	ers brain waves has been developed.		

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particular, a word-familiarity prediction approach				
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(EEG). In	,			
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Electroencephalography		<u> </u>		
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words which are unfamiliar to the users while reading using				
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often disturbs communication and reading. This paper focuses on detecting those				
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features and frequency bands combination

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Journal of Neural Engineering				
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Glannon (2018) Ethical issue	es in neuroprosthetics.	•		
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Walter		,		
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techniques to better understa	and and treat brain disorders.			
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brains. These questions should shape the evolution and application of novel				
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will generate new ethical and philosophical questions about people and their

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may be an ethical obligation	to conduct this research. Advances in neurosc	cience
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can be ethically justified. Dep	pending on their neurogenerative potential, the	ere
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therapeutic applications of no	europrosthetics outweighs the risk and therefo	ore
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. Provided that adequate pro	tections are in place	,
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Significance		1
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people affected by damage	d or dysfunctional brains and improve the qual	ity of
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their identity. Neuroprosthe	tics can maximize benefit and minimize harm fo	or
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properties they had before	njury or disease onset and thereby re-establish	า
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also re-establish the connec	ctedness and continuity of the psychological	
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with these circuits, neuroprosthetic	cs can restore varying degrees of autonomous	

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modulating dysregulation in	neural circuits. As enabling devices that integr	rate
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or improve motor and menta	Il functions in bypassing areas of injury or	
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. Neuroprosthetics can resto	re	•
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results		
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Main		
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patients' best interests.		

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to neuroprosthetic research	and balancing technological innovation with	
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as how to establish and imp	lement fair selection criteria in providing acces	S
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these questions. It also inclu	udes consideration of social justice issues such	1
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. This review is an analysis	and discussion of	<u> </u>
. This review is an analysis	and discussion of	<u> </u>
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indicated. These include informed	consent, agency, autonomy (free will) and	

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goals of particular neuroprosthetic	s and the conditions for which they are	

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psychological sequelae. Other eth	ical questions are more specific to the therapeutic	

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altering neural circuits against the	potential harm from neurophysiological and	

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raise general ethical questions abo	out weighing the potential benefit of	

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thought and behavior. These direc	t and indirect interventions in the brain		

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people with these conditions	s to gain or regain varying degrees of control of	f
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dysfunctional neural circuits	, brain injury and limb loss. They can enable	1
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	Full SCI2010 Essay.docx prosthetics can bypass, replace or compensat	
	,	
	,	
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neurodevelopmental and neurode	generative disorders. Cochlear implants, visual	

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congenital anomalies, traumatic br	ain injury, infection, amputation or		

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neurally mediated functions. Thes	e include sensorimotor, visual, auditory,	

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devices or systems designed to ge	enerate, restore or modulate a range of	

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using this system.		

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LIS patients, while none of the VS	UWS patients showed a response to command	

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ntropy system could detect	a response to command in all healthy subjects	s and
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present study provides evidence the	nat an EEG-based measure of attention could	

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entropy could not distinguish indiv	idual VS/UWS patients from LIS patients. The	

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reached a lower accuracy than sp	ectral entropy. Resting-state EEG spectral	

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respectively. VS/UWS patients we	re at chance level. EEG rhythms classification	

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classification. Spectral entropy classification during the attention-rest		
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entropy was computed during a ga	aze-independent 2-class (attention vs rest)	

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state/unresponsive wakefulness syndrome (VS/UWS) were included. Spectral				

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volunteers, 6 LIS patients, and 10 patients with a vegetative				

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the issues of accuracy and training requirement. Data from 20 healthy			

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objective diagnostic tool for patients with locked-in syndrome (LIS), answering			
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focal attention in order to develop	a motor-independent, portable, and		
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unconscious patients. We studied	the use of spectral entropy as a measure of		
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severely brain-injured populations helping to distinguish conscious from			
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has been proposed as a supplemental tool for reducing clinical misdiagnosis in			
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Locked-in Syndrome

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Real-time decoding of covert atter	ntion in higher-order visual areas. NeuroImage,	

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suicidology. Expert Systems with	Applications, 103, pp.206-217.	

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and frequency bands combination	. Cognitive Systems Research, 49,	pp.33-48.	

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processes, cognitive BCIs access	varied and therefore more versatile	

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system. Furthermore, we present	two illustrative experimental applications of the BCI-c	controlled

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arms for assistive technologies and	d rehabilitation applications. We account for robotics	

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and restoring lost sensorimot	or function in human patients. Noninvasive bi	rain-computer
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Khurana et all.(2018) devised an i	nvestigation into a method of reading a subjects brain	n waves when

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With Neuroprosthetics and Brain C	Computer Interfaces becoming more advanced and a	s more

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subjects. The research trials were	e carried out on 20 Healthy Volounteers, 6 Patients so	uffering from

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classification of brain activations. These were linked to the covert allocation		
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attention. Using realtime fMRI, we	implemented an online winner-takes-all	

approach with quadrant-specific parameter estimates, to achieve single-block

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higher-order brain regions involved	d in complex cognitive processes such as	

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neuroimaging techniques. Here, w	e provide proof-of-principle for the use of	

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motor and sensory brain regions,	using surgical implants or non-invasive	

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arms for assistive technologies an	d rehabilitation applications. We account for robotics	

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importance. Off-the-shelf BCI systems are based on fast, reproducible detection of mental activity		

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limitations. Taking into account the	e neurophysiological alterations of disabled individual	ls,

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cost, while recent advances aim a	t improving past technological and neurophysiologica	al

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interfaces (BCIs) are popular due	to considerable advantages including simplicity, safe	ty, and low

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and restoring lost sensorimotor fur	nction in human patients. Noninvasive brain-compute	ır

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Advances in neural interfaces hav	e demonstrated remarkable results in the direction of	replacing

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Rehabilitation Robotics: Off-the-Sl	nelf BCI Control of Anthropomorphic Robotic	

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Towards		

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comparative study with other popu	llar classification technique is also discussed.	

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recorded using the proposed class	sifier combination approach. Finally, a	

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word for which the user has confus	sion in his mind. An accuracy of 82% has been	

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Similarly, the pattern of brain waves has been found to be different for the		

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be totally different from the pattern when he is familiar with the word.		

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comes across an unknown word then the pattern of his brain waves comes out to		

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at the time of unknown word perception can be detected, i.e., when the user		

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are reading 25 words. The results show that the characteristics of brain waves		

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unfamiliar with the text. EEG dataset of 12 users has been developed while they		

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been developed to provide the meaning of the word when a user is found to be		

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used to boost the prediction performance. A dictionary based pop-up window has		

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Random Forest (RF) classifier. Next, a decision fusion approach has also been		

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frequency bands. The prediction of word-familiarity has been performed using		

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Root Mean Square (RMS) and power have been computed from beta and gamma		

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decomposition technique and four features, namely mean, standard deviation,			

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reading the text. The record	ed signals have been processed using Wavel	et
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based on EEG signals from the users brain waves has been developed.			

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particular, a word-familiarity prediction approach		

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(EEG). In		

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words which are unfamiliar to the users while reading using			

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often disturbs communication and reading. This paper focuses on detecting those			
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The appearance of unknown wo	ords	·	
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features and frequency bands of	ombination	1	
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EEG based word familiarity using			
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techniques to better understand and treat brain disorders.			

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brains. These questions should shape the evolution and application of novel			

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will generate new ethical and philosophical questions about people and their		
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may be an ethical obligation to co	onduct this research. Advances in neuroscience	
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can be ethically justified. Depending on their neurogenerative potential, there		
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therapeutic applications of neuro	prosthetics outweighs the risk and therefore	
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for research subjects and patients, the probable benefit of research into and		
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. Provided that adequate protections are in place

Significance	2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
	Significance		

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their lives.		

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people affected by damaged or dysfunctional brains and improve the quality of		

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their identity. Neuroprosthetics can maximize benefit and minimize harm for		

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properties they had before injury of	r disease onset and thereby re-establish	

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also re-establish the connectedne	ss and continuity of the psychological	

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agency for people affected b	by neurological and psychiatric disorders. They	/ can
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vith these circuits, neuropro	esthetics can restore varying degrees of autono	omous
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nodulating dysregulation in	neural circuits. As enabling devices that integr	rate
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or improve motor and menta	al functions in bypassing areas of injury or	I
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. Neuroprosthetics can resto	pre	
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results

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Main		

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patients' best interests.		

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to neuroprosthetic research and balancing technological innovation with		

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as how to establish and implemen	t fair selection criteria in providing access	

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these questions. It also includes c	onsideration of social justice issues such	

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. This review is an analysis and dis	scussion of	

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Approach		

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identity.		

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indicated. These include informed	consent, agency, autonomy (free will) and	

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goals of particular neuroprosthetic	s and the conditions for which they are	

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psychological sequelae. Other eth	ical questions are more specific to the therapeutic	

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altering neural circuits against the	potential harm from neurophysiological and	

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raise general ethical question	ons about weighing the potential benefit of	·
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thought and behavior. Thes	e direct and indirect interventions in the brain	,
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people with these condition	s to gain or regain varying degrees of control o	of
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dysfunctional neural circuits	s, brain injury and limb loss. They can enable	I
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prosthetics, deep brain stimulation	, brain-computer interfaces, brain-to-brain	

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neurodevelopmental and neurodegenerative disorders. Cochlear implants, visual				
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congenital anomalies, traum	atic brain injury, infection, amputation or			
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cognitive affective and volition	onal functions that have been impaired or lost	from		
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neurally mediated functions.	These include sensorimotor, visual, auditory,			
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Neuroprosthetics are artificial

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Ethical issues in neuroprosthetics		

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LIS patients, while none of the VS/UWS patients showed a response to command		

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entropy system could detect a res	ponse to command in all healthy subjects and	

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detect command-following in patie	nts with severe motor disabilities. The	

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ı	present study provides evidence th	nat an EEG-based measure of attention could	

entropy could not distinguish individual VS/UWS patients from LIS patients. The	2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition				

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reached a lower accuracy than spectral entropy. Resting-state EEG spectral		

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respectively. VS/UWS patients were at chance level. EEG rhythms classification		

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paradigm showed 93% and 91% a	accuracy in healthy volunteers and LIS patients	

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classification. Spectral entropy classification during the attention-rest		

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paradigm, and compared with EEG	G rhythms (delta, theta, alpha, and beta)	

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entropy was computed dur	ing a gaze-independent 2-class (attention vs re	st)
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state/unresponsive wakefu	Iness syndrome (VS/UWS) were included. Spe	ctral

volunteers, 6 LIS patients, and 10 patients with a vegetative

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the issues of accuracy and training requirement. Data from 20 healthy

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
objective diagnostic tool for patien	ts with locked-in syndrome (LIS), answering	

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focal attention in order to develop	a motor-independent, portable, and	

2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  severely brain-injured populations helping to distinguish conscious from  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  has been proposed as a supplemental tool for reducing clinical misdiagnosis in  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  Electroencephalography (EEG)  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  Locked-in Syndrome					
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severely brain-injured populations helping to distinguish conscious from  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  has been proposed as a supplemental tool for reducing clinical misdiagnosis in  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  Electroencephalography (EEG)  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  Locked-in Syndrome	unconscious patients. We studied the use of spectral entropy as a measure of				
severely brain-injured populations helping to distinguish conscious from  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  has been proposed as a supplemental tool for reducing clinical misdiagnosis in  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  Electroencephalography (EEG)  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  Locked-in Syndrome					
severely brain-injured populations helping to distinguish conscious from  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  has been proposed as a supplemental tool for reducing clinical misdiagnosis in  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  Electroencephalography (EEG)  2018-04-18 12:33:00 Full SCI2010 Essay.docx Addition  Locked-in Syndrome					
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Toward an Attention-Based Diagnostic Tool for Patients With

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169, pp.462-472.		

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decoding of covert attention in higher-order visual areas. NeuroImage,			

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N. and Rees, G. (2018).		

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Ekanayake, J., Hutton, C., Ridgway, G., Scharnowski, F., Weiskopf,			

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, 2017, pp.1-17.		

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BioMed Research		

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Control of Anthropomorphic Robo	tic Arms.	

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Athanasiou, A., Xygonakis, I., Pan	dria, N., Kartsidis, P., Arfaras, G., Kavazidi, K., Foro	glou,

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and frequency bands combination	. Cognitive Systems Research, 49,	pp.33-48.	

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Khurana, V., Kumar, P., Saini, R.	and Roy, P. (2018). EEG based word familiarity using	3

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13(2), p.021002.		

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Glannon, W. (2016). Ethical issues in neuroprosthetics. Journal of Neural Engineering,				
2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition		
doi 122-135.				
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Clinical EEG and Neuroscier	nce	1		
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Syndrome.

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for Patients With Locked-in		-
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(2018) Toward an Attention	-Based Diagnostic Tool	
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169, pp.462-472.		

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decoding of covert attention in hig	her-order visual areas. Neurolmage,	

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Real-time		

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for industrial and assistive use in everyday lives.		

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enhancing progress into creating robotic arm technologies for use as rehabilitation assistance and		istance and	

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The aim of the investigation devise	ed by Athanasiou et all.(2017) was to aim at developi	ng and

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2017, pp.1-17.		

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word.		

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implementation of a dictionary dev	ice returned an accuracy of 82% in determining an u	nknown

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displayed on a screen for the read	er. The team involved found that this method and	

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the investigation was able to devis	se a system where the unknown word and its meaning	g were

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acro	oss a word that they are unfam	iliar with or do not know the meaning of. Through thi	is reading

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
measuring device. The investigation	ion found a difference in brain waves when the subje	ct comes

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investigation involved 12 participar	nts who were required to read text while connected to	o an EEG

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when the subject is reading and determining whether the user knows the meaning of a word. The

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
Khurana et all.(2018) devised an i	nvestigation into a method of reading a subjects brain	n waves

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Systems Research, 49,	pp.33-4	8.	

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features and frequency bands con	nbination. Cognitive	

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word familiarity using		

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Khurana, V., Kumar, P., Saini, R. a	and Roy, P. (2018). EEG based	

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
need of Neuroprosthetics to impro	ve their quality of life.	

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outweigh any potential risks while	also working to minimise the potential for harm of su	bjects in

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proper protections and safeguards	in place the benefits and advantages of the devices	far

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Glannon concludes that while ther	e can be real dangers and issues with Neuroprosthe	tics with

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
from potential harm caused by the	prosthetics to the subjects free will and how it will be	e affected.

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ethical situations. The situations r	elating to the ethical questions raised from augmenta	ation range

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out to review the issues facing the advancement and usage of Neuroprosthetics in a range of		

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
progress is made in the field the q	uestions of ethical responsibilities only increase. Gla	nnon sets

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
With Neuroprosthetics and Brain (	Computer Interfaces becoming more advanced and a	s more

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13(2), p.021002.		

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Neural Engineering,		

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Glannon, W. (2016). Ethical issues	s in neuroprosthetics. Journal of	

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unresponsive or vegetative even if	there are no other visible signs or responsiveness.	

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diagnosis LIS severity as well as h	nelp ensure that patients aren't inaccurately deemed	

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
patients are given instructions or c	commands. The results found that this method may h	nelp better

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
better diagnosis of severity of LIS	by measuring eye movement and EEG responsivene	ess after

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syndrome (VS/UWS). The aim of t	he research was to investigate the viability of spectra	al entropy in

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6	Patients suffering from LIS and 1	0 patients in a vegetative state/unresponsive wakefu	ılness

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vegetative/unresponsive subjects.	The research trials were carried out on 20 Healthy	/olounteers,

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Locked in syndrome(LIS) and how	they compared too healthy and completely	

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
Leesenfants et al.(2018) set out in	this investigation to research the brain waves of vict	ims of

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
doi 122-135.		

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Neuroscience		

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Clinical EEG and		

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Syndrome.		

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Attention-Based Diagnostic Tool for	or Patients With Locked-in	

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Toward an		

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; et al (2018)		

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Electroencephalography, In	vasive, Non Invasive, Electrical Signals, Extern	nal
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Keywords: Brain Computer	Interface,	
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measuring devices directly i	nto the users brain.	
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BCI's usually involve comple	ex surgeries to implant a computer chip and	-
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implanted under the skull bu	ut above the brain to record signals whilst Invas	sive

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usually wires

Addition

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the brain however the severity of t	he connection can differ. Semi invasive BCI's are	

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accurate readings. Invasive and semi invasive BCI's connect directly to		

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less risk of injury through infection or complications however produce less		

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These systems do not require surgery to connect to the subject and carry		

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to EEG as this are the most common.		

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connected to an external device.	Non invasive forms of BCI usually refers	

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person is		

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). These categories relate to how the user or		

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Walter Glannon (2018)		

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invasive classifications(		

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BCI's have different categories such as invasive, non invasive and semi		

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through an invasive implant in the	brain.	

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records electric signals within the brain. To restoring a person's sight		

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Electroencephalography(EEG) wh	ich is a monitoring method that non invasively	

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uses for these devices can range	from simple brain wave recorders i.e	

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interact with an external device. T	he	

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measuring electrical signals in the	brain and uses these signals to directly	

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programmed for a specific task. B	CI's operate under the principle of	

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that connects the brain to an external system, usually a computer of some kind				
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Brain Computer Interface(BC	Cls) is the technical term for a device			
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Introduction:	·			
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Enhancements.				
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Comparing the Possibilities of	of Future Technological Human			
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Final	1	1		

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Expert Systems with Applications,	103, pp.206-217.	

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analysis using EEG activities for	suicidology.	

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dictionary device returned an accu	racy of 82% in determining an unknown word.	

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on a screen for the reader. The te	am involved found that this method and implementat	ion of a

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investigation was able to devise a	system where the unknown word and its meaning we	ere displayed

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across a word that they are unfamiliar with or do not know the meaning of. Through		s reading the

2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition
measuring device. The investigati	on found a difference in brain waves when the subje	ct comes

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investigation involved 12 participal	nts who were required to read text while connected to	o an EEG

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the subject is reading and determi	ning whether the user knows the meaning of a word.	The

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Systems Research, 49, p	p.33-48.	

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features and frequency bands con	nbination. Cognitive	

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word familiarity using		

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Neuroprosthetics to improve their	quality of life.	

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any potential risks while also work	ing to minimise the potential for harm of subjects in n	ieed of

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proper protections and safeguards	in place the benefits and advantages of the devices	far outweigh

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Glannon concludes that while ther	e can be real dangers and issues with Neuroprosthe	tics with

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potential harm caused by the pros	thetics to the subjects free will and how it will be affe	cted.

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situations. The situations relating	to the ethical questions raised from augmentation rai	nge from

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to review the issues facing the advancement and usage of Neuroprosthetics in a range of eth		

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progress is made in the field the q	uestions of ethical responsibilities only increase. Gla	innon sets out

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13(2), p.021002.		

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Neural Engineering,		

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other visible signs or responsiveness.		

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ensure that patients aren't inaccura	ately deemed unresponsive or vegetative even if the	re are no

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commands. The results found that this method may help better diagnosis LIS severity as well as help				
2018-04-18 12:33:00	Full SCI2010 Essay.docx	Addition		
by measuring eye movemer	nt and EEG responsiveness after patients are	given instructions or		
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the research was to investigate the viability of spectral entropy in better diagnosis of severity of LIS				
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LIS and 10 patients in a vegetative state/unresponsive wakefulness syndrome (VS/UWS). The aim of				
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Brain-computer-interfaces	1	1		

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Laureys, Steven		
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Soddu, Andrea		
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neurally mediated functions. These	e include sensorimotor, visual, auditory,			
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are unable to speak or move due t	o brain injury.	

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information, potentially prov	riding a platform for communication in patients	who
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processes, cognitive BCIs a	access varied and therefore more versatile	,
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	rull SCI2010 Essay.docx ng upto 70%. By utilising higher order mental	Addition
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decoding accuracies reachi	ng upto 70%. By utilising higher order mental	

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of attention to real-world images p	resented at 4-quadrant locations. Accuracies	

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classification of brain activations.	hese were linked to the covert allocation	

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approach with quadrant-specific parameter estimates, to achieve single-block			

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attention. Using realtime fMRI, we	implemented an online winner-takes-all	

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higher-order brain regions involved	d in complex cognitive processes such as	

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neuroimaging techniques. Here, w	re provide proof-of-principle for the use of	

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motor and sensory brain regions,	using surgical implants or non-invasive	

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devices for communication. Until n	ow this has only been demonstrated in primary	

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(BCI) provide a means of using hu	uman brain activations to control	

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attention in higher-order visual are	eas	

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waves in EEG channels related to	memory can provide classification accuracy of	

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experience or conditioning. Quantitatively, our results indicate that the beta				
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the brain signals are more d	liscriminatory in participants with no prior			
the brain signals are more discriminatory in participants with no prior				
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beneficial in discriminating beneficial in discrimination and beneficial in discrimination beneficial in discrimination and benef	petween genuine and hoax suicide notes and t	hat		

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is studied. Our study provides an i	mportant and interesting conclusion that	

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perusal is studied. Also, the discrir	ninatory role of alpha waves and beta waves		

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emotion, attention, and memory in	detection of suicidal ideation through	

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which may indicate genuine suicid	e attempt or a hoax suicide note. The role of	

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ideation through data analysis of E	EG signals elicit by reading of text notes,	

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utility of EEG signals in suicidology, particularly for detection of suicidal				

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This paper investigates the		

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activities for suicidology			

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Sentiment analysis using EEG		

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comparative study with other popular classification technique is also discussed.		

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recorded using the proposed class	sifier combination approach. Finally, a	

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word for which the user has confusion in his mind. An accuracy of 82% has been			

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Similarly, the pattern of brain waves has been found to be different for the			

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be totally different from the pattern	when he is familiar with the word.	

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comes across an unknown word then the pattern of his brain waves comes out to		

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at the time of unknown word perce	eption can be detected, i.e., when the user	

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are reading 25 words. The results show that the characteristics of brain waves		

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unfamiliar with the text. EEG dataset of 12 users has been developed while they		

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been developed to provide the me	aning of the word when a user is found to be		

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used to boost the prediction performance. A dictionary based pop-up window has			

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Random Forest (RF) classifier. Ne	ext, a decision fusion approach has also been	

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frequency bands. The prediction o	f word-familiarity has been performed using	

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Root Mean Square (RMS) and por	wer have been computed from beta and gamma	

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decomposition technique and four	features, namely mean, standard deviation,	

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reading the text. The recorded sign	nals have been processed using Wavelet	

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Word-familiarity refers whether a user is familiar with the word or not while			

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based on EEG signals from the us	ers brain waves has been developed.	

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particular, a word-familiarity predic	ction approach	

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(EEG). In		

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words which are unfamiliar to the	users while reading using	

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often disturbs communication and	reading. This paper focuses on detecting those	

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The appearance of unknow	n words	
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features and frequency ban	ds combination	
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techniques to better unders	tand and treat brain disorders.	
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brains. These questions sho	ould shape the evolution and application of nov	/el
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brains. These questions sho 2018-04-18 12:02:00	Full SCI2010 Essay.docx	/el Addition
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can be ethically justified. Dependir	ng on their neurogenerative potential, there	

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therapeutic applications of	neuroprosthetics outweighs the risk and therefo	re
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for research subjects and p	atients, the probable benefit of research into an	nd
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. Provided that adequate pr	rotections are in place	
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people affected by damaged or dysfunctional brains and improve the quality of

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their identity. Neuroprosthet	cs can maximize benefit and minimize harm fo	or
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properties they had before in	njury or disease onset and thereby re-establish	h
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also re-establish the connec	tedness and continuity of the psychological	
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agency for people affected b	by neurological and psychiatric disorders. They	y can
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with these circuits, neuropro	sthetics can restore varying degrees of autono	omous
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modulating dysregulation in neura	I circuits. As enabling devices that integrate	

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or improve motor and menta	Il functions in bypassing areas of injury or	l .
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. Neuroprosthetics can resto	re	
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results		
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patients' best interests.		,
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	and balancing technological innovation with	Addition

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ement fair selection criteria in providing acces	s
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goals of particular neuroprosthetics and the conditions for which they are		

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psychological sequelae. Other eth	ical questions are more specific to the therapeutic	

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altering neural circuits against the potential harm from neurophysiological and		

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raise general ethical questions abo	out weighing the potential benefit of	

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thought and behavior. These direct and indirect interventions in the brain		

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people with these conditions to ga	in or regain varying degrees of control of	

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dysfunctional neural circuits, brain injury and limb loss. They can enable		

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interfaces and hippocampal prosthetics can bypass, replace or compensate for		

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prosthetics, deep brain stimulation, brain-computer interfaces, brain-to-brain		

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neurodevelopmental and neurode	generative disorders. Cochlear implants, visual	

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congenital anomalies, traumatic b	rain injury, infection, amputation or	

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cognitive affective and volitional fu	nctions that have been impaired or lost from	

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neurally mediated functions. These include sensorimotor, visual, auditory,			

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devices or systems designed to generate, restore or modulate a range of		

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using this system.		

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LIS patients, while none of the VS/UWS patients showed a response to command		

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entropy system could detect a response to command in all healthy subjects and		

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detect command-following in patie	nts with severe motor disabilities. The	

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present study provides evidence that an EEG-based measure of attention could		

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entropy could not distinguish individual VS/UWS patients from LIS patients. The		

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reached a lower accuracy than spectral entropy. Resting-state EEG spectral						

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respectively. VS/UWS patients were at chance level. EEG rhythms classification		

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paradigm showed 93% and 91% accuracy in healthy volunteers and LIS patients			

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classification. Spectral entropy cla	classification. Spectral entropy classification during the attention-rest		

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paradigm, and compared with EE0	paradigm, and compared with EEG rhythms (delta, theta, alpha, and beta)		

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entropy was computed during a gaze-independent 2-class (attention vs rest)			

state/unresponsive wakefulness syndrome (VS/UWS) were included. Spectral	2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition

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volunteers, 6 LIS patients, and 10 patients with a vegetative		

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the issues of accuracy and training requirement. Data from 20 healthy			

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objective diagnostic tool for patien	objective diagnostic tool for patients with locked-in syndrome (LIS), answering		

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focal attention in order to develop	a motor-independent, portable, and	

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unconscious patients. We studied	the use of spectral entropy as a measure of	

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severely brain-injured populations helping to distinguish conscious from			
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has been proposed as a sup	pplemental tool for reducing clinical misdiagnos	sis in	
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Electroencephalography (EE	EG)		
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and frequency bands combination	. Cognitive Systems Research, 49,	pp.33-48.	

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Prasad, D., Liu, S., Chen, S. and C	Quek, C. (2018). Sentiment	

2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition
dictionary device returned an accu	racy of 82% in determining an unknown word.	

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on a screen for the reader. The te	eam involved found that this method and implementat	ion of a

2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition
investigation was able to devise a	system where the unknown word and its meaning we	ere displayed

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across a word that they are unfamiliar with or do not know the meaning of. Through this reading the

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measuring device. The investigati	on found a difference in brain waves when the subje	ct comes	

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investigation involved 12 participants who were required to read text while connected to an EEG		o an EEG

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the subject is reading and determine	ning whether the user knows the meaning of a word.	The	

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Khurana et all.(2018) devised an i	nvestigation into a method of reading a subjects brain	n waves when

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Systems Research, 49,	pp.33-48.	

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features and frequency bands con	nbination. Cognitive	

2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition
word familiarity using		

2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition
Khurana, V., Kumar, P., Saini, R. and Roy, P. (2018). EEG based		

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Neuroprosthetics to improve their	quality of life.	

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aı	ny potential risks while also work	ing to minimise the potential for harm of subjects in n	eed of

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proper protections and safeguards in place the benefits and advantages of the devices far		far outweigh

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Glannon concludes that while there can be real dangers and issues with Neuroprosthetics with

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potential harm caused by the pros	thetics to the subjects free will and how it will be affe	cted.

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situations. The situations relating	to the ethical questions raised from augmentation ra	nge from

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to review the issues facing the adv	vancement and usage of Neuroprosthetics in a range	of ethical

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progress is made in the field the q	uestions of ethical responsibilities only increase. Gla	nnon sets out

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With Neuroprosthetics and Brain C	Computer Interfaces becoming more advanced and a	s more

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13(2), p.021002.		

2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition
Neural Engineering,		

2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition
Glannon, W. (2016). Ethical issues	s in neuroprosthetics. Journal of	

2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition
other visible signs or responsivene	ess.	

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ensure that patients aren't inaccura	ately deemed unresponsive or vegetative even if the	e are no	

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commands. The results found tha	t this method may help better diagnosis LIS severity	as well as help

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by measuring eye movement and	FFG responsiveness after patients are given instruct	ions or

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the research was to investigate the	e viability of spectral entropy in better diagnosis of se	verity of LIS

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LIS and 10 patients in a vegetative state/unresponsive wakefulness syndrome (VS/UWS). The aim of

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subjects. The research trials were	carried out on 20 Healthy Volounteers, 6 Patients s	uffering from

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in syndrome(LIS) and how they co	mpared too healthy and completely vegetative/unres	ponsive

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Leesenfants et al.(2018) set out in	this investigation to research the brain waves of vict	ims of Locked

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doi 122-135.		

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Vol. 49, Iss. 2		

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; Wheaton		

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Neuroscience		

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Clinical EEG and		

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Syndrome.		

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Attention-Based Diagnostic	Tool for Patients With Locked-in	·
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Toward an		·
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; et al (2018)		
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;		-
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Lesenfants Damien;		
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Sumarries:		·
2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition
System		
2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition
Electroencephalography, Invas	ive, Non Invasive, Electrical Signals, Extern	nal
2018-04-18 12:02:00	Full SCI2010 Essay.docx	Addition
Brain Computer Interface,		'
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Keywords:

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measuring devices directly into the	e users brain.	

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BCI's usually involve complex surg	geries to implant a computer chip and	

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implanted under the skull but above	ve the brain to record signals whilst Invasive	

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the brain however the severity of the	he connection can differ. Semi invasive BCI's are us	ually wires

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accurate readings. Invasive and s	emi invasive BCI's connect directly to	

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less risk of injury through infection	or complications however produce less	

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These systems do not requi	re surgery to connect to the subject and carry	
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to EEG as this are the most	common.	
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connected to an external de	vice. Non invasive forms of BCI usually refers	3
connected to an external de	vice. Non invasive forms of BCI usually refers	3
connected to an external de	vice. Non invasive forms of BCI usually refers	
	Full SCI2010 Essay.docx	Addition
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Walter Glannon (2018)

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invasive classifications(		

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BCI's have different categories such	ch as invasive, non invasive and semi	

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through an invasive implant in the brain.		

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records electric signals within the	brain. To restoring a person's sight	

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Electroencephalography(EEG) wh	ich is a monitoring method that non invasively	

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uses for these devices can range from simple brain wave recorders i.e			

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nteract with an external device. The		

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measuring electrical signals in the brain and uses these signals to directly		

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programmed for a specific task. BCI's operate under the principle of		

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that connects the brain to an external system, usually a computer of some kind		

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Brain Computer Interface(BCIs) is the technical term for a device		

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Introduction:		

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Enhancements.		

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Comparing the Possibilities of Futi	ure Technological Human	

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Final		

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are unable to speak or move due	to brain injury.	

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information, potentially providing a	platform for communication in patients who	

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processes, cognitive BCIs access	varied and therefore more versatile	

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decoding accuracies reachin	g upto 70%. By utilising higher order mental			
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in three target regions were	significantly above chance, with individual			
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of attention to real-world images presented at 4-quadrant locations. Accuracies				
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classification of brain activations. These were linked to the covert allocation				
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approach with quadrant-spec	cific parameter estimates, to achieve single-bl	lock		

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attention. Using realtime fMRI, we	implemented an online winner-takes-all	

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higher-order brain regions involved in complex cognitive processes such as			

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neuroimaging techniques. Here, w	re provide proof-of-principle for the use of	

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motor and sensory brain regions,	using surgical implants or non-invasive	

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devices for communication. Until r	now this has only been demonstrated in primary	

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(BCI) provide a means of using he	uman brain activations to control	

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attention in higher-order visual ar	eas	

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more than 70%.		

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experience or conditioning. Quant	itatively, our results indicate that the beta	

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the brain signals are more discrim	inatory in participants with no prior	

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beneficial in discriminating between	n genuine and hoax suicide notes and that	

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prior experience or conditioned tra	ining in detection of suicide notes is not	

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is studied. Our study provides an i	mportant and interesting conclusion that	

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perusal is studied. Also, the	discriminatory role of alpha waves and beta w	aves
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emotion, attention, and men	nory in detection of suicidal ideation through	
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which may indicate genuine	suicide attempt or a hoax suicide note. The ro	le of
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ideation through data analysis of EEG signals elicit by reading of text notes,		
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utility of EEG signals in suicidology, particularly for detection of suicidal		

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activities for suicidology

Addition

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comparative study with other popu	lar classification technique is also discussed.	

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recorded using the proposed class	sifier combination approach. Finally, a	

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word for which the user has confu	sion in his mind. An accuracy of 82% has been	

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Similarly, the pattern of brain wave	es has been found to be different for the	

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be totally different from the pattern	when he is familiar with the word.		

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comes across an unknown word t	hen the pattern of his brain waves comes out to	

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at the time of unknown word perce	eption can be detected, i.e., when the user	

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are reading 25 words. The results	show that the characteristics of brain waves	

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unfamiliar with the text. EEG datas	set of 12 users has been developed while they	

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been developed to provide the me	aning of the word when a user is found to be	

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used to boost the prediction perform	mance. A dictionary based pop-up window has	

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Random Forest (RF) classifier. Ne	xt, a decision fusion approach has also been		

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frequency bands. The prediction of	of word-familiarity has been performed using	·
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Root Mean Square (RMS) and po	ower have been computed from beta and gamma	<b>-</b>
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decomposition technique and fou	r features, namely mean, standard deviation,	
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reading the text. The recorded sig	nals have been processed using Wavelet	

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based on EEG signals from the us	ers brain waves has been developed.	

Word-familiarity refers whether a user is familiar with the word or not while

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particular, a word-familiarity	prediction approach	
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(EEG). In		
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Electroencephalography	•	,
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words which are unfamiliar	to the users while reading using	
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often disturbs communication	on and reading. This paper focuses on detectin	ng those

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features and frequency bands combination

Addition

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Journal of Neural Engineeri	ng		
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Glannon (2018) Ethical issu	es in neuroprosthetics.		
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Walter	•	,	
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techniques to better underst	tand and treat brain disorders.		
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2010 01 10 12:02:00	brains. These questions should shape the evolution and application of novel		
	ould shape the evolution and application of nov	/el	

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will generate new ethical and philo	sophical questions about people and their	

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may be an ethical obligation	to conduct this research. Advances in neurosc	cience
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can be ethically justified. De	pending on their neurogenerative potential, the	ere
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therapeutic applications of n	neuroprosthetics outweighs the risk and therefo	pre
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for research subjects and pa	atients, the probable benefit of research into an	nd
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		Addition
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their lives.		

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people affected by damaged or dy	sfunctional brains and improve the quality of	

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their identity. Neuroprosthetics car	n maximize benefit and minimize harm for	

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properties they had before injury of	r disease onset and thereby re-establish	

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also re-establish the connectednes	ss and continuity of the psychological	

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agency for people affected by neu	rological and psychiatric disorders. They can	

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with these circuits, neuroprosthetics can restore varying degrees of autonomous		
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modulating dysregulation in n	neural circuits. As enabling devices that integr	rate
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or improve motor and mental functions in bypassing areas of injury or		
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. Neuroprosthetics can restor	e	•
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results		,
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Main		

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patients' best interests.		

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to neuroprosthetic research and be	alancing technological innovation with	

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as how to establish and implemen	t fair selection criteria in providing access	

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these questions. It also includes c	onsideration of social justice issues such	

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. This review is an analysis and dis	scussion of	

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Approach		

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identity.		

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indicated. These include informed	consent, agency, autonomy (free will) and	

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goals of particular neuroprosthetic	s and the conditions for which they are	

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psychological sequelae. Other eth	ical questions are more specific to the therapeutic	

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altering neural circuits against the	potential harm from neurophysiological and	

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raise general ethical questions abo	out weighing the potential benefit of	

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thought and behavior. These direct and indirect interventions in the brain		

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people with these conditions to ga	in or regain varying degrees of control of	

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dysfunctional neural circuits, brain	injury and limb loss. They can enable	

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interfaces and hippocampal prosth	netics can bypass, replace or compensate for	

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prosthetics, deep brain stimulation	, brain-computer interfaces, brain-to-brain	

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neurodevelopmental and neurode	generative disorders. Cochlear implants, visual	

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congenital anomalies, traumatic brain injury, infection, amputation or		

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cognitive affective and volitional fu	nctions that have been impaired or lost from	

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devices or systems designed to ge	enerate, restore or modulate a range of	

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xri/sid:primo&accountid=12528		

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using this system.		

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LIS patients, while none of the VS	UWS patients showed a response to command	

2018-04-18 12:02:00 entropy system could detect a r	Full SCI2010 Essay.docx response to command in all healthy subjects	Addition s and
entropy system could detect a r	response to command in all healthy subjects	s and
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detect command-following in pa	atients with severe motor disabilities. The	
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present study provides evidenc	e that an EEG-based measure of attention	could
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reached a lower accuracy than spe	ectral entropy. Resting-state EEG spectral	

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respectively. VS/UWS patients we	re at chance level. EEG rhythms classification	

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paradigm showed 93% and	91% accuracy in healthy volunteers and LIS p	atients
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classification. Spectral entro	opy classification during the attention-rest	<u>'</u>
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paradigm, and compared wi	ith EEG rhythms (delta, theta, alpha, and beta)	
paradigm, and compared w	ith EEG rhythms (delta, theta, alpha, and beta)	)
paradigm, and compared w	ith EEG rhythms (delta, theta, alpha, and beta)	
	Full SCI2010 Essay.docx	Addition
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volunteers, 6 LIS patients, and 10	patients with a vegetative	

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the issues of accuracy and training requirement. Data from 20 healthy			
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objective diagnostic tool for	patients with locked-in syndrome (LIS), answe	ring	
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focal attention in order to de	velop a motor-independent, portable, and	-	
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unconscious patients. We studied the use of spectral entropy as a measure of			
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severely brain-injured popul	ations helping to distinguish conscious from	I	

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has been proposed as a suppleme	ental tool for reducing clinical misdiagnosis in	

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Locked-in Syndrome		

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Abstracts:		

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suicidology. Expert Systems with	Applications, 103, pp.206-217.	

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and frequency bands combi	nation. Cognitive Systems Research, 49, pp	0.33-48.
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for communication. Until no	w this has only been demonstrated in primary	motor and sensory brain		
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This paper investigates the utility of	of EEG signals in suicidology, particularly for detectio	n of suicidal

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Sentiment analysis using El	EG activities for suicidology	·
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The appearance of unknow	n words often disturbs communication and rea	ding. This paper focuses on
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EEG based word familiarity	using features and frequency bands combinat	tion
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Journal of Neural Engineering

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Walter Glannon (2018) Ethical issu	ues in neuroprosthetics.	

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potential, there may be an ethical	obligation to conduct this research. Advances in neu	roscience will

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Neuroprosthetics are artificial devi	ces or systems designed to generate, restore or mod	lulate a range

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Ethical issues in neuroprosthetics		

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Electroencephalography (EEG) ha	as been proposed as a supplemental tool for reducing	g clinical

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are unable to speak or move due	to brain injury.	

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information, potentially providing a	platform for communication in patients who	

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processes, cognitive BCIs access	varied and therefore more versatile	

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decoding accuracies reaching upto	o 70%. By utilising higher order mental	

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in three target regions were significantly above chance, with individual			

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of attention to real-world images p	resented at 4-quadrant locations. Accuracies	

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classification of brain activations.	These were linked to the covert allocation	

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approach with quadrant-specific pa	arameter estimates, to achieve single-block	

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attention. Using realtime fMRI, we	implemented an online winner-takes-all	

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higher-order brain regions involved	d in complex cognitive processes such as	

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neuroimaging techniques. Here, w	e provide proof-of-principle for the use of	

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motor and sensory brain regions,	using surgical implants or non-invasive	

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devices for communication. Until now this has only been demonstrated in primary		

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(BCI) provide a means of using h	uman brain activations to control	

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attention in higher-order visual are	eas	

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Real-time decoding of covert			

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more than 70%.		
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	ated to memory can provide classification accu	iracy of

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experience or conditioning. Quant	itatively, our results indicate that the beta	

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the brain signals are more discrimi	natory in participants with no prior		

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beneficial in discriminating betwee	n genuine and hoax suicide notes and that	

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prior experience or conditioned tra	ining in detection of suicide notes is not		

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is studied. Our study provides an important and interesting conclusion that		

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perusal is studied. Also, the discri	minatory role of alpha waves and beta waves	

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emotion, attention, and memory in	detection of suicidal ideation through	

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which may indicate genuine suicid	e attempt or a hoax suicide note. The role of	

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ideation through data analysis of EEG signals elicit by reading of text notes,		

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utility of EEG signals in suicidology, particularly for detection of suicidal				
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This paper investigates the		'		
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2018-04-18 11:21:00 activities for suicidology	Full SCI2010 Essay.docx	Addition		
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comparative study with other popu	lar classification technique is also discussed.		

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recorded using the proposed class	sifier combination approach. Finally, a	

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word for which the user has confus	sion in his mind. An accuracy of 82% has been	

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Similarly, the pattern of brain wave	es has been found to be different for the	

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be totally different from the pattern	when he is familiar with the word.	

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comes across an unknown word th	nen the pattern of his brain waves comes out to	

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at the time of unknown word perce	ption can be detected, i.e., when the user	

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are reading 25 words. The results	show that the characteristics of brain waves	

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unfamiliar with the text. EEG datas	set of 12 users has been developed while they	

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been developed to provide the me	aning of the word when a user is found to be	

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used to boost the prediction perform	mance. A dictionary based pop-up window has	

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Random Forest (RF) classifier. Ne	ext, a decision fusion approach has also been	

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frequency bands. The prediction o	f word-familiarity has been performed using		

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Root Mean Square (RMS) ar	nd power have been computed from beta and	gamma
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decomposition technique and	d four features, namely mean, standard devia	tion,
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reading the text. The recorde	ed signals have been processed using Wavele	ət
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Word-familiarity refers wheth	er a user is familiar with the word or not while	<u> </u>

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based on EEG signals from the users brain waves has been developed.		

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particular, a word-familiarity prediction approach		

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(EEG). In		

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words which are unfamiliar to the users while reading using		

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often disturbs communication and reading. This paper focuses on detecting those		

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The appearance of unknown word	S	

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features and frequency bands combination		

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EEG based word familiarity using		

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Glannon (2018) Ethical issues in neuroprosthetics.		

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techniques to better understand and treat brain disorders.		

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brains. These questions should sh	ape the evolution and application of novel	

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will generate new ethical and philosophical questions about people and their				
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may be an ethical obligation to	conduct this research. Advances in neurosc	cience		
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can be ethically justified. Depe	ending on their neurogenerative potential, the	ere		
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therapeutic applications of neuroprosthetics outweighs the risk and therefore				
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for research subjects and patients, the probable benefit of research into and				

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. Provided that adequate protections are in place

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Significance	

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their lives.		

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people affected by damaged or dy	sfunctional brains and improve the quality of	

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their identity. Neuroprosthetics can maximize benefit and minimize harm for		

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properties they had before injury of	r disease onset and thereby re-establish	

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also re-establish the connectednes	ss and continuity of the psychological		

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agency for people affected I	by neurological and psychiatric disorders. They	/ can
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with these circuits, neuropro	esthetics can restore varying degrees of autono	omous
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modulating dysregulation in	neural circuits. As enabling devices that integr	rate
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or improve motor and menta	al functions in bypassing areas of injury or	
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. Neuroprosthetics can resto	pre	1
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results

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Main		

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patients' best interests.		

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to neuroprosthetic research and b	alancing technological innovation with	

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as how to establish and implemen	t fair selection criteria in providing access	

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these questions. It also includes c	onsideration of social justice issues such	

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. This review is an analysis and dis	scussion of	

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Approach		

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identity.		

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indicated. These include informed	consent, agency, autonomy (free will) and	

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goals of particular neuroprosthetic	s and the conditions for which they are	

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psychological sequelae. Other eth	ical questions are more specific to the therapeutic	

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altering neural circuits against the	potential harm from neurophysiological and	

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raise general ethical questic	ns about weighing the potential benefit of	
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thought and behavior. These	e direct and indirect interventions in the brain	
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people with these conditions	to gain or regain varying degrees of control c	of
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dysfunctional neural circuits	, brain injury and limb loss. They can enable	
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interfaces and hippocampal	prosthetics can bypass, replace or compensa	te for

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prosthetics, deep brain stimulation	, brain-computer interfaces, brain-to-brain	

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neurodevelopmental and neurodegenerative disorders. Cochlear implants, visual			
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congenital anomalies, trauma	tic brain injury, infection, amputation or		
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cognitive affective and volition	nal functions that have been impaired or lost f	rom	
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neurally mediated functions. These include sensorimotor, visual, auditory,			
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devices or systems designed to generate, restore or modulate a range of			
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Neuroprosthetics are artificial

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Ethical issues in neuroprosthetics		

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using this system.		

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LIS patients, while none of the VS	/UWS patients showed a response to command	

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entropy system could detect a resp	oonse to command in all healthy subjects and	

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detect command-following in patie	nts with severe motor disabilities. The	

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present study provides evidence the	nat an EEG-based measure of attention could	

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entropy could not distinguish indiv	idual VS/UWS patients from LIS patients. The	

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reached a lower accuracy than spe	ectral entropy. Resting-state EEG spectral	

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respectively. VS/UWS patients we	re at chance level. EEG rhythms classification	

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paradigm showed 93% and 91% a	ccuracy in healthy volunteers and LIS patients	

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classification. Spectral entro	py classification during the attention-rest	,
		,
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paradigm, and compared wit	th EEG rhythms (delta, theta, alpha, and beta)	<u>'</u>
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state/unresponsive wakefulness s	yndrome (VS/UWS) were included. Spectral	

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volunteers, 6 LIS patients, and 10	patients with a vegetative	

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the issues of accuracy and training	requirement. Data from 20 healthy	

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objective diagnostic tool for	patients with locked-in syndrome (LIS), answe	ring
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focal attention in order to de	evelop a motor-independent, portable, and	
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unconscious patients. We s	tudied the use of spectral entropy as a measur	e of
unconscious patients. We s	tudied the use of spectral entropy as a measur	e of
unconscious patients. We s	tudied the use of spectral entropy as a measur	e of
unconscious patients. We s 2018-04-18 11:21:00	Full SCI2010 Essay.docx	e of Addition
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Electroencephalography (EEG)		

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Locked-in Syndrome		

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Toward an Attention-Based Diagn	ostic Tool for Patients With	

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Ekanayake, J., Hutton, C., Ridgwa	y, G., Scharnowski, F., Weiskopf, N. and Rees, G. (2	2018).

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suicidology. Expert Systems with	Applications, 103, pp.206-217.	

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Prasad, D., Liu, S., Chen, S. and C	Quek, C. (2018). Sentiment analysis using EEG activ	ities for

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and frequency bands combination	. Cognitive Systems Research, 49,	pp.33-48.	

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Khurana, V., Kumar, P., Saini, R. a	and Roy, P. (2018). EEG based word familiarity using	9

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doi 122-135.		

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Clinical EEG and Neuroscience		

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N. and Rees, G. (2018).		

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Ekanayake, J., Hutton, C., Ridgway, G., Scharnowski, F., Weiskopf,		

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Expert Systems with Applications, 103, pp.206-217.		

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analysis using EEG activities for	suicidology.	

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Prasad, D., Liu, S., Chen, S. and Quek, C. (2018). Sentiment		

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Systems Research, 49, pp	o.33-48.	

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features and frequency bands combination. Cognitive		

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word familiarity using		

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Khurana, V., Kumar, P., Saini, R. and Roy, P. (2018). EEG based		

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Neural Engineering,			

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Glannon, W. (2016). Ethical issue:	s in neuroprosthetics. Journal of	

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other visible signs or responsivene	ess.	

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ensure that patients aren't inaccur	ately deemed unresponsive or vegetative even if the	re are no

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commands. The results found that	t this method may help better diagnosis LIS severity	as well as help

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by measuring eye movement and	EEG responsiveness after patients are given instruct	ions or

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the research was to investigate the	e viability of spectral entropy in better diagnosis of se	verity of LIS	

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LIS and 10 patients in a vegetative state/unresponsive wakefulness syndrome (VS/UWS). The aim of

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subjects. The research trials were	e carried out on 20 Healthy Volounteers, 6 Patients s	uffering from

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in syndrome(LIS) and how they co	mpared too healthy and completely vegetative/unres	ponsive

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Leesenfants et al.(2018) set out in	this investigation to research the brain waves of vict	ims of Locked

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doi 122-135.		

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Attention-Based Diagnostic	Tool for Patients With Locked-in	
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Sumarries:

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System		

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Electroencephalography, Invasive	, Non Invasive, Electrical Signals, External	

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Brain Computer Interface,		

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Keywords:		

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measuring devices directly into the users brain.		

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BCI's usually involve complex surg	eries to implant a computer chip and		

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implanted under the skull but above	ve the brain to record signals whilst Invasive	

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the brain however the severity of t	he connection can differ. Semi invasive BCI's are us	ually wires

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accurate readings. Invasive and s	semi invasive BCI's connect directly to	

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less risk of injury through infection	or complications however produce less	

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These systems do not require sur	gery to connect to the subject and carry	

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to EEG as this are the most comm	on.		

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connected to an external de	vice. Non invasive forms of BCI usually refers	
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person is		
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). These categories relate to	o how the user or	'
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Walter Glannon (2018)		
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invasive classifications(		,
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	ies such as invasive, non invasive and semi	

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through an invasive implant in the	brain.	

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records electric signals within the	brain. To restoring a person's sight	

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Electroencephalography(EEG) which is a monitoring method that non invasively		

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uses for these devices can range	from simple brain wave recorders i.e	

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interact with an external device. T	he .	

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measuring electrical signals in the	brain and uses these signals to directly	

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programmed for a specific ta	ask. BCI's operate under the principle of	·
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that connects the brain to ar	external system, usually a computer of some	kind
		_
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Brain Computer Interface(BC	Cls) is the technical term for a device	
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Enhancements.	,	'
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Final		

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communication in patients who are	e unable to speak or move due to brain injury.	

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access varied and therefore more	versatile information, potentially providing a platform	for

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decoding accuracies reaching upto	o 70%. By utilising higher order mental processes, co	ognitive BCIs

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lc	ocations. Accuracies in three targ	et regions were significantly above chance, with indiv	<i>r</i> idual

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These were linked to the covert all	ocation of attention to real-world images presented a	at 4-quadrant

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quadrant-specific parameter estimates, to achieve single-block classification of brain activations.

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such as attention. Using realtime f	MRI, we implemented an online winner-takes-all app	roach with

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proof-of-principle for the use of hig	her-order brain regions involved in complex cognitive	e processes

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regions, using surgical implants or	non-invasive neuroimaging techniques. Here, we pro	ovide

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(BCI) provide a means of using he	uman brain activations to control devices	

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beta waves in EEG channels relate	ed to memory can provide classification accuracy of	more than 70%.

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participants with no prior experience	ce or conditioning. Quantitatively, our results indicate	that the

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between genuine and hoax suicide	e notes and that the brain signals are more discrimina	atory in

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experience or conditioned training	in detection of suicide notes is not beneficial in discr	iminating

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and beta waves is studied. Our stu	udy provides an important and interesting conclusion	that prior

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detection of suicidal ideation throu	gh perusal is studied. Also, the discriminatory role of	alpha waves

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genuine suicide attempt or a hoax	suicide note. The role of emotion, attention, and mer	mory in

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ideation through data analysis of E	EG signals elicit by reading of text notes, which may	indicate

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study with other popular classifica	tion technique is also discussed.	

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82% has been recorded using the	proposed classifier combination approach. Finally, a	comparative

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been found to be different for the v	vord for which the user has confusion in his mind. Ar	accuracy of

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different from the pattern when he	is familiar with the word. Similarly, the pattern of brain	in waves has

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the user comes across an unknow	n word then the pattern of his brain waves comes ou	t to be totally

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characteristics of brain waves at the time of unknown word perception can be detected, i.e., when

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12 users has been developed while	e they are reading 25 words. The results show that t	he

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provide the meaning of the word w	hen a user is found to be unfamiliar with the text. EE	G dataset of

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used to boost the prediction perfor	mance. A dictionary based pop-up window has been	developed to

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been performed using Random Fo	orest (RF) classifier. Next, a decision fusion approach	n has also been

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have been computed from beta and gamr		d gamma frequency bands. The prediction of word-fa	amiliarity has

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technique and four features, namely mean, standard deviation, Root Mean Square (RMS) and power

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while reading the text. The records	ed signals have been processed using Wavelet deco	mposition

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waves has been developed. Word	-familiarity refers whether a user is familiar with the w	vord or not

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(EEG). In particular, a word-familia	arity prediction approach based on EEG signals from	the users brain

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Electroencephalography		

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detecting those words which are u	nfamiliar to the users while reading using	

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disorders.		

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should shape the evolution and application of novel techniques to better understand and treat brain		

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generate new ethical and phil	osophical questions about people and their b	orains. These questions
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outweighs the risk and therefo	ore can be ethically justified. Depending on the	heir neurogenerative
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patients, the probable benefit	of research into and therapeutic applications	s of neuroprosthetics
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. Provided that adequate prote	ections are in place for research subjects and	d
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Significance		
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their lives.

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minimize harm for people affected	by damaged or dysfunctional brains and improve the	e quality of

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or disease onset and thereby re-es	stablish their identity. Neuroprosthetics can maximize	e benefit and

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re-establish the connectedness a	nd continuity of the psychological properties they had	before injury

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autonomous agency for people aff	ected by neurological and psychiatric disorders. The	y can also

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devices that integrate with these c	ircuits, neuroprosthetics can restore varying degrees	of

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functions in bypassing areas of inj	ury or modulating dysregulation in neural circuits. As	enabling

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. Neuroprosthetics can resto	ore or improve motor and mental	
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Main results	,	
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patients' best interests.		
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criteria in providing access to neuroprosthetic research and balancing technological innovation with		
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includes consideration of social just	stice issues such as how to establish and implement	fair selection

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. This review is an analysis and dis	scussion of these questions. It also		

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Approach		

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will) and identity.		

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conditions for which they are indic	ated. These include informed consent, agency, autor	nomy (free

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questions are more specific to the	therapeutic goals of particular neuroprosthetics and	the

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against the potential harm from ne	urophysiological and psychological sequelae. Other	ethical

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brain raise general ethical question	ns about weighing the potential benefit of altering ned	ural circuits

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and the second of the could be be size. The second is directive and in the second is the			

varying degrees of control of thought and behavior. These direct and indirect interventions in the

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circuits, brain injury and limb loss.	They can enable people with these conditions to gain	n or regain

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interfaces and hippocampal prosthetics can bypass, replace or compensate for dysfunctional ne		ctional neural

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implants, visual prosthetics, deep	brain stimulation, brain-computer interfaces, brain-to-	-brain

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injury, infection, amputation or neu	rodevelopmental and neurodegenerative disorders.	Cochlear

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volitional functions that have been	impaired or lost from congenital anomalies, traumati	c brain

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of neurally mediated functions. The	ese include sensorimotor, visual, auditory, cognitive	affective and

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this system.		

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subjects and LIS patients, while no	one of the VS/UWS patients showed a response to c	ommand using

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severe motor disabilities. The entre	opy system could detect a response to command in a	all healthy

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evidence that an EEG-based measure of attention could detect command-following in pa		patients with

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could not distinguish individual VS	/UWS patients from LIS patients. The present study	provides

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classification reached a lower acc	uracy than spectral entropy. Resting-state EEG spec	tral entropy

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volunteers and LIS patients respec	ctively. VS/UWS patients were at chance level. EEG	rhythms

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entropy classification during the at	tention-rest paradigm showed 93% and 91% accurac	cy in healthy

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paradigm, and compared with EEC	G rhythms (delta, theta, alpha, and beta) classification	n. Spectral

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were included. Spectral entropy was computed during a gaze-independent 2-class (attention vs		ention vs rest)	

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LIS patients, and 10 patients with a vegetative state/unresponsive wakefulness syndrome (VS/UWS)

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(LIS), answering the issues of accuracy and training requirement. Data from 20 healthy vol		volunteers, 6

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motor-independent, portable, and	objective diagnostic tool for patients with locked-in sy	/ndrome

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patients. We studied the use of sp	ectral entropy as a measure of focal attention in orde	er to develop a

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misdiagnosis in severely brain-injured populations helping to distinguish co		n unconscious

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http://iopscience.iop.org.ezproxy.li	b.monash.edu.au/article/10.1088/1741-2560/13/2/02	1002/meta

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Toward an Attention-Based Diagn	ostic Tool for Patients With Locked-in Syndrome	

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Real-time decoding of covert atter	ntion in higher-order visual areas. NeuroImage, 169,	

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suicidology. Expert Systems with A	Applications, 103, pp.206-217.	

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Prasad, D., Liu, S., Chen, S. and Quek, C. (2018). Sentiment analysis using EEG activities for

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features and frequency bands com	nbination. Cognitive Systems Research, 49, pp.33-48	<b>5.</b>	

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Khurana, V., Kumar, P., Saini, R.	and Roy, P. (2018). EEG based word familiarity using	9

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Glannon, W. (2016). Ethical issues in neuroprosthetics. Journal of Neural Engineering,			

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(2018) Toward an Attention-Based	d Diagnostic Tool for Patients With Locked-in Syndro	me.

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or		

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system		

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device		

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(BCIs)		

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devices		

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device		

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Walter Glannon (2018)		

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Brain-computer-interfaces		

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Electroencephalography		

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communication in patients who are	e unable to speak or move due to brain injury.	

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access varied and therefore more	versatile information, potentially providing a platform	for

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decoding accuracies reaching upto 70%. By utilising higher order mental processes, cognitive BCIs

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locations. Accuracies in three targ	et regions were significantly above chance, with indiv	ridual

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These were linked to the covert all	ocation of attention to real-world images presented a	at 4-quadrant

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quadrant-specific parameter estim	ates, to achieve single-block classification of brain ac	ctivations.

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such as attention. Using realtime f	MRI, we implemented an online winner-takes-all app	roach with

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proof-of-principle for the use of hig	her-order brain regions involved in complex cognitive	e processes

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regions, using surgical implants or	non-invasive neuroimaging techniques. Here, we pro	ovide

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for communication. Until now this	has only been demonstrated in primary motor and se	nsory brain

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(BCI) provide a means of using h	uman brain activations to control devices	

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higher-order visual areas		

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Real-time decoding of covert atter	ntion in	

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http://iopscience.iop.org.ezproxy.li	b.monash.edu.au/article/10.1088/1741-2560/13/2/02	1002/meta

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beta waves in EEG channels related to memory can provide classification accuracy of more than 70%.

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participants with no prior experien	ce or conditioning. Quantitatively, our results indicate	that the

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between genuine and hoax suicide	e notes and that the brain signals are more discrimina	atory in	

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experience or conditioned training	in detection of suicide notes is not beneficial in discr	iminating

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and beta waves is studied. Our stu	dy provides an important and interesting conclusion	that prior

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detection of suicidal ideation throu	gh perusal is studied. Also, the discriminatory role of	alpha waves

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genuine suicide attempt or a hoax	suicide note. The role of emotion, attention, and me	mory in

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ideation through data analysis of E	EG signals elicit by reading of text notes, which may	indicate

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This paper investigates the utility of	of EEG signals in suicidology, particularly for detectio	n of suicidal

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suicidology		

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Sentiment analysis using EEG act	ivities for	

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https://www-sciencedirect-com.ezproxy.lib.monash.edu.au/science/article/pii/S1389041717302334		

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study with other popular classifica	tion technique is also discussed.	

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82% has been recorded using the	proposed classifier combination approach. Finally, a	comparative

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been found to be different for the v	vord for which the user has confusion in his mind. An	accuracy of

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different from the pattern when he	is familiar with the word. Similarly, the pattern of bra	n waves has

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the user comes across an unknow	n word then the pattern of his brain waves comes ou	t to be totally

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characteristics of brain waves at the time of unknown word perception can be detected, i.e., when		

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12 users has been developed while they are reading 25 words. The results show that the		

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provide the meaning of the word w	hen a user is found to be unfamiliar with the text. EE	G dataset of

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used to boost the prediction performance. A dictionary based pop-up window has been developed to			

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been performed using Random Forest (RF) classifier. Next, a decision fusion approach has al		has also been	

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have been computed from beta ar	nd gamma frequency bands. The prediction of word-fa	amiliarity has

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technique and four features, name	ly mean, standard deviation, Root Mean Square (RM	1S) and power

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while reading the text. The records	ed signals have been processed using Wavelet deco	mposition

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waves has been developed. Word	-familiarity refers whether a user is familiar with the w	vord or not

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(EEG). In particular, a word-familia	urity prediction approach based on EEG signals from	the users brain

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detecting those words which are u	nfamiliar to the users while reading using	

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The appearance of unknown v	words often disturbs communication and rea	ding. This paper focuses on

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frequency bands combination		

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EEG based word familiarity using features and			
		,	
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Journal of Neural Engineering		

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Walter Glannon (2018) Ethical issu	ues in neuroprosthetics.	

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http://iopscience.iop.org.ezproxy.li	b.monash.edu.au/article/10.1088/1741-2560/13/2/02	1002/meta

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disorders.		

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should shape the evolution and application of novel techniques to better understand and treat brain		

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generate new ethical and philosophical questions about people and their brains. These questions		

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potential, there may be an ethical obligation to conduct this research. Advances in neuroscience will				
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outweighs the risk and there	fore can be ethically justified. Depending on the	heir neurogenerative		
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patients, the probable benef	it of research into and therapeutic applications	s of neuroprosthetics		
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. Provided that adequate pro	otections are in place for research subjects an	d		
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Significance		I		
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their lives.

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minimize harm for people affected by damaged or dysfunctional brains and improve the quality of		e quality of

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or disease onset and thereby re-establish their identity. Neuroprosthetics can maximize benefit and		

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re-establish the connectedness and continuity of the psychological properties they had before injur		before injury

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autonomous agency for people affected by neurological and psychiatric disorders. They can also		y can also

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devices that integrate with these	circuits, neuroprosthetics can restore varying degrees	of

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functions in bypassing areas of injury or modulating dysregulation in neural circuits. As enabling		

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. Neuroprosthetics can restore or improve motor and mental				
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patients' best interests.				
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criteria in providing access to neuroprosthetic research and balancing technological innovation with				
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. This review is an analysis and dis	scussion of these questions. It also	

includes consideration of social justice issues such as how to establish and implement fair selection

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Approach		

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will) and identity.		

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conditions for which they are indic	ated. These include informed consent, agency, autor	nomy (free

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questions are more specific to the	therapeutic goals of particular neuroprosthetics and	the

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against the potential harm from ne	urophysiological and psychological sequelae. Other	ethical

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brain raise general ethical question	ns about weighing the potential benefit of altering neu	ural circuits

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	what are all hash as size. The area discrete areal in discrete interestanti	! 4l

varying degrees of control of thought and behavior. These direct and indirect interventions in the

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circuits, brain injury and limb loss.	They can enable people with these conditions to gain	n or regain

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interfaces and hippocampal prosth	netics can bypass, replace or compensate for dysfund	ctional neural

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implants, visual prosthetics, deep	brain stimulation, brain-computer interfaces, brain-to-	-brain

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injury, infection, amputation or neu	rodevelopmental and neurodegenerative disorders.	Cochlear

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volitional functions that have been	impaired or lost from congenital anomalies, traumati	c brain

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of a complicate of formations. The		

of neurally mediated functions. These include sensorimotor, visual, auditory, cognitive affective and

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Neuroprosthetics are artificial devi	ces or systems designed to generate, restore or mod	lulate a range

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Ethical issues in neuroprosthetics		

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xri/sid:primo&accountid=12528		

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https://search-proquest-com.ezpro	oxy.lib.monash.edu.au/docview/1999856284?OpenUi	rlRefId=info:

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this system.		

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subjects and LIS patients, while none of the VS/UWS patients showed a response to command using

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severe motor disabilities. The entr	opy system could detect a response to command in a	all healthy

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evidence that an EEG-based meas	sure of attention could detect command-following in p	patients with

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could not distinguish individual VS	/UWS patients from LIS patients. The present study	provides	

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classification reache	d a lower accı	uracy than spectral entropy. Resting-state EEG spec	tral entropy

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volunteers and LIS patients respec	ctively. VS/UWS patients were at chance level. EEG	rhythms

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	tantian mast manadisms about a 000/ and 040/ accura	

entropy classification during the attention-rest paradigm showed 93% and 91% accuracy in healthy

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paradigm, and compared with EEG rhythms (delta, theta, alpha, and beta) classification. Spectral		

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were included. Spectral entropy was computed during a gaze-independent 2-class (attention vs rest)		

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LIS patients, and 10 patients with a vegetative state/unresponsive wakefulness syndrome (VS/UWS)		me (VS/UWS)	

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(LIS), answering the issues of accuracy and training requirement. Data from 20 healthy volunteers, 6		

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motor-independent, portable, and objective diagnostic tool for patients with locked-in syndrome		/ndrome	

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patients. We studied the use of spectral entropy as a measure of focal attention in order to develop a			
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misdiagnosis in severely brain-inju	red populations helping to distinguish conscious fron	n unconscious	
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Electroencephalography (EEG) ha	s been proposed as a supplemental tool for reducing	g clinical	
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Patients With Locked-in Syndrome			
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Toward an Attention-Based Diagn	ostic Tool for		
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**Abstracts** 

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directly into the users brain.		

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usually involve complex surgeries to implant a computer chip and measuring device		

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implanted under the skull but below the brain to record signals whilst Invasive BCI's		

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however the severity of the connection can differ. Semi invasive BCI's are usually wires		

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accurate readings. Invasive and semi invasive BCI's connect directly to the brain		

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carry less risk of injury through infe	ection or complications however produce less		

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r	most common. These systems do	not require surgery to connect to the subject and	

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external device. Non invasive forr	ns of BCI usually refers to EEG BCI's as these are th	e

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classifications(). These categories	s relate to how the user or person is connected to an	

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BCI's have different categories such	ch as invasive, non invasive and semi invasive	

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within the brain. To restoring a pe	erson's sight through an invasive implant in the brain.	

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EEG for short which is a monitorin	g method that non invasively records electric signals	

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these devices can range from simp	ole brain wave recorders i.e Electroencephalography	or

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the brain and uses these signals to	o directly interact with an external device. The uses t	for

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for a specific task. BCI's operate	under the principle of measuring electrical signals in	

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connects the brain to an external of	device, usually a computer of some kind programmed	k

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Brain Computer Interfaces or BCI	s for short is the technical term for a device that	

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Introduction:		

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Comparing the possibilities of future technological human enhancements.