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10 years of EPOC: A scoping review of Emotiv's portable EEG device

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10 years of EPOC: A scoping review of Emotiv's portable EEG device

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Abstract

BACKGROUND: Commercially-made low-cost electroencephalography (EEG) devices have become increasingly available over the last decade. One of these devices, Emotiv EPOC, is currently used in a wide variety of settings, including brain-computer interface (BCI) and cognitive neuroscience research.

PURPOSE: The aim of this study was to chart peer-reviewed reports of Emotiv EPOC projects to provide an informed summary on the use of this device for scientific purposes.

METHODS: We followed a five-stage methodological framework for a scoping review that included a systematic search using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines. We searched the following electronic databases: PsychINFO, MEDLINE, Embase, Web of Science, and IEEE Xplore. We charted study data according to application (BCI, clinical, signal processing, experimental research, and validation) and location of use (as indexed by the first author's address).

RESULTS: We identified 382 relevant studies. The top five publishing countries were the United States (n = 35), India (n = 25), China (n = 20), Poland (n = 17), and Pakistan (n = 17). The top five publishing cities were Islamabad (n = 11), Singapore (n = 10), Cairo, Sydney, and Bandung (n = 7 each). Most of these studies used Emotiv EPOC for BCI purposes (n = 277), followed by experimental research (n = 51). Thirty-one studies were aimed at validating EPOC as an EEG device and a handful of studies used EPOC for improving EEG signal processing (n = 12) or for clinical purposes (n = 11).

CONCLUSIONS: In its first 10 years, Emotiv EPOC has been used around the world in diverse applications, from control of robotic limbs and wheelchairs to user

40 authentication in security systems to identification of emotional states. Given the
41 widespread use and breadth of applications, it is clear that researchers are
42 embracing this technology.
43

Introduction

Electroencephalography (EEG) is a continuous recording of the electrical activity generated by groups of neurons firing in the brain. An EEG typically comprises recordings of activity present at multiple sites on the head, indexed using metal electrodes placed on the scalp. EEG recordings can be inspected by sight for signs of brain dysfunction (e.g., epilepsy), or can be processed to produce spectral analyses of the electrical activity over a period of time, and event-related potentials (ERPs) that reflect the average pattern of electrical activity generated by a particular stimulus (e.g., a speech sound, a face, a written word).

EEG is one of the oldest neuroscientific techniques in use today. Since the first human recordings published by Hans Berger in 1929 [see 1, for a history], EEG has become a popular tool for neuroscientists due to its non-invasive nature and high temporal resolution. The technique has matured over the decades due to advances in technology, which has allowed for greater instrument sensitivity and better signal processing techniques. What used to be analogue signals scribed onto rolls of paper are now digital recordings stored on hard drives, ready for processing using a myriad statistical and mathematical techniques.

In recent years, one of the biggest evolutions in EEG applications has been the development of consumer-grade devices. Not only do these devices make acquiring EEG signals easier, but they can do so in natural environments outside the traditional laboratory setting. In 2009, a biotech company, Emotiv Systems, released EPOC, a consumer-oriented EEG device. EPOC was originally designed and marketed as a hands-free videogame device, placing it within the class of brain-computer interface (BCI) devices. As one of the first EEG devices available to consumers, EPOC's release demonstrated the feasibility of low-cost neuroimaging

outside of research laboratories. The next 10 years saw the EPOC developer re-established as Emotiv Inc., a second iteration of the device called EPOC+, and the market of EPOC evolve to include research applications. Neuroscientists, keen to take advantage of efficiency increases and budget decreases, saw an opportunity in EPOC for user-friendly research at a fraction of the cost of traditional research-grade EEG systems.

In the decade since its release, EPOC has been used in hundreds of scientific applications as its ease of setup and low price-point make it an appealing option for researchers and engineers. The first published works using EPOC appeared in 2010, describing the use of EPOC in BCI applications [2-4]. In 2011, the first study using for experimental research was published [5]. Two years later, studies validating the use of EPOC in experimental research began to emerge [6-8]. In the years that followed, EPOC appeared in many conference proceedings and journal articles, suggesting its wide adoption as an EEG device. In our laboratory, we have successfully converted the EPOC into an ERP device, which we have validated against a research-grade system [8-10]. In addition, our department has integrated EPOC into the Bachelor of Cognitive and Brain Sciences as a practical demonstration of neuroscience methodology [11].

Given the demonstrated validity of the EPOC as a research tool, as well as its low cost, researchers around the world are understandably curious about what the EPOC system can and cannot be used for. This has inspired a number of reviews of EPOC's use in specific domains such as BCI [12-17], cognitive enhancement [18, 19], stress detection [20], and education [21]. However, no review has considered the use of the EPOC across multiple domains. In addition, while other reviews have

93 focused on portable EEG devices in general [22-26], none have focused on the
94 EPOC device specifically.
95 With this gap in knowledge in mind, we aimed to carry out a scoping review of
96 studies that have used the EPOC as an EEG and ERP device to understand the use
97 and location of EPOC research to date. We followed the framework put forth by
98 Arksey and O'Malley (27 p. 21) for conducting a scoping review, where, in contrast to
99 a systematic review, a scoping review does not seek to answer a narrowly-defined
100 research question but to examine and describe the “extent, range, and nature of
101 research activity”. We followed the five stages described by Arksey and O'Malley
102 (27), which were:
103 Stage 1: identifying the research question.
104 Stage 2: identifying relevant studies.
105 Stage 3: study selection.
106 Stage 4: charting the data.
107 Stage 5: collating, summarising, and reporting the results.
108 Additionally, we followed the Preferred Reporting Items for Systematic
109 Reviews and Meta-analyses Extension for Scoping Reviews (PRISMA-ScR)
110 guidelines [28]. See supporting information (S1 PRISMA-ScR) for the checklist.

111 **Stage 1: Identifying the Research Question**

112 We sought to answer the question of where (i.e., locations) and how (i.e.,
113 applications) EPOC has been used in research settings. In addressing this question,
114 we aim to facilitate decision-making about EPOC useability and expect this review
115 may be particularly beneficial for researchers who are searching for inexpensive
116 neuroscience techniques. It may also be useful for clinicians in the development of
117 BCI-assisted technologies that support people with physical limitations.

Emotiv EPOC

There have been two versions of Emotiv's device, EPOC and EPOC+. The primary difference is that EPOC+ can capture data at 128 Hz and 256 Hz sampling rates whereas EPOC samples at 128 Hz only. We reviewed projects using both devices in this scoping review, but for simplicity we will refer to both versions as EPOC.

Stage 2: Identifying Relevant Studies

The first author conducted a systematic search of the literature by retrieving records from the following online bibliographic databases: (a) PsychINFO, (b) MEDLINE, (c) Embase, (d) Web of Science, and (e) IEEE Xplore. These widely-used databases cover a large breadth of fields, including psychology, cognitive science, medicine, and engineering. Searches included peer-reviewed studies conducted with human participants and written in English. Searches included studies published from 2009 onwards (i.e., the year EPOC was released). To find records in each database, we used the following search strings in conjunction with wildcards to capture keyword variations: Emotiv, EPOC, electroencephalograph, EEG, event-related, ERP. For example, in PsychINFO we used: (Emotiv OR EPOC) AND (electroenceph* OR EEG OR event-related OR event related OR ERP). The initial search was conducted in June of 2018. A second search was conducted in February of 2019 and a third search was conducted in February 2020.

Fig 1 outlines the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flowchart for this review (Moher, Liberati, Tetzlaff, & Altman, 2009). In brief, we identified 724 articles via the database search. This included 249 duplicate articles resulting in 475 articles after removal.

Fig 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flowchart.

Stage 3: Study Selection

We excluded twenty-two records for which the full-text could not be retrieved and screened the remaining articles according to the following eligibility criteria: (1) EPOC device used; (2) Actual data collected; (3) Articles published in peer-reviewed journals or conference proceedings. We removed seventy-one studies that failed at least one of these criteria. These included publications in which EPOC appeared as the acronym for *Effective Practice and Organisation of Care,* in which no actual EEG data was collected, which were not written in English, or were literature reviews.

The final number of studies included in this review was 382. Of these, 252 were conference proceedings and 130 were journal articles. As the conference proceedings in this review meet the criteria of peer review, we did not distinguish between conference proceedings and journal articles. However, Fig 2 provides a breakdown of the types of studies over the years included in this review.

Fig 2. Number of EPOC studies by type from 2010 to 2019.

Stage 4: Charting the data

We charted the data by recording relevant information from each record. This information included the author(s), year of publication, study location, and aims of the study. We classified each study according to its aim into one of five categories: (1) EPOC used as a BCI device (e.g., control of a wheel chair); (2) EPOC used as a clinical tool (e.g., to assess depression); (3) EPOC used to collect EEG data for developing or refining EEG signal processing techniques (e.g., to reduce artefacts in EEG data streams); (4) EPOC used as a theory development tool (e.g., to examine

166 EEG signatures in cognitive tasks); and (5) studies aimed at validating EPOC as an
167 EEG device (e.g., comparing EPOC to research-grade EEG systems). See Table 1
168 for descriptions and number of studies assigned to each category.

169 **Table 1. Category descriptions and counts of EPOC-related studies**

Category	Description	Conference proceedings	Journal articles	Total
Brain-computer interface	Studies that used EPOC as a means of interacting with a computer or a machine.	212	65	277
Clinical	Studies that used EPOC as a diagnostic or therapeutic device.	3	8	11
Signal Processing	Studies that used EPOC to collect data to develop or refine EEG signal processing or analysis techniques.	7	5	12
Experimental Research	Studies that used EPOC to collect EEG data to answer a neuroscience research question or hypothesis.	21	30	51
Validation	Studies that investigated whether EPOC was a valid EEG device.	14	17	31

170

171 To chart the location of EPOC studies, we used the first authors'
172 corresponding address. To visualise the global distribution of EPOC studies, we
173 obtained latitude and longitude coordinates from a world cities database
174 (https://simplemaps.com/data/world-cities). If cities did not have coordinate
175 information in the database, we performed a Google search and entered the
176 coordinates manually. See supporting information (S2 Appendix) for data extracted
177 and charted.

Stage 5: Collating, Summarising, and Reporting the Results

The first three EPOC-related studies were published in the year after its release, 2010. These initial studies were all related to BCI: two P300 classification studies [2, 4] and a robotic arm control study [3]. A year later, 2011, saw the first study published using EPOC for experimental research [5]. This study examined the relationship between EEG, personality, and mood on perceived engagement. The first publications aimed at validating EPOC appeared in 2013 [6-8, 29, 30].

Overall, the number of EPOC studies showed a steady increase from 2010 (n = 3) to 2015 (n = 61), after which the numbers fell to 58, 59 and 44 in 2016, 2017, and 2018 respectively, and then increased to 52 publications in 2019 (see Fig 3). While the true reason for this pattern is unknown, it may well reflect a change in the licensing of Emotiv software, which switched to a subscription-based license in 2016 (previously the license involved a one-time fee). This increased the cost of the EPOC for research, which may explain the declining in publications in 2015 – 2018. The resurgence in 2019 could be acceptance of the licensing fee as the new standard and being factored into budgets and grant applications. It remains to be seen how this fee structure will impact EPOC use in the future.

Fig 3. Number of EPOC studies from 2010 to 2019 by study application.

Location

In the years 2009 to 2019, the five countries that published the most EPOC studies were the United States (n = 35), India (n = 25), China (n = 20), Poland (n = 17), and Pakistan (n = 17). The five individual cities that published the most EPOC studies were Islamabad (n = 11), Singapore (n = 10), Bandung, Indonesia (n = 7), Cairo (n = 7), and Sydney (n = 7). See Fig 4 for overall global distribution of studies covered by this systematic review.

Fig 4. Global distribution of EPOC studies from 2010 to 2019.

Applications

BCI. BCI applications represented the majority of EPOC studies (approximately 73% of studies in this review). To better characterise BCI studies, we further classified them into four subcategories: (a) biometrics, (b) device control, and (c) state recognition, and (c) general classification. See Table 2 for description of each subcategory.

Table 2. Descriptions and study counts of EPOC-related BCI subcategories.

BCI Subcategory	Description	Study count
Biometrics	Studies that used EPOC to characterise EEG signatures for identification/authentication of individual users.	11
Device control	Studies that used EPOC to enable control of devices in an individual's environment (e.g., wheelchairs, appliances).	97
State recognition	Studies that used EPOC to recognise human physical, mental, or affective states.	94
General classification	Studies that used EPOC to collect EEG data for the classification of EEG signatures, without explicit applications associated with other BCI subcategories in this table.	75

BCI biometrics. Much like a fingerprint or a password, individual brain signatures can identify individuals, granting them access to systems or facilities. As the variation between individuals' brain waves can be quite complex, the use of

individual EEG signatures as a biometric indicator represents a promising application of portable EEG technology. A total of 11 studies used EPOC to investigate EEG in the context of user-authentication and security. The earliest biometric EPOC study was published in 2013 and used a P300 speller paradigm to investigate the feasibility of using EEG classification for user authentication [31]. Recently, study designs and classification methods have grown more sophisticated. For example, Moctezuma, Torres-Garcia (32) used feature extraction and classification to distinguish between individuals' EEG signatures while they imagined speaking words. Likewise, Seha and Hatzinakos (33) also employed feature extraction, in this case on auditory evoked potentials, to accurately (> 95%) discriminate between individuals. Compared to BCI studies in general, relatively few EPOC studies have focused on biometry. Nevertheless, there has been a general increase in biometric studies since 2013 and this field represents one of the many practical applications of portable EEG technology.

BCI device control. The control of external devices, such as prostheses or wheelchairs, is the most straightforward application of EEG-based BCIs. A total of 97 studies, representing 35% of BCI studies and 25% of studies overall, used EPOC as a means of controlling or interacting with machines in users' environment. P300 spellers are perhaps the most well-known type of BCI interface that fall under this category. P300 speller interfaces exploit the well-documented and robust signature observed as deflection in an ERP waveform in a response to a target stimulus. By capitalising on the P300, a computer can detect when a target letter flashes on a screen thereby allowing selection of letters without physical interaction. Though there were several EPOC studies in this review that investigated traditional P300 speller BCI interfaces [34-37], others harnessed P300 for such purposes as interacting with

navigation systems [38] and robotic devices [39]. Suhas, Dhal (40) investigated using ERPs to control a light bulb and a fan, with an eye towards giving physically disabled individuals control of 'smart' appliances. Other studies have employed EPOC as a means of controlling robots [41-47], tractors [48], and drones [49]. Practical and effective BCI device control using EEG has the potential to benefit a large population, such as individuals who have lost the use of motor functions. For this reason, this area of research has received much attention and it should be expected to continue to do so.

BCI state recognition. Characterising and identifying cognitive or affective states using EEG is critical for many BCI paradigms and is a hallmark of neurofeedback applications. Many researchers have used EPOC to achieve this. For example, an early EPOC study attempted to recognise EEG patterns when participants imagined pictures [50]. More recent studies have used sophisticated algorithms to identify cognitive states, such as confusion [51], fatigue [52] and emotions [53-55]. Identifying an individual's mental state can help to improve human performance in demanding situations. For example, Binias, Myszor (56) used an EPOC to develop algorithms aimed at helping pilots respond more quickly to unanticipated events. Studies like these demonstrate that the rapid and accurate identification of cognitive and affective states, even before conscious recognition, may lead to safer roads and skies.

BCI general classification. A total of 75 BCI studies were not readily classifiable in the above subcategories as they were not concerned with a direct application of research. Rather, these studies aimed to increase the usability of BCI technology through the development and refinement of EEG classification algorithms. For example, Perez-Vidal, Garcia-Beltran (57) collected EEG data with

EPOC in order to determine the effectiveness of a machine-learning algorithm for correctly identifying P300 evoked potentials. In this example, direct use of the P300 was not directly used for interfacing with a specific device/machine. Rather, the central focus was on the algorithm itself. We categorised these types of studies as general classification studies.

Clinical. The small form factor and ease of setup make portable EEG devices ideal for use in clinical settings in which the objective is to treat or diagnosis health conditions. Eleven studies in this review used EPOC for this purpose, with six studies aimed at using EPOC specifically for a therapeutic purpose. For example, studies have used EPOC to provide neurofeedback for motor rehabilitation [58, 59] or for the treatment of depression [60] and pain [61, 62]. Five studies used EPOC as a diagnostic tool with the aims of assessing conditions such as depression [63], attention deficit hyperactivity disorder [64, 65], or encephalopathy [66]. Yet another study used EPOC to monitor changes in the nervous system of a group of Turkish researchers who visited Antarctica [67].

Signal processing. Twelve studies in this review aimed to improve EEG signal processing techniques used with EPOC data. For example, Sinha, Chatterjee (68), Soumya, Zia Ur Rahman (69), and Jun Hou, Mustafa (70) used EPOC to test techniques aimed at reducing EEG artefacts and noise. Additionally, Moran and Soriano (71) compared different techniques for maximising EPOC EEG signal quality while Petrov, Stamenova (72) and Shahzadi, Anwar (73) investigated remote EEG transmission and processing. These studies are important as the signal-to-noise ratio of EEG can be small and techniques aimed at increasing it can broaden the utility of EEG devices. In addition, the increasingly distanced nature of research and

clinical diagnostics necessitates the development of effective data transmission pipelines.

Experimental Research. We identified a total of 51 experimental research studies that used EPOC incidentally to answer questions related to brain function. That is, researchers could have used any EEG device to collect data but they chose EPOC. Most of these studies were directly concerned with investigating EEG signatures related to certain processes, situations, or tasks. Many were cognitive in nature including EEG signatures related to cognitive load [74-77], alertness [78], distraction [79], learning styles [76], semantic association [80-82], and memory [83]. Other studies examined EEG signatures related to perception. These included spatial perception [84], taste perception [85], olfactory perception [86], and visual perception [87, 88].

Studies examining social phenomena also constituted a large proportion of EPOC research projects. For example, we found studies in which EPOC was used to investigate consumer behaviour and preference [89-92]. Other socially-oriented studies examined the EEQ patterns associated with conformity [93], deception [94], perception of quality, [95], and motivation and interest in an educational environment [96].

Researchers also used EPOC to better understand ailments or disorders. These types of studies are contrasted with those in the *clinical* category where publications were aimed at *treating* ailments or disorders, rather than *investigating* the ailments or disorders. For example, Askari, Setarehdan (97), Askari, Setarehdan (98) used the device to investigate neural connectivity in autism. Similarly, Fan, Wade (99) used EPOC to collect EEG data with the aim of building models to accurately identify cognitive and affective states in autistic individuals while driving.

In addition to autism, other studies examined the EEG signatures associated with bipolar disorder [100] and mild cognitive impairment [101].

Many research studies were more action-oriented. These types of studies used EPOC to characterise the EEG signatures associated with video games [102, 103], driving [104-106], moving through urban [107] or virtual [108] environments, and performance of specialised tasks [109, 110].

Validation. Assessing the validity of a device is an important step in establishing its widespread implementation. If an EEG system cannot be demonstrated to accurately capture the data it purports to, then any conclusions drawn from this data are questionable. We identified thirty-one studies that tested the validity of EPOC as a research-grade EEG device. The first EPOC validation studies appeared in 2013. In this year there were five studies assessing the capabilities of EPOC. These studies assessed the accuracy of P300 identification [6], the validity of affect signatures [7], and whether EPOC could be used to collect valid ERPs [8, 29, 30]. Another five EPOC validation studies were published in 2014 before peaking in 2015 (n = 7) and then declining in 2016, 2017, 2018, and 2019 (n = 4, n = 4, n = 3, and n = 3, respectively).

Studies varied in both approach and intended application of the validation. Some did not use a benchmark device with which to compare EPOC. For example, Rodriguez Ortega, Rey Solaz (111) compared EPOC-captured affect signatures to those demonstrated in the literature. Another simply aimed to determine the classification accuracy of EPOC in P300 tasks [112]. However, most studies compared the EPOC to the performance of other research- or consumer-grade EEG devices. Four validation studies compared auditory ERPs between systems [8, 10, 113]. Three studies compared visual ERPs between systems [9, 114 McDowell, &

Hairston, 2014, 115, 116]. Tello, Müller (117) also conducted a visual-related validation study in which they compared EEG device performance on steady-state visual evoked potential (SSVEP) tasks, while Szalowski and Picovici (118) tested the capacity of EPOC to distinguish between different SSVEP experimental parameters. Melnik, Legkov (119) compared the performance of multiple systems on both visual ERPs and SSVEPs. Also in the visual domain, Kotowski, Stapor (120) examined the capacity of EPOC to collect ERPs of emotional face processing. Takehara, Kayanuma (121) compared the performance of EPOC to another device on capacity to capture event-related desynchronization while Grummett, Leibbrandt (122) conducted a comprehensive validation study that compared EPOC to other devices on power spectra, ERPs, SSVEPs, and event-related desynchronization/synchronisation.

Some studies validated EPOC's capacity to measure cognitive indicators with one study comparing devices' capture of cognitive load signatures [123 Sinharay, & Sinha, 2014], and another comparing the performance of systems during cognitive tasks using time and frequency analyses [124]. Likewise, Naas, Rodrigues (125) tested whether EPOC could enhance cognitive performance in neurofeedback tasks.

Three studies validated EPOC for BCI use by comparing its performance to other device performance on P300 speller tasks [6, 126, 127]. Two others compared the performance of devices on motor imagery tasks [128, 129]. Finally, Maskeliunas, Damasevicius (130) compared the capacity of devices to recognise mental states.

Since 2013, many studies have sought to determine the validity of EPOC. While assessment of the conclusions of these studies are outside the aims of this scoping review, what can be noted is that quantity of studies demonstrates researchers' interest in employing these devices in their work.

Limitations

This scoping review has some limitations. With nearly 400 records selected, the charting phase represented an enormous undertaking. Although the review employed a systematic methodology using PRISMA guidelines and searching a broad array of databases, it was impossible to include every study that used EPOC. We deliberately omitted common systematic search strategies, such as grey-literature searching, hand searching, and backward citation searching. We did this as inclusion of these strategies would not have added enough value to justify the additional time and resources. We believe this scoping review represents a quality characterisation of EPOC research and satisfies the stated aims of the project. In addition, like all scientific reviews, its success depends on the search terms. If a publication did not contain 'Emotiv' or 'EPOC' in the title, abstract, or keywords, then it did not appear in our search. We could have overcome this limitation by broadening our search terms. However, we again believe our search constraints produced an accurate characterisation of the EPOC literature, without creating an unwieldy scoping dataset.

Conclusion

In this scoping review, we aimed to chart the location and purpose of EPOC-related research. In doing so, we have outlined the many studies that have used Emotiv EPOC as an EEG acquisition device. From BCI applications to experimental research studies to clinical environments, the last 10 years has seen diverse implementation of EPOC. Global use and a low financial barrier likely facilitate research in areas of limited resources. Considering the cost of a research-grade EEG system, it is not hard to imagine scientists and engineers in developing nations

389 embracing EPOC as an ideal device with which to conduct neuroscience research.
390 In addition, this device (and devices like it) may enable collection of data that would
391 be impossible with traditional EEG devices. For example, Parameshwaran and
392 Thiagarajan (131) used an EPOC in both rural and urban settings in India to
393 demonstrate differences in EEG signatures related to factors such as socioeconomic
394 status, exposure to technology, and travel experience.

395 We expect that this review will provide a useful reference for researchers who
396 may be looking for cost-effective, portable EEG solutions. We hope it may also serve
397 as an inspiration for those considering incorporating portable EEG devices into their
398 research and facilitate the conceptualisation and development of future experiments
399 and applications.

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406 **S1 PRISMA-ScR Checklist.**

407 **S2 Appendix. Scoping review charted data.**

408

Cited References

1. Stone JL, Hughes JR. Early history of electroencephalography and establishment of the American Clinical Neurophysiology Society. Journal of Clinical Neurophysiology. 2013;30(1):28-44.
2. Ramirez-Cortes JM, Alarcon-Aquino V, Rosas-Cholula G, Gomez-Gil P, Escamilla-Ambrosio J, editors. P-300 rhythm detection using ANFIS algorithm and wavelet feature extraction in EEG signals. 2010 World Conggress on Engineering and Computer Sciencce; 2010; San Francisco, CA, USA: International Association of Engineers San Francisco.
3. Ranky G, Adamovich S, editors. Analysis of a commercial EEG device for the control of a robot arm. Proceedings of the 2010 IEEE 36th Annual Northeast Bioengineering Conference (NEBEC); 2010; New York, NY, USA: IEEE. doi: 10.1109/NEBC.2010.5458188.
4. Rosas-Cholula G, Ramirez-Cortes JM, Alarcón-Aquino V, Martinez-Carballido J, Gomez-Gil P, editors. On signal P-300 detection for BCI applications based on wavelet analysis and ICA preprocessing. 2010 IEEE Electronics, Robotics and Automotive Mechanics Conference; 2010; Morelos, Mexico: IEEE. doi: 10.1109/CERMA.2010.48.
5. Goldberg BS, Sottilare RA, Brawner KW, Holden HK, editors. Predicting learner engagement during well-defined and ill-defined computer-based intercultural interactions. International Conference on Affective Computing and Intelligent Interaction; 2011; Berlin, Germany.: Springer. Retrieved from: https://www.gifttutoring.org/attachments/download/126/ACII2011_Goldberg_et_al_Predicting_Learner_Engagement_0.pdf.
6. Duvinage M, Castermans T, Petieau M, Hoellinger T, Cheron G, Dutoit T. Performance of the Emotiv Epoc headset for P300-based applications. Biomedical Engineering Online. 2013;12:56. Epub 2013/06/27. doi: 10.1186/1475-925X-12-56. PubMed PMID: 23800158; PubMed Central PMCID: PMCPMC3710229.
7. Rodriguez Ortega A, Rey Solaz B, Raya A, Luis M. Validation of a low-cost EEG device for mood induction studies. Annual Review of Cybertherapy and Telemedicine. 2013;11:43-7. doi: Retrieved from: https://riunet.upv.es/handle/10251/78724.
8. Badcock NA, Mousikou P, Mahajan Y, de Lissa P, Thie J, McArthur G. Validation of the Emotiv EPOC EEG gaming system for measuring research quality auditory ERPs. PeerJ. 2013;1:e38. Epub 2013/05/03. doi: 10.7717/peerj.38. PubMed PMID: 23638374; PubMed Central PMCID: PMCPMC3628843.
9. de Lissa P, Sorensen S, Badcock N, Thie J, McArthur G. Measuring the face-sensitive N170 with a gaming EEG system: A validation study. Journal of Neuroscience Methods. 2015;253:47-54. Epub 2015/06/10. doi: 10.1016/j.jneumeth.2015.05.025. PubMed PMID: 26057115.
10. Badcock NA, Preece KA, de Wit B, Glenn K, Fieder N, Thie J, et al. Validation of the Emotiv EPOC EEG system for research quality auditory event-related potentials in children. PeerJ. 2015;3:e907. Epub 2015/04/30. doi: 10.7717/peerj.907. PubMed PMID: 25922794; PubMed Central PMCID: PMCPMC4411518.
11. De Wit B, Badcock NA, Grootswagers T, Hardwick K, Teichmann L, Wehrman J, et al. Neurogaming technology meets neuroscience education: a cost-effective,

456 scalable, and highly portable undergraduate teaching laboratory for neuroscience.
457 Journal of Undergraduate Neuroscience Education. 2017;15(2):A104.
458 12. Alchalabi AE, Eddin AN, Shirmohammadi S, editors. More Attention, Less
459 Deficit: Wearable EEG-Based Serious Game for Focus Improvement. Ieee Int Conf
460 Seriou; 2017; Perth, WA. doi: 10.1109/SeGAH.2017.7939288.
461 13. Ancau D, Roman N-M, Ancău M, editors. The Emotiv EPOC interface
462 paradigm in Human-Computer Interaction. MATEC Web of Conferences; 2017: EDP
463 Sciences. DOI: 10.1051/matecconf/201713704001.
464 14. Masood N, Farooq H, editors. Emotiv-Based Low-Cost Brain Computer
465 Interfaces: A Survey. 2016 International Conference on Neuroergonomics and
466 Cognitive Engineering; 2017; Orlando, FL, USA. doi: 10.1007/978-3-319-41691-
467 5_12.
468 15. Rechy-Ramirez E-J, Hu H, McDonald-Maier K, editors. Head movements
469 based control of an intelligent wheelchair in an indoor environment. 2012 IEEE
470 International Conference on Robotics and Biomimetics (ROBIO); 2012; Guangzhou,
471 China: IEEE. doi: 10.1109/ROBIO.2012.6491175.
472 16. Thomas KP, Vinod AP. Toward EEG-Based Biometric Systems The Great
473 Potential of Brain-Wave-Based Biometrics. Ieee Syst Man Cybern. 2017;3(4):6-15.
474 doi: 10.1109/Msmc.2017.2703651. PubMed PMID: WOS:000414932700004.
475 17. Yang S, Deravi F. On the Usability of Electroencephalographic Signals for
476 Biometric Recognition: A Survey. IEEE Transactions on Human-Machine Systems.
477 2017;47(6):958-69. doi: 10.1109/Thms.2017.2682115. PubMed PMID:
478 WOS:000415153100020.
479 18. Kutt K, Gunia A, Nalepa GJ, editors. Cognitive enhancement: How to increase
480 chance of survival in the jungle? 2015 IEEE 2nd International Conference on
481 Cybernetics (CYBCONF); 2015; Gdynia, Poland: IEEE. doi:
482 10.1109/CYBConf.2015.7175949.
483 19. Mavros P, Coyne R, Roe J, Aspinall P, editors. Engaging the brain:
484 Implications of mobile EEG for spatial representation. 30th International Conference
485 on Education and Research in Computer Aided Architectural Design in Europe
486 (eCAADe); 2012; Prague, Czech Republic. Retrieved from:
487 http://papers.cumincad.org/cgi-bin/works/Show?ecaade2012_190.
488 20. Ijjada MS, Thapliyal H, Caban-Holt A, Arabnia HR, editors. Evaluation of
489 wearable head set devices in older adult populations for research. 2015 International
490 Conference on Computational Science and Computational Intelligence (CSCI); 2015;
491 Las Vegas, NV, USA: IEEE. doi: 10.1109/CSCI.2015.158.
492 21. Xu JH, Zhong BC. Review on portable EEG technology in educational
493 research. Computers in Human Behavior. 2018;81:340-9. doi:
494 10.1016/j.chb.2017.12.037. PubMed PMID: WOS:000423893900033.
495 22. Ashok S. High-level hands-free control of wheelchair - a review. Journal of
496 Medical Engineering & Technology. 2017;41(1):46-64. Epub 2016/08/09. doi:
497 10.1080/03091902.2016.1210685. PubMed PMID: 27498944.
498 23. Ekandem JI, Davis TA, Alvarez I, James MT, Gilbert JE. Evaluating the
499 ergonomics of BCI devices for research and experimentation. Ergonomics.
500 2012;55(5):592-8. Epub 2012/04/18. doi: 10.1080/00140139.2012.662527. PubMed
501 PMID: 22506831.
502 24. Jenita B, Umamakeswari A, Sree J. An approach toward wireless brain-
503 computer interface system using EEG signals: A review. National Journal of
504 Physiology, Pharmacy and Pharmacology. 2015;5(5). doi:
505 10.5455/njppp.2015.5.0306201555.

25. Mihajlović V, Grundlehner B, Vullers R, Penders JJIjob, informatics h. Wearable, wireless EEG solutions in daily life applications: what are we missing? IEEE Journal of Biomedical Health Informatics. 2015;19(1):6-21.
26. Niha K, Banu WA, editors. Brain signal processing: Technologies, analysis and application. 2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC); 2016; Chennai, India: IEEE. doi: 10.1109/ICCIC.2016.7919569.
27. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. International journal of social research methodology. 2005;8(1):19-32.
28. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Annals of internal medicine. 2018;169(7):467-73.
29. Boutani H, Ohsuga M, editors. Applicability of the "Emotiv EEG Neuroheadset" as a user-friendly input interface. 2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2013; Osaka, Japan: IEEE. doi: 10.1109/EMBC.2013.6609758.
30. Mayaud L, Congedo M, Van Laghenhove A, Orlikowski D, Figere M, Azabou E, et al. A comparison of recording modalities of P300 event-related potentials (ERP) for brain-computer interface (BCI) paradigm. Neurophysiologie Clinique. 2013;43(4):217-27. Epub 2013/10/08. doi: 10.1016/j.neucli.2013.06.002. PubMed PMID: 24094907.
31. Jolfaei A, Wu X-W, Muthukkumarasamy V, editors. On the feasibility and performance of pass-thought authentication systems. Emerging Security Technologies (EST), 2013 Fourth International Conference on; 2013; Cambridge, UK: IEEE. doi: 10.1109/EST.2013.12.
32. Moctezuma LA, Torres-Garcia AA, Villasenor-Pineda L, Carrillo M. Subjects identification using EEG-recorded imagined speech. Expert Systems with Applications. 2019;118:201-8. doi: 10.1016/j.eswa.2018.10.004. PubMed PMID: WOS:000451653400014.
33. Seha SNA, Hatzinakos D. Human recognition using transient auditory evoked potentials: a preliminary study. IET Biometrics. 2018;7(3):242-50. doi: 10.1049/iet-bmt.2017.0185
34. Elsawy AS, Eldawlatly S, Taher M, Aly GM. MindEdit: A P300-based text editor for mobile devices. Computers in Biology and Medicine. 2017;80:97-106. Epub 2016/12/05. doi: 10.1016/j.compbiomed.2016.11.014. PubMed PMID: 27915127.
35. Jijun T, Peng Z, Ran X, Lei D, editors. The portable P300 dialing system based on tablet and Emotiv Epoc headset. Engineering in Medicine and Biology Society (EMBC), 2015 37th Annual International Conference of the IEEE; 2015; Milan, Italy: IEEE. doi: 10.1109/EMBC.2015.7318425.
36. Meshriky MR, Eldawlatly S, Aly GM, editors. An Intermixed Color Paradigm for P300 Spellers: A Comparison with Gray-scale Spellers. 2017 IEEE 30th International Symposium on Computer-Based Medical Systems (CBMS); 2017; Thessaloniki, Greece. doi: 10.1109/Cbms.2017.123.
37. Tahmasebzadeh A, Bahrani M, Setarehdan SK, editors. Development of a robust method for an online P300 Speller Brain Computer Interface. 2013 6th International IEEE/EMBS Conference on Neural Engineering (NER); 2013; San Diego, CA, USA. doi: 10.1109/NER.2013.6696122.
38. Fan X-a, Bi L, Teng T, Ding H, Liu Y. A brain–computer interface-based vehicle destination selection system using P300 and SSVEP signals. IEEE

Transactions on Intelligent Transportation Systems. 2015;16(1):274-83. doi: doi: 10.1109/TITS.2014.2330000.
39. Nurseitov D, Serekov A, Shintemirov A, Abibullaev B, editors. Design and Evaluation of a P300-ERP based BCI System for Real-Time Control of a Mobile Robot. 2017 5th International Winter Conference on Brain-Computer Interface (BCI); 2017; Sabuk, South Korea. doi: 10.1109/IWW-BCI.2017.7858177.
40. Suhas K, Dhal S, Shankar PV, Hugar SH, Tejas C, editors. A Controllable Home Environment for the Physically Disabled Using the Principles of BCI. 2018 9th International Conference on Computing, Communication and Networking Technologies (ICCCNT); 2018; Bangalore, India: IEEE. doi: 10.1109/ICCCNT.2018.8494070.
41. Garcia AP, Schjølberg I, Gale S, editors. EEG control of an industrial robot manipulator. 2013 IEEE 4th International Conference on Cognitive Infocommunications (CogInfoCom); 2013; Budapest, Hungary: IEEE. doi: 10.1109/CogInfoCom.2013.6719280.
42. Gargava P, Sindwani K, Soman S, editors. Controlling an arduino robot using Brain Computer Interface. 2014 3rd International Conference on Reliability, Infocom Technologies and Optimization (ICRITO)(Trends and Future Directions); 2014; Noida, India: IEEE. doi: 10.1109/ICRITO.2014.7014713.
43. Grude S, Freeland M, Yang C, Ma H, editors. Controlling mobile Spykee robot using Emotiv neuro headset. 2013 32nd Chinese Control Conference (CCC); 2013; Xi'an, China: IEEE. Retrieved from: https://ieeexplore.ieee.org/document/6640475.
44. Guneysu A, Akin HL, editors. An SSVEP based BCI to control a humanoid robot by using portable EEG device. 2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2013; Osaka, Japan: IEEE. doi: 10.1109/EMBC.2013.6611145.
45. Malki A, Yang C, Wang N, Li Z, editors. Mind guided motion control of robot manipulator using EEG signals. 2015 5th International Conference on Information Science and Technology (ICIST); 2015; Changsha, China: IEEE. doi: 10.1109/ICIST.2015.7289033.
46. Mondada L, Karim ME, Mondada F. Electroencephalography as implicit communication channel for proximal interaction between humans and robot swarms. Swarm Intelligence. 2016;10(4):247-65. doi: 10.1007/s11721-016-0127-0. PubMed PMID: WOS:000389629200002.
47. Szafir D, Signorile R, editors. An exploration of the utilization of electroencephalography and neural nets to control robots. IFIP Conference on Human-Computer Interaction; 2011; Lisbon, Portugal: Springer. doi: 10.1007/978-3-642-23768-3.
48. Gomez-Gil J, San-Jose-Gonzalez I, Nicolas-Alonso LF, Alonso-Garcia S. Steering a tractor by means of an EMG-based human-machine interface. Sensors (Basel). 2011;11(7):7110-26. Epub 2011/12/14. doi: 10.3390/s110707110. PubMed PMID: 22164006; PubMed Central PMCID: PMCPMC3231667.
49. Song Y, Liu J, Gao Q, Liu M, editors. A quadrotor helicopter control system based on Brain-computer interface. 2015 IEEE International Conference on Mechatronics and Automation (ICMA); 2015; Beijing, China: IEEE. doi: 10.1109/ICMA.2015.7237703.
50. Bobrov P, Frolov A, Cantor C, Fedulova I, Bakhnyan M, Zhavoronkov A. Brain-computer interface based on generation of visual images. PLoS One. 2011;6(6):e20674. Epub 2011/06/23. doi: 10.1371/journal.pone.0020674. PubMed PMID: 21695206; PubMed Central PMCID: PMCPMC3112189.

606 51. Zhou Y, Xu T, Li S, editors. Confusion State Induction and EEG-based
607 Detection in Learning. 2018 40th Annual International Conference of the IEEE
608 Engineering in Medicine and Biology Society (EMBC); 2018; Honolulu, HI, USA:
609 NLM (Medline). http://dx.doi.org/10.1109/EMBC.2018.8512943.
610 52. Xiao H, Duan YG, Zhang ZB, Li M. Detection and estimation of mental fatigue
611 in manual assembly process of complex products. Assembly Automation.
612 2018;38(2):239-47. doi: 10.1108/aa-03-2017-040. PubMed PMID:
613 WOS:000426675800011.
614 53. Lekova A, Dimitrova M, Kostova S, Bouattane O, Ozaeta L, editors. BCI for
615 Assessing the Emotional and Cognitive Skills of Children with Special Educational
616 Needs. 2018 IEEE 5th International Congress on Information Science and
617 Technology (CiSt); 2018 21-27 Oct. 2018; Marrakech, Morocco. doi:
618 10.1109/CIST.2018.8596571.
619 54. Matlovic T, Gaspar P, Moro R, Simko J, Bielikova M, editors. Emotions
620 detection using facial expressions recognition and EEG. 2016 11th International
621 Workshop on Semantic and Social Media Adaptation and Personalization (SMAP);
622 2016; Thessaloniki, Greece: IEEE. doi: 10.1109/SMAP.2016.7753378.
623 55. Sanchez-Reolid R, Garcia AS, Vicente-Querol MA, Fernandez-Aguilar L,
624 Lopez MT, Fernandez-Caballero A, et al. Artificial Neural Networks to Assess
625 Emotional States from Brain-Computer Interface. Electronics. 2018;7(12). doi:
626 10.3390/electronics7120384. PubMed PMID: WOS:000455067800043.
627 56. Binias B, Myszor D, Cyran KA. A Machine Learning Approach to the Detection
628 of Pilot's Reaction to Unexpected Events Based on EEG Signals. Computational
629 intelligence and neuroscience. 2018;2018:2703513. doi:
630 http://dx.doi.org/10.1155/2018/2703513.
631 57. Perez-Vidal AE, Garcia-Beltran CD, Martinez-Sibaja A, Posada-Gomez R.
632 Use of the Stockwell Transform in the Detection of P300 Evoked Potentials with
633 Low-Cost Brain Sensors. Sensors. 2018;18(5). doi: 10.3390/s18051483. PubMed
634 PMID: WOS:000435580300182.
635 58. Munoz J, Villada J, Munoz C, Henao O, editors. Multimodal system for
636 rehabilitation aids using videogames. 2014 IEEE Central America and Panama
637 Convention (CONCAPAN XXXIV); 2014; Panama City, Panama: IEEE. doi:
638 10.1109/CONCAPAN.2014.7000395.
639 59. Verplaetse T, Sanfilippo F, Rutle A, Osen OL, Bye RT, editors. On Usage of
640 EEG Brain Control for Rehabilitation of Stroke Patients. 30th European Conference
641 on Modelling and Simulation; 2016. doi: 10.7148/2016-0544.
642 60. Ramirez R, Palencia-Lefler M, Giraldo S, Vamvakousis Z. Musical
643 neurofeedback for treating depression in elderly people. Frontiers in Neuroscience.
644 2015;9:354. Epub 2015/10/21. doi: 10.3389/fnins.2015.00354. PubMed PMID:
645 26483628; PubMed Central PMCID: PMCPMC4591427.
646 61. Al-Taleb MKH, Purcell M, Fraser M, Petric-Gray N, Vuckovic A. Home used,
647 patient self-managed, brain-computer interface for the management of central
648 neuropathic pain post spinal cord injury: usability study. Journal of neuroengineering
649 and rehabilitation. 2019;16(1):128. doi: http://dx.doi.org/10.1186/s12984-019-0588-7.
650 62. Vuckovic A, Altaleb MKH, Fraser M, McGeady C, Purcell M. EEG correlates
651 of self-managed neurofeedback treatment of central neuropathic pain in chronic
652 spinal cord injury. Frontiers in Neuroscience. 2019;13(JUL):762. doi:
653 http://dx.doi.org/10.3389/fnins.2019.00762.
654 63. Wang D, Mo F, Zhang Y, Yang C, Liu J, Chen Z, et al. Auditory evoked
655 potentials in patients with major depressive disorder measured by Emotiv system.

Bio-medical materials and engineering. 2015;26(s1):S917-S23. doi: 10.3233/BME-151385.

64. Mercado-Aguirre IM, Gutierrez-Ruiz K, Contreras-Ortiz SH, editors. Acquisition and analysis of cognitive evoked potentials using an Emotiv headset for ADHD evaluation in children. 2019 XXII Symposium on Image, Signal Processing and Artificial Vision (STSIVA); 2019; Bucaramanga, Colombia. doi: 10.1109/stsiva.2019.8730225.

65. Martinez F, Barraza C, Gonzalez N, Gonzalez J. KAPEAN: Understanding Affective States of Children with ADHD. Educational Technology & Society. 2016;19(2):18-28. doi: Retrieved from: https://www.jstor.org/stable/10.2307/jeductechsoci.19.2.188?seq=1&cid=pdf-reference#references_tab_contents. PubMed PMID: WOS:000375636600003.

66. Schiff S, Casa M, Di Caro V, Aprile D, Spinelli G, De Rui M, et al. A low-cost, user-friendly electroencephalographic recording system for the assessment of hepatic encephalopathy. Hepatology. 2016;63(5):1651-9. Epub 2016/02/03. doi: 10.1002/hep.28477. PubMed PMID: 26833704.

67. Cotuk HB, Duru AD, Aktas S. Monitoring Autonomic and Central Nervous System Activity by Permutation Entropy during Short Sojourn in Antarctica. Entropy. 2019;21(9). doi: 10.3390/e21090893. PubMed PMID: WOS:000489176800077.

68. Sinha A, Chatterjee D, Das R, Datta S, Gavas R, Saha SK, editors. Artifact Removal from EEG Signals Recorded Using Low Resolution Emotiv Device. 2015 IEEE International Conference on Systems, Man, and Cybernetics; 2015; Kowloon, China: IEEE. doi: 10.1109/SMC.2015.256.

69. Soumya I, Zia Ur Rahman M, Rama Koti Reddy D, Lay-Ekuakille A. Efficient block processing of long duration biotelemetric brain data for health care monitoring. Review of Scientific Instruments. 2015;86(3):035003.

70. Jun Hou T, Mustafa M, Zahari ZL, Pebrianti D, Zain ZM, Noordin NH, et al., editors. Time-frequency Analysis from Earthing Application. 10th National Technical Seminar on Underwater System Technology 2018; 2019. 10.1007/978-981-13-3708-6_36.

71. Moran A, Soriano MC. Improving the quality of a collective signal in a consumer EEG headset. PLoS ONE. 2018;13(5):e0197597. doi: http://dx.doi.org/10.1371/journal.pone.0197597.

72. Petrov BB, Stamenova ED, Petrov NB, editors. Brain-computer interface as internet of things device. 2016 XXV International Scientific Conference Electronics (ET); 2016; **Sozopol, Bulgaria**: IEEE. doi: 10.1109/ET.2016.7753505.

73. Shahzadi R, Anwar SM, Qamar F, Ali M, Rodrigues JJPC, Alnowami M. Secure EEG Signal Transmission for Remote Health Monitoring Using Optical Chaos. IEEE Access. 2019;7:57769-78. doi: 10.1109/ACCESS.2019.2912548.

74. Chatterjee D, Das R, Sinha A, Datta S, editors. Analyzing elementary cognitive tasks with Bloom's taxonomy using low cost commercial EEG device. 2015 IEEE Tenth International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP); 2015; Singapore, Singapore: IEEE. doi: 10.1109/ISSNIP.2015.7106928.

75. Díaz MH, Cordova FM, Canete L, Palominos F, Cifuentes F, Sanchez C, et al. Order and chaos in the brain: fractal time series analysis of the EEG activity during a cognitive problem solving task. Procedia Computer Science. 2015;55:1410-9. doi: doi: 10.1016/j.procs.2015.07.135.

76. Cordova FM, Diaz H, Cifuentes F, Canete L, Palominos F. Identifying problem solving strategies for learning styles in engineering students subjected to intelligence

test and EEG monitoring. Procedia Computer Science. 2015;55:18-27. doi: 10.1016/j.procs.2015.07.003. PubMed PMID: WOS:000360101400002.

77. Szarkowska A, Krejtz K, Dutka L, Pilipczuk O. Cognitive Load in Intralingual and Interlingual Respeaking - a Preliminary Study. Poznan Studies in Contemporary Linguistics. 2016;52(2):209-33. doi: 10.1515/psicl-2016-0008. PubMed PMID: WOS:000378062400004.

78. Sawicki D, Wolska A, Roslon P, Ordysinski S, editors. New EEG Measure of the Alertness Analyzed by Emotiv EPOC in a Real Working Environment. 4th International Congress on Neurotechnology, Electronics and Informatics; 2016. doi: 10.5220/0006041200350042.

79. Sena P, d'Amore M, Brandimonte MA, Squitieri R, Fiorentino A. Experimental framework for simulators to study driver cognitive distraction: brake reaction time in different levels of arousal. Transp Res Proc. 2016;14:4410-9. doi: 10.1016/j.trpro.2016.05.363. PubMed PMID: WOS:000383251004053.

80. Calvo H, Paredes JL, Figueroa-Nazuno J. Measuring concept semantic relatedness through common spatial pattern feature extraction on EEG signals. Cognitive Systems Research. 2018;50:36-51. doi: http://dx.doi.org/10.1016/j.cogsys.2018.03.004.

81. Ousterhout T, editor Cross-form facilitation effects from simultaneous gesture/word combinations with ERP analysis. 2015 6th IEEE International Conference on Cognitive Infocommunications (CogInfoCom); 2015; Gyor, Hungary: IEEE. doi: 10.1109/CogInfoCom.2015.7390643.

82. Ousterhout T, editor N400 congruency effects from emblematic gesture probes following sentence primes. 2015 IEEE 19th International Conference on Intelligent Engineering Systems (INES); 2015; Bratislava, Slovakia: IEEE. doi: 10.1109/INES.2015.7329744.

83. Beardsley M, Hernandez-Leo D, Ramirez-Melendez R. Seeking reproducibility: Assessing a multimodal study of the testing effect. Journal of Computer Assisted Learning. 2018;34(4):378-86. doi: 10.1111/jcal.12265. PubMed PMID: WOS:000439797800006.

84. Mavros P, editor A neuropsychological perspective of spatial experience. 2015 Sixth International Conference on Spatial Cognition (ICSC); 2015 Sep; Rome, Italy. http://dx.doi.org/10.1007/s10339-015-0732-7.

85. Jadav GM, Vrankić M, Vlahinić S, editors. Monitoring cerebral processing of gustatory stimulation and perception using emotiv epoc. 2015 38th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO); 2015; Opatija, Croatia: IEEE. doi: 10.1109/MIPRO.2015.7160351.

86. Kusumawardani SR, Fitri LL, Suprijanto, editors. Theta Brainwave Activity as the Response to Lavender (Lavendula angustifolia) Aromatherapy Inhalation of Postgraduate Students with Acasdemic Stress Condition. Iop Conf Ser-Mat Sci; 2017. doi: 10.1088/1757-899x/180/1/012271.

87. Szalowski A, Picovici D, editors. Investigating brain signal peaks vs electroencephalograph electrode placement using multicolour 10Hz flickering graphics stimulation for Brain-Computer Interface development. 2016 27th Irish Signals and Systems Conference (ISSC); 2016; Londonderry, UK. doi: 10.1109/ISSC.2016.7528453.

88. Szalowski A, Picovici D, editors. Investigating stimuli graphics' size and resolution performance in Steady State Visual Evoked Potential. 2017 28th Irish

755 Signals and Systems Conference (ISSC); 2017; Killarney, Ireland. doi:
756 10.1109/ISSC.2017.7983618.
757 89. Rosenbaum MS, Contreras Ramirez G, Matos N. A neuroscientific
758 perspective of consumer responses to retail greenery. Service Industries Journal.
759 2019;39(15-16):1034-45. doi: 10.1080/02642069.2018.1487406. PubMed PMID:
760 WOS:000503221800002.
761 90. Bercik J, Horska E, Wang RW, Chen YC. The impact of parameters of store
762 illumination on food shopper response. Appetite. 2016;106:101-9. Epub 2016/04/17.
763 doi: 10.1016/j.appet.2016.04.010. PubMed PMID: 27083127.
764 91. Khushaba RN, Wise C, Kodagoda S, Louviere J, Kahn BE, Townsend C.
765 Consumer neuroscience: Assessing the brain response to marketing stimuli using
766 electroencephalogram (EEG) and eye tracking. Expert Systems with Applications.
767 2013;40(9):3803-12. doi: 10.1016/j.eswa.2012.12.095. PubMed PMID:
768 WOS:000316581300044.
769 92. Khushaba RN, Greenacre L, Al-Timemy A, Al-Jumaily A. Event-Related
770 Potentials of Consumer Preferences. Procedia Computer Science. 2015;76:68-73.
771 doi: 10.1016/j.procs.2015.12.277. PubMed PMID: WOS:000373789200011.
772 93. Perfumi SC, Cardelli C, Bagnoli F, Guazzini A, editors. Conformity in virtual
773 environments: a hybrid neurophysiological and psychosocial approach. International
774 Conference on Internet Science; 2016; Florence, Italy: Springer.
775 94. Marcelo CAG, Pasquin ZRB, Pichay ADT, Tan MLD, Simon MFKN, Prado SV,
776 et al., editors. Characterization and Comparison of Brain Wave Signals during
777 Deception. 2017 IEEE 9th International Conference on Humanoid, Nanotechnology,
778 Information Technology, Communication and Control, Environment and
779 Management (HNICEM); 2017; Manila, Philippines. doi:
780 10.1109/HNICEM.2017.8269508.
781 95. Antons J-N, Arndt S, De Moor K, Zander S, editors. Impact of perceived
782 quality and other influencing factors on emotional video experience. 2015 Seventh
783 International Workshop on Quality of Multimedia Experience (QoMEX); 2015; Pylos-
784 Nestoras, Greece: IEEE. doi: 10.1109/QoMEX.2015.7148124.
785 96. Babiker A, Faye I, Malik A, editors. Investigation of situational interest effects
786 on learning using physiological sensors: Preliminary result. 2016 6th International
787 Conference on Intelligent and Advanced Systems (ICIAS); 2016; Kuala Lumpur,
788 Malaysia: IEEE. doi: 10.1109/ICIAS.2016.7824075.
789 97. Askari E, Setarehdan SK, Sheikhani A, Mohammadi MR, Teshnehlab M.
790 Designing a model to detect the brain connections abnormalities in children with
791 autism using 3D-cellular neural networks. Journal of Integrative Neuroscience.
792 2018;17(3-4):391-411. doi: http://dx.doi.org/10.3233/JIN-180075.
793 98. Askari E, Setarehdan SK, Sheikhani A, Mohammadi MR, Teshnehlab M.
794 Modeling the connections of brain regions in children with autism using cellular
795 neural networks and electroencephalography analysis. Artificial Intelligence in
796 Medicine. 2018;89:40-50. doi: http://dx.doi.org/10.1016/j.artmed.2018.05.003.
797 99. Fan J, Wade JW, Key AP, Warren ZE, Sarkar N. EEG-Based Affect and
798 Workload Recognition in a Virtual Driving Environment for ASD Intervention. IEEE
799 Transactions on Biomedical Engineering. 2018;65(1):43-51. Epub 2017/04/20. doi:
800 10.1109/TBME.2017.2693157. PubMed PMID: 28422647; PubMed Central PMCID:
801 PMCPMC5638702.
802 100. Handayani N, Khotimah SN, Haryanto F, Arif I, Taruno WP, editors. Resting
803 State EEG Power, Intra-Hemisphere and Inter-Hemisphere Coherence in Bipolar

804 Disorder. AIP Conference Proceedings; 2017; Bydgoszcz, Poland. doi:
805 10.1063/1.4976797.
806 101. Handayani N, Haryanto F, Khotimah SN, Arif I, Taruno WP. Coherence and
807 phase synchrony analyses of EEG signals in Mild Cognitive Impairment (MCI): A
808 study of functional brain connectivity. Polish Journal of Medical Physics and
809 Engineering. 2018;24(1):1-9. doi: http://dx.doi.org/10.2478/pjmpe-2018-0001.
810 102. Adamos AC, Beredo JD, Garcia CJG, Mateo WB, Villalobos MJM, Prado SV,
811 et al., editors. A Comparison of Brain Activities Stimulated by Playing Different Video
812 Game Genres using Electroencephalogram Signal Analysis. 2017 Ieee 9th
813 International Conference on Humanoid, Nanotechnology, Information Technology,
814 Communication and Control, Environment and Management (IEEE HNICEM); 2017;
815 Manilla. doi: 10.1109/HNICEM.2017.8269514.
816 103. Aliyari H, Sahraei H, Daliri MR, Minaei-Bidgoli B, Kazemi M, Agaei H, et al.
817 Research Paper: The beneficial or harmful effects of computer game stress on
818 cognitive functions of players. Basic and Clinical Neuroscience. 2018;9(3):177-86.
819 doi: http://dx.doi.org/10.29252/nirp.bcn.9.3.177.
820 104. He S, Chen L, Yue M. Reliability analysis of driving behaviour in road traffic
821 system considering synchronization of neural activity. NeuroQuantology.
822 2018;16(4):62-8. doi: http://dx.doi.org/10.14704/nq.2018.16.4.1209.
823 105. Purawijaya DA, Fitri LL, Suprijanto, editors. Evaluation of blue light exposure
824 to beta brainwaves on simulated night driving. AIP Conference Proceedings; 2015:
825 AIP Publishing. doi: https://doi.org/10.1063/1.4930757.
826 106. Sugiono S, Denny W, Andriani DP. The impact of road complexity on the
827 psychophysiological load experienced by car drivers using electroencephalography
828 (EEG) measurement of brainwaves. Acta Neuropsychologica. 2018;16(4):361-74.
829 doi: http://dx.doi.org/10.5604/01.3001.0012.7926.
830 107. Neale C, Aspinall P, Roe J, Tilley S, Mavros P, Cinderby S, et al. The Aging
831 Urban Brain: Analyzing Outdoor Physical Activity Using the Emotiv Affectiv Suite in
832 Older People. Journal of Urban Health. 2017;94(6):869-80. doi: doi: 10.1007/s11524-
833 017-0191-9.
834 108. Oliveira SMSd, Medeiros CSPd, Pacheco TBF, Bessa NPOS, Silva FGM,
835 Tavares NSA, et al. Electroencephalographic changes using virtual reality program:
836 Technical note. Neurological research. 2018;40(3):160-5. doi: doi:
837 10.1080/01616412.2017.1420584.
838 109. Diaz H, Rivas G, Cordova FM, Palominos F, Canete L, Troncoso N.
839 Specialized Brains Performing Specialized Tasks: Beta/Gamma EEG Non-linear
840 Analysis Reveals Discriminative Differences between the Chaos/no-chaos Content
841 of Specialized Brain's Dynamics. Procedia Computer Science. 2016;91:813-22. doi:
842 10.1016/j.procs.2016.07.086. PubMed PMID: WOS:000387683300097.
843 110. Ji L, Wang H, Zheng TQ, Hua CC, Zhang NN. Correlation analysis of EEG
844 alpha rhythm is related to golf putting performance. Biomedical Signal Processing
845 and Control. 2019;49:124-36. doi: http://dx.doi.org/10.1016/j.bspc.2018.11.009.
846 111. Rodriguez Ortega A, Rey Solaz B, Raya A, Luis M. Evaluating virtual reality
847 mood induction procedures with portable EEG devices. Annual Review of
848 Cybertherapy and Telemedicine. 2013;11:131-5. doi: Retrieved from:
849 https://riunet.upv.es/handle/10251/78725.
850 112. Liu XQ, Chao F, Jiang M, Zhou CL, Ren WF, Shi MH, editors. Towards Low-
851 Cost P300-Based BCI Using Emotiv Epoc Headset. 17th UK Workshop on
852 Computational Intelligence; 2017; Cardiff, UK. doi: 10.1007/978-3-319-66939-7_20.

113. Barham MP, Clark GM, Hayden MJ, Enticott PG, Conduit R, Lum JAG. Acquiring research-grade ERPs on a shoestring budget: A comparison of a modified Emotiv and commercial SynAmps EEG system. Psychophysiology. 2017;54(9):1393-404. Epub 2017/05/13. doi: 10.1111/psyp.12888. PubMed PMID: 28497557.
114. Ries AJ, Touryan J, Vettel J, McDowell K, Hairston WD. A Comparison of Electroencephalography Signals Acquired from Conventional and Mobile Systems. Journal of Neuroscience and Neuroengineering. 2014;3(1):10-20. doi: 10.1166/jnsne.2014.1092.
115. Torok Á, Sulykos I, Kecskes-Kovacs K, Persa G, Galambos P, Kobor A, et al., editors. Comparison between wireless and wired EEG recordings in a virtual reality lab: Case report. 2014 5th IEEE Conference on Cognitive Infocommunications (CogInfoCom); 2014; Vietri sul Mare, Italy: IEEE. doi: 10.1109/CogInfoCom.2014.7020414.
116. Wang DC, Chen ZC, Yang C, Lu J, Mo FM, Zhang YD. Validation of the Mobile Emotiv Device Using a Neuroscan Event-Related Potential System. Journal of Medical Imaging and Health Informatics. 2015;5(7):1553-7. doi: 10.1166/jmihi.2015.1563. PubMed PMID: WOS:000362695500031.
117. Tello RM, Müller SM, Bastos-Filho T, Ferreira A, editors. Comparison between wire and wireless EEG acquisition systems based on SSVEP in an Independent-BCI. 2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society; 2014; Chicago, IL, USA: IEEE. doi: 10.1109/EMBC.2014.6943519.
118. Szalowski A, Picovici D, editors. Investigating the robustness of constant and variable period graphics in eliciting steady state visual evoked potential signals using Emotiv EPOC, MATLAB, and Adobe after effects. 2015 26th Irish Signals and Systems Conference (ISSC); 2015; Carlow, Ireland: IEEE. doi: 10.1109/ISSC.2015.7163777.
119. Melnik A, Legkov P, Izdebski K, Kärcher SM, Hairston WD, Ferris DP, et al. Systems, subjects, sessions: To what extent do these factors influence EEG data? Journal of Frontiers in Human Neuroscience. 2017;11:150. doi: doi: 10.3389/fnhum.2017.00150.
120. Kotowski K, Stapor K, Leski J, Kotas M. Validation of Emotiv EPOC+ for extracting ERP correlates of emotional face processing. Biocybernetics and Biomedical Engineering. 2018;38(4):773-81. doi: http://dx.doi.org/10.1016/j.bbe.2018.06.006.
121. Takehara D, Kayanuma H, Matsubara M, Seki N, Wada K, Kurata M, et al., editors. Development of an ERD measurement system using Emotiv Epoc. Japanese Society for Medical Biological Engineering; 2017. https://doi.org/10.11239/jsmbe.55Annual.556.
122. Grummett TS, Leibbrandt RE, Lewis TW, DeLosAngeles D, Powers DM, Willoughby JO, et al. Measurement of neural signals from inexpensive, wireless and dry EEG systems. Physiological Measurement. 2015;36(7):1469-84. Epub 2015/05/29. doi: 10.1088/0967-3334/36/7/1469. PubMed PMID: 26020164.
123. Das R, Chatterjee D, Das D, Sinharay A, Sinha A, editors. Cognitive load measurement - A methodology to compare low cost commercial EEG devices. 2014 International Conference on Advances in Computing, Communications and Informatics (ICACCI); 2014; New Delhi, India: IEEE. doi: 10.1109/ICACCI.2014.6968528.
124. Raduntz T. Signal quality evaluation of emerging EEG devices. Frontiers in Physiology. 2018;9:98. doi: http://dx.doi.org/10.3389/fphys.2018.00098.

125. Naas A, Rodrigues J, Knirsch JP, Sonderegger A. Neurofeedback training with a low-priced EEG device leads to faster alpha enhancement but shows no effect on cognitive performance: A single-blind, sham-feedback study. PLoS ONE. 2019;14(9):e0211668. doi: http://dx.doi.org/10.1371/journal.pone.0211668.
126. Nijboer F, van de Laar B, Gerritsen S, Nijholt A, Poel M. Usability of Three Electroencephalogram Headsets for Brain-Computer Interfaces: A Within Subject Comparison. Interacting with Computers. 2015;27(5):500-11. doi: 10.1093/iwc/iwv023. PubMed PMID: WOS:000364776100003.
127. Wang Y, Wang Z, Clifford W, Markham C, Ward TE, Deegan C, editors. Validation of low-cost wireless EEG system for measuring event-related potentials. 2018 29th Irish Signals and Systems Conference (ISSC); 2018; Belfast, UK: IEEE. doi: 10.1109/ISSC.2018.8585297.
128. Martinez-Leon J-A, Cano-Izquierdo J-M, Ibarrola J. Are low cost Brain Computer Interface headsets ready for motor imagery applications? Expert Systems with Applications. 2016;49:136-44. doi: http://dx.doi.org/10.1016/j.eswa.2015.11.015.
129. Senadeera M, Maire F, Rakotonirainy A, editors. Turning gaming EEG peripherals into trainable brain computer interfaces. Australasian Joint Conference on Advances in Artificial Intelligence; 2015; Canberra, ACT, Australia: Springer. doi: 10.1007/978-3-319-26350-2.
130. Maskeliunas R, Damasevicius R, Martisius I, Vasiljevas M. Consumer-grade EEG devices: are they usable for control tasks? PeerJ. 2016;4:e1746. Epub 2016/03/26. doi: 10.7717/peerj.1746. PubMed PMID: 27014511; PubMed Central PMCID: PMCPMC4806709.
131. Parameshwaran D, Thiagarajan TC. Complexity of EEG reflects socioeconomic context and geofootprint. bioRxiv. 2017:125872. doi: doi: http://dx.doi.org/10.1101/125872. .

Uncited References Included in Scoping Review

1. Abdalsalam ME, Yusoff MZ, Kamel N, Malik A, Meselhy M, editors. Mental task motor imagery classifications for noninvasive brain computer interface. 5th International Conference on Intelligent and Advanced Systems (ICIAS); 2014; Kuala Lumpur: IEEE. doi: 10.1109/ICIAS.2014.6869531.
2. Abdulaal MJ, Casson AJ, Gaydecki P, editors. Performance of Nested vs. Non-Nested SVM Cross-Validation Methods in Visual BCI: Validation Study. 2018 26th European Signal Processing Conference (EUSIPCO); 2018; Rome: IEEE. doi: 10.23919/EUSIPCO.2018.8553102.
3. Abu Kasim MA, Low CY, Ayub MA, Zakaria NAC, Salleh MHM, Johar K, et al. User-Friendly LabVIEW GUI for Prosthetic Hand Control using Emotiv EEG Headset. Procedia Computer Science. 2017;105:276-81. doi: 10.1016/j.procs.2017.01.222. PubMed PMID: WOS:000398830900044.
4. Aguiar S, Yánez W, Benítez D, editors. Low complexity approach for controlling a robotic arm using the Emotiv EPOC headset. 2016 IEEE International Autumn Meeting on Power, Electronics, and Computing (ROPEC), ; 2016; Ixtapa: IEEE. doi: 10.1109/ROPEC.2016.7830526.
5. Ahmad M, Aqil M, editors. Implementation of nonlinear classifiers for adaptive autoregressive EEG features classification. 2015 Symposium on Recent Advances in Electrical Engineering (RAEE); 2015; Islamabad: IEEE. doi: 10.1109/RAEE.2015.7352749.
6. Ahmad M, Aqil M, editors. QR decomposition based recursive least square adaptation of autoregressive EEG features. 2016 International Conference on Intelligent Systems Engineering (ICISE); 2016; Islamabad: IEEE. doi: 10.1109/INTELSE.2016.7475176.
7. Ahmad M, Aqil M, Khan H, editors. Reducing the Computational Cost of a Classifier by Subtracting the Dual-Class Features. 2017 International Conference on Innovations in Electrical Engineering and Computational Technologies (ICIEECT); 2017; Karachi. doi: 10.1109/ICIEECT.2017.7916521.
8. Al-dabag ML, Ozkurt N. EEG motor movement classification based on cross-correlation with effective channel. Signal Image and Video Processing. 2019;13(3):567-73. doi: doi: 10.1007/s11760-018-1383-9. PubMed PMID: WOS:000463797100018.
9. Alakus TB, Turkoglu I, editors. EEG-Based Emotion Estimation with Different Deep Learning Models. 2019 4th International Conference on Computer Science and Engineering; 2019; Samsun, Turkey,. doi: 10.1109/ubmk.2019.8907135.
10. Almehmadi A, Bourque M, El-Khatib K, editors. A tweet of the mind: Automated emotion detection for social media using brain wave pattern analysis. 2013 International Conference on Social Computing (SocialCom); 2013; Alexandria, VA, USA: IEEE. doi: 10.1109/SocialCom.2013.158.
11. Almehmadi A, El-Khatib K. On the Possibility of Insider Threat Prevention Using Intent-Based Access Control (IBAC). Ieee Syst J. 2017;11(2):373-84. doi: 10.1109/Jsyst.2015.2424677. PubMed PMID: WOS:000404985800003.
12. Alrajhi W, Alaloola D, Albarqawi A, editors. Smart home: Toward daily use of BCI-based systems. 2017 International Conference on Informatics, Health & Technology (ICIHT); 2017; Riyadh, Saudi Arabia: IEEE. doi: 10.1109/ICIHT.2017.7899002.

13. Alshbatat AIN, Vial PJ, Premaratne P, Tran LC. EEG-based Brain-computer Interface for Automating Home Appliances. Journal of Computers. 2014;9(9):2159-66. doi: 10.4304/jcp.9.9.2159-2166. PubMed PMID: WOS:000218231100022.
14. Amarasinghe K, Wijayasekara D, Manic M, editors. EEG based brain activity monitoring using Artificial Neural Networks. 2014 7th International Conference on Human System Interactions (HSI); 2014; Costa da Caparica, Portugal: IEEE. 10.1109/HSI.2014.6860449.
15. Amjad I, Toor H, Niazi IK, Afzal H, Jochumsen M, Shafique M, et al. Therapeutic effects of aerobic exercise on EEG parameters and higher cognitive functions in mild cognitive impairment patients. International Journal of Neuroscience. 2019;129(6):551-62. doi: 10.1080/00207454.2018.1551894. PubMed PMID: WOS:000462845700004.
16. Ancau D, Roman N-M, Ancau M, editors. Evaluating a Method of Offline Detection of P-3 Waves. 6th International Conference on Advancements of Medicine and Health Care through Technology, Meditech 2018; 2019; Cluj-Napoca, Romania. doi: 10.1007/978-981-13-6207-1_22.
17. Anupama H, Cauvery N, Lingaraju G, editors. Real-time EEG based object recognition system using Brain Computer Interface. 2014 International Conference on Contemporary Computing and Informatics (IC3I); 2014; Mysore, India: IEEE. doi: 10.1109/IC3I.2014.7019589.
18. Anwar SM, Saeed SMU, Majid M, editors. Classification of Expert-Novice Level of Mobile Game Players Using Electroencephalography. 2016 International Conference on Frontiers of Information Technology (FIT); 2016; Islamabad, Pakistan: IEEE. doi: 10.1109/FIT.2016.064.
19. Arfaras G, Athanasiou A, Niki P, Kyriaki RK, Kartsidis P, Astaras A, et al., editors. Visual versus kinesthetic motor imagery for BCI control of robotic arms (Mercury 2.0). 2017 IEEE 30th International Symposium on Computer-Based Medical Systems (CBMS); 2017; Thessaloniki, Greece: IEEE. doi: 10.1109/CBMS.2017.34.
20. Arias-Mora L, López-Ríos L, Céspedes-Villar Y, Velasquez-Martinez L, Alvarez-Meza A, Castellanos-Dominguez G, editors. Kernel-based relevant feature extraction to support motor imagery classification. 2015 20th Symposium on Signal Processing, Images and Computer Vision (STSIVA); 2015; Bogota, Colombia: IEEE. doi: 10.1109/STSIVA.2015.7330403.
21. Arnau-Gonzalez P, Katsigiannis S, Ramzan N, Tolson D, Arevalillo-Herrez M, editors. ES1D: A deep network for EEG-based subject identification. 2017 IEEE 17th International Conference on Bioinformatics and Bioengineering (BIBE); 2017; Washington, DC, USA: IEEE. doi: 10.1109/BIBE.2017.00-74.
22. Arora S, Chandel SS, Chandra S, editors. An efficient multi modal emotion recognition system: ISAMC. 2014 International Conference on the IMpact of E-Technology on US (IMPETUS); 2014; Bangalore, India: IEEE. 10.1109/IMPETUS.2014.6775870.
23. Arvaneh M, Umilta A, Robertson IH, editors. Filter bank common spatial patterns in mental workload estimation. 2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2015; Milan, Italy: IEEE. doi: 10.1109/EMBC.2015.7319455.
24. Aspinall P, Mavros P, Coyne R, Roe J. The urban brain: analysing outdoor physical activity with mobile EEG. British Journal of Sports Medicine. 2015;49(4):272-6. Epub 2013/03/08. doi: 10.1136/bjsports-2012-091877. PubMed PMID: 23467965.

25. Athanasiou A, Arfaras G, Xygonakis I, Kartsidis P, Pandria N, Kavazidi KR, et al., editors. Commercial BCI Control and functional brain networks in spinal cord injury: a proof-of-concept. 2017 IEEE 30th International Symposium on Computer-Based Medical Systems (CBMS); 2017; Thessaloniki, Greece: IEEE. doi: 10.1109/CBMS.2017.35.
26. Azevedo AS, Jorge J, Campos P. Combining EEG Data with Place and Plausibility Responses as an Approach to Measuring Presence in Outdoor Virtual Environments. Presence-Teleop Virt. 2015;23(4):354-68. doi: 10.1162/PRES_a_00205. PubMed PMID: WOS:000351287300003.
27. Baglietto Araquistain I, Garmendia X, Grana M, Asiain JdL, editors. Fusion of Inertial Motion Sensors and Electroencephalogram for Activity Detection. 8th International Work-Conference on the Interplay Between Natural and Artificial Computation (IWINAC); 2019. doi: 10.1007/978-3-030-19591-5_33.
28. Bellman C, Martin MV, editors. Use of Machine Learning for Detection of Unaware Facial Recognition Without Individual Training. 2017 16th IEEE International Conference on Machine Learning and Applications (ICMLA); 2017; Cancun, Mexico: IEEE. doi: 10.1109/ICMLA.2017.00-31.
29. Bellman C, Martin MV, MacDonald S, editors. On the Potential of Data Extraction by Detecting Unaware Facial Recognition with Brain-Computer Interfaces. 2018 IEEE International Conference on Cognitive Computing (ICCC); 2018 2-7 July 2018; San Francisco, CA, USA. doi: 10.1109/ICCC.2018.00022.
30. Benitez DS, Toscano S, Silva A, editors. On the use of the Emotiv EPOC neuroheadset as a low cost alternative for EEG signal acquisition. 2016 IEEE Colombian Conference on Communications and Computing (COLCOM); 2016; Cartagena, Colombia: IEEE. doi: 10.1109/ColComCon.2016.7516380.
31. Bernays R, Mone J, Yau P, Murcia M, Gonzalez-Sanchez J, Chavez-Echeagaray ME, et al., editors. Lost in the dark: emotion adaption. Adjunct proceedings of the 25th annual ACM symposium on User interface software and technology; 2012: ACM. doi: 10.1145/2380296.2380331.
32. Beyrouthy T, Al Kork SK, Korbane JA, Abdulmonem A, editors. EEG mind controlled smart prosthetic arm. IEEE International Conference on Emerging Technologies and Innovative Business Practices for the Transformation of Societies (EmergiTech); 2016; Balaclava, Mauritius: IEEE. doi: 10.1109/EmergiTech.2016.7737375.
33. Bhatti MH, Khan J, Khan MUG, Iqbal R, Aloqaily M, Jararweh Y, et al. Soft Computing-Based EEG Classification by Optimal Feature Selection and Neural Networks. IEEE Transactions on Industrial Informatics. 2019;15(10):5747-54. doi: 10.1109/TII.2019.2925624.
34. Bialas P, Milanowski P, editors. A high frequency steady-state visually evoked potential based brain computer interface using consumer-grade EEG headset. 2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2014; Chicago, IL, USA: IEEE. doi: 10.1109/EMBC.2014.6944857.
35. Bilalpur M, Kia SM, Chua T-S, Subramanian R, editors. Discovering gender differences in facial emotion recognition via implicit behavioral cues. 2017 Seventh International Conference on Affective Computing and Intelligent Interaction (ACII); 2017; San Antonio, TX, USA: IEEE. doi: 10.1109/ACII.2017.8273588.
36. Binias B, Myszor D, Niezabitowski M, Cyran KA, editors. Evaluation of alertness and mental fatigue among participants of simulated flight sessions. 2016

17th International Carpathian Control Conference (ICCC); 2016; Tatranska Lomnica, Slovakia: IEEE. doi: 10.1109/CarpathianCC.2016.7501070.

37. Bissoli AL, Sime MM, Bastos-Filho TF. Using sEMG, EOG and VOG to control an intelligent environment. IFAC-PapersOnLine. 2016;49(30):210-5.

38. Blaiech H, Neji M, Wali A, Alimi AM, editors. Emotion recognition by analysis of EEG signals. 2013 13th International Conference on Hybrid Intelligent Systems (HIS); 2013; Gammarth, Tunisia: IEEE. doi: 10.1109/HIS.2013.6920451.

39. Bodranghien FCAA, Mahe ML, Clement S, Manto MU. A Pilot Study on the Effects of Transcranial Direct Current Stimulation on Brain Rhythms and Entropy during Self-Paced Finger Movement using the Epoc Helmet. Frontiers in Human Neuroscience. 2017;11. doi: doi: 10.3389/fnhum.2017.00201. PubMed PMID: WOS:000401592200001.

40. Bonotis PA, Tsouros DC, Smyrlis PN, Tzallas AT, Giannakeas N, Glavas E, et al. Automated Assessment of Pain Intensity Based on EEG Signal Analysis. 2019 IEEE 19th International Conference on Bioinformatics and Bioengineering (BIBE). 2019:583-8. doi: 10.1109/bibe.2019.00111. PubMed PMID: INSPEC:19243626.

41. Borisov V, Syskov A, Kublanov V, editors. Functional State Assessment of an Athlete by Means of the Brain-Computer Interface Multimodal Metrics. World Congress on Medical Physics and Biomedical Engineering; 2018; Singapore. doi: 10.1007/978-981-10-9023-3_13.

42. Borisov V, Syskov A, Kublanov V, editors. Functional State Assessment of an Athlete by Means of the Brain-Computer Interface Multimodal Metrics. World Congress on Medical Physics and Biomedical Engineering 2018; 2019. doi: 10.1007/978-981-10-9023-3_13.

43. Borisov V, Syskov A, Tetervak V, Kublanov V, editors. Mobile brain-computer interface application for mental status evaluation. 2017 International Multi-Conference on Engineering, Computer and Information Sciences (SIBIRCON); 2017; Novosibirsk, Russia: IEEE. doi: 10.1109/SIBIRCON.2017.8109952.

44. Bousseta R, El Ouakouak I, Gharbi M, Regragui F. EEG Based Brain Computer Interface for Controlling a Robot Arm Movement Through Thought. IRBM. 2018;39(2):129-35. doi: http://dx.doi.org/10.1016/j.irbm.2018.02.001.

45. Bousseta R, Tayeb S, El Ouakouak I, Gharbi M, Regragui F, Himmi MM, editors. EEG efficient classification of imagined hand movement using RBF kernel SVM. 2016 11th International Conference on Intelligent Systems: Theories and Applications (SITA); 2016; Mohammedia, Morocco: IEEE. doi: 10.1109/SITA.2016.7772278.

46. Brennan C, McCullagh P, Lightbody G, Galway L, Feuser D, González JL, et al., editors. Accessing tele-services using a hybrid bci approach. International Work-Conference on Artificial Neural Networks; 2015; Palma de Mallorac, Spain: Springer.

47. Browarska N, Stach T, editors. System to Communicate Disabled People with Environment Using Brain-Computer Interfaces. 3rd International Scientific Conference on Brain-Computer Interfaces; 2018; Opole, Poland. 10.1007/978-3-319-75025-5_14.

48. Bustomi A, Wijaya S, Prawito, editors. Analyzing power spectral of electroencephalogram (EEG) signal to identify motoric arm movement using EMOTIV EPOC+. International Symposium on Current Progress in Mathematics and Sciences 2016 (ISCPMS 2016); 2017; Depok, Indonesia: AIP Publishing. https://doi.org/10.1063/1.4991175.

49. Caesarendra W, Ariyanto M, Lexon SU, Pasmanasari ED, Chang CR, Setiawan JD, editors. EEG based pattern recognition method for classification of

different mental tasking: Preliminary study for stroke survivors in Indonesia. Automation, Cognitive Science, Optics, Micro Electro-Mechanical System, and Information Technology (ICACOMIT), 2015 International Conference on; 2015; Bandung, Indonesia: IEEE. doi: 10.1109/ICACOMIT.2015.7440193.

50. Camelo GA, Menezes ML, Sant'Anna AP, Vicari RM, Pereira CE, editors. Control of Smart Environments Using Brain Computer Interface Based on Genetic Algorithm. Asian Conference on Intelligent Information and Database Systems; 2016; Da Nang, Vietnam: Springer.

51. Carabalona R, Grossi F, Tessadri A, Castiglioni P, Caracciolo A, de Munari I. Light on! Real world evaluation of a P300-based brain-computer interface (BCI) for environment control in a smart home. Ergonomics. 2012;55(5):552-63. Epub 2012/03/30. doi: 10.1080/00140139.2012.661083. PubMed PMID: 22455346.

52. Carrillo I, Meza-Kubo V, Morán AL, Galindo G, García-Canseco E, editors. Processing EEG signals towards the construction of a user experience assessment method. First International Conference Ambient Intelligence for Health; 2015; Puerto Varas, Chile: Springer.

53. Cernea D, Olech P-S, Ebert A, Kerren AJK-KI. Measuring subjectivity. KI-Künstliche Intelligenz. 2012;26(2):177-82.

54. Chamanzar A, Malekmohammadi A, Bahrani M, Shabany M, editors. Accurate single-trial detection of movement intention made possible using adaptive wavelet transform. 2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2015; Milan, Italy: IEEE. doi: 10.1109/EMBC.2015.7318757.

55. Charisis V, Hadjidimitriou S, Hadjileontiadis L, Uğurca D, Yilmaz E, editors. EmoActivity-An EEG-based gamified emotion HCI for augmented artistic expression: The i-Treasures paradigm. International Conference on Universal Access in Human-Computer Interaction; 2015; Los Angeles, CA, USA: Springer.

56. Chew O, Robinson N, Gopi S, editors. Covert Visuospatial Attention (VSA) for EEG-Based Asynchronous Control of Robot. 2018 IEEE International Conference on Systems, Man, and Cybernetics (SMC); 2018 7-10 Oct. 2018; Miyazaki, Japan. 10.1109/SMC.2018.00100.

57. Chiuzbaian A, Jakobsen J, Puthusserypady S, editors. Mind Controlled Drone: An Innovative Multiclass SSVEP based Brain Computer Interface. 2019 7th International Winter Conference on Brain-Computer Interface (BCI); 2019 18-20 Feb. 2019; Gangwon, Korea. 10.1109/IWW-BCI.2019.8737327.

58. Choo A, May A, editors. Virtual mindfulness meditation: Virtual reality and electroencephalography for health gamification. 2014 IEEE Games Media Entertainment (GEM); 2014; Toronto, ON, Canada: IEEE. doi: 10.1109/GEM.2014.7048076.

59. Chowdhury P, Shakim SK, Karim MR, Rhaman MK, editors. Cognitive efficiency in robot control by Emotiv EPOC. 2014 International Conference on Informatics, Electronics & Vision (ICIEV); 2014; Dhaka, Bangladesh: IEEE. doi: 10.1109/ICIEV.2014.6850775.

60. Chumerin N, Manyakov NV, van Vliet M, Robben A, Combaz A, Van Hulle MM. Steady-State Visual Evoked Potential-Based Computer Gaming on a Consumer-Grade EEG Device. Ieee T Comp Intel Ai. 2013;5(2):100-10. doi: 10.1109/Tciaig.2012.2225623. PubMed PMID: WOS:000320582000003.

61. Chynal P, Sobecki J, Rymarz M, Kilijanska B, editors. Shopping behaviour analysis using eyetracking and EEG. 9th International Conference on Human System Interactions; 2016; Portsmouth, UK: IEEE. doi: 10.1109/HSI.2016.7529674.

62. Clemente M, Rodriguez A, Rey B, Alcaniz M. Measuring presence during the navigation in a virtual environment using EEG. Annual Review of Cybertherapy and Telemedicine. 2013;191:136.
63. Clemente M, Rodriguez A, Rey B, Alcaniz M. Assessment of the influence of navigation control and screen size on the sense of presence in virtual reality using EEG. Expert Systems with Applications. 2014;41(4):1584-92. doi: 10.1016/j.eswa.2013.08.055. PubMed PMID: WOS:000329955900006.
64. Comaniciu AN, L., editor Enabling Communication for Locked-in Syndrome Patients using Deep Learning and an Emoji-based Brain Computer Interface. 2018 IEEE Biomedical Circuits and Systems Conference (BioCAS); 2018 17-19 Oct. 2018. 10.1109/BIOCAS.2018.8584821.
65. Das A, Leong TT, Suresh S, Sundararajan N, editors. Meta-cognitive interval type-2 fuzzy controller for quadcopter flight control-an EEG based approach. 2016 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE); 2016; Vancouver, BC, Canada: IEEE. doi: 10.1109/FUZZ-IEEE.2016.7738008.
66. Dhanapala W, Bakmeedeniya A, Amarakeerthi S, Jayaweera P, Sumathipala S, editors. A brain signal-based credibility assessment approach. 2017 Joint 17th World Congress of International Fuzzy Systems Association and 9th International Conference on Soft Computing and Intelligent Systems (IFSA-SCIS); 2017; Otsu, Japan: IEEE. doi: 10.1109/IFSA-SCIS.2017.8305563.
67. Dharmasena S, Lalitharathne K, Dissanayake K, Sampath A, Pasqual A, editors. Online classification of imagined hand movement using a consumer grade EEG device. 2013 8th IEEE International Conference on Industrial and Information Systems (ICIIS); 2013; Peradeniya, Sri Lanka: IEEE. doi: 10.1109/ICIInfS.2013.6732041.
68. Dimitrov GP, Aleksiev KV, Garvanova M, Dimitrova I, Kovatcheva E, editors. Identification of EEG Brain Waves Obtained by Emotive Device. 2019 9th International Conference on Advanced Computer Information Technologies (ACIT); 2019 5-7 June 2019. 10.1109/ACITT.2019.8779861.
69. Dimitrov GP, Kostadinova IS, Panayotova G, Petrova P, Aleksiev KV, Oleksii B, et al., editors. Using Mixed Linear Programming to Classify BCI Signals Submission. 2019 IEEE 60th International Scientific Conference on Power and Electrical Engineering of Riga Technical University; 2019. 10.1109/rtucon48111.2019.8982368.
70. Dkhil MB, Neji M, Wali A, Alimi AM, editors. A new approach for a safe car assistance system. 2015 4th International Conference on Advanced Logistics and Transport (ICALT); 2015; Valenciennes, France: IEEE. doi: 10.1109/ICAdLT.2015.7136627.
71. Dutta S, Hazra S, Nandy A, editors. Human Cognitive State Classification Through Ambulatory EEG Signal Analysis. Artificial Intelligence and Soft Computing, ICAISC 2019; 2019; Zakopane, Poland. doi: 10.1007/978-3-030-20915-5_16.
72. Elsawy AS, Eldawlatly S, Taher M, Aly GM, editors. Performance analysis of a Principal Component Analysis ensemble classifier for Emotiv headset P300 spellers. 2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2014; Chicago, IL, USA: IEEE. doi: 10.1109/EMBC.2014.6944755.
73. Elsawy AS, Eldawlatly S, Taher M, Aly GM, editors. Enhancement of mobile development of brain-computer platforms. 2015 IEEE International Conference on Electronics, Circuits, and Systems (ICECS); 2015; Cairo, Egypt: IEEE. doi: 10.1109/ICECS.2015.7440355.

74. Espiritu NMD, Chen SAC, Blasa TAC, Munsayac FET, Arenos RP, Baldovino RG, et al., editors. BCI-controlled Smart Wheelchair for Amyotrophic Lateral Sclerosis Patients. 2019 7th International Conference on Robot Intelligence Technology and Applications (RiTA); 2019 1-3 Nov. 2019; Daejeon, Korea. doi: 10.1109/RITAPP.2019.8932748.
75. Fakhruzzaman MN, Riksakomara E, Suryotrisongko H. EEG Wave Identification in Human Brain with Emotiv EPOC for Motor Imagery. Procedia Computer Science. 2015;72:269-76. doi: 10.1016/j.procs.2015.12.140. PubMed PMID: WOS:000373775700033.
76. Falkowska J, Sobecki J, Pietrzak M, editors. Eye tracking usability testing enhanced with EEG analysis. International Conference of Design, User Experience, and Usability; 2016; Toronto, Canada: Springer. doi: 10.1007/978-3-319-40409-7.
77. Fatima M, Amjad N, Shafique M, editors. Analysis of Electroencephalographic Signal Acquisition and Processing for Use in Robotic Arm Movement. 2018 IEEE-EMBS Conference on Biomedical Engineering and Sciences (IECBES); 2018; Sarawak, Malaysia: IEEE. doi: 10.1109/IECBES.2018.8626663.
78. Fattouh A, Albidewi I, Baterfi B, editors. EEG-based emotion recognition of Quran listeners. 3rd International Conference on Computing for Sustainable Global Development (INDIACom); 2016; New Delhi, India: IEEE. Retrieved from https://ieeexplore.ieee.org/document/7724483.
79. Fernandez X, García R, Ferreira E, Menendez J, editors. Classification of Basic Human Emotions from Electroencephalography Data. Iberoamerican Congress on Pattern Recognition; 2015; Montevideo, Uraguay: Springer.
80. Fernandez-Fraga SM, Aceves-Fernandez MA, Pedraza-Ortega JC. EEG data collection using visual evoked, steady state visual evoked and motor image task, designed to brain computer interfaces (BCI) development. Data in Brief. 2019;25. doi: 10.1016/j.dib.2019.103871. PubMed PMID: WOS:000495104500006.
81. Friedman D, Shapira S, Jacobson L, Gruberger M, editors. A data-driven validation of frontal EEG asymmetry using a consumer device. 2015 International Conference on Affective Computing and Intelligent Interaction (ACII); 2015; Xi'an, China: IEEE. doi: 10.1109/ACII.2015.7344686.
82. Gaber A, Ghazali M, Iahad NA, Wadha B. USABILITY TESTING ON MOTIONMOUSE: A PROTOTYPE TO CONTROL ANDROID TABLET USING EMOTIV EPOC. Malaysian Journal of Computer Science. 2019:73-86. doi: 10.22452/mjcs.sp2019no3.5. PubMed PMID: WOS:000505031800005.
83. George K, Iniguez A, Donze H, editors. Sensing and decoding of visual stimuli using commercial Brain Computer Interface technology. 2014 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) Proceedings; 2014; Montevideo, Uruguay: IEEE. doi: 10.1109/I2MTC.2014.6860913.
84. George K, Iniguez A, Donze H, editors. Automated sensing, interpretation and conversion of facial and mental expressions into text acronyms using brain-computer interface technology. 2014 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) Proceedings; 2014; Montevideo, Uruguay: IEEE. doi: 10.1109/I2MTC.2014.6860944.
85. George K, Iniguez A, Donze H, Kizhakkumthala S, editors. Design, implementation and evaluation of a brain-computer interface controlled mechanical arm for rehabilitation. 2014 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) Proceedings; 2014; Montevideo, Uruguay: IEEE. doi: 10.1109/I2MTC.2014.6860961.

86. Ghasemy H, Momtazpour M, Sardouie SH, editors. Detection of Sustained Auditory Attention in Students with Visual Impairment. 2019 27th Iranian Conference on Electrical Engineering (ICEE); 2019 30 April-2 May 2019; Yazd, Iran. doi: 10.1109/IranianCEE.2019.8786565.
87. Gomez-Lopez P, Montero F, Lopez MT, editors. Empowering UX of Elderly People with Parkinson's Disease via BCI Touch. 8th International Work-Conference on the Interplay Between Natural and Artificial Computation (IWINAC); 2019; Almeria, Spain. doi: 10.1007/978-3-030-19591-5_17.
88. Gull MA, Elahi H, Marwae M, Waqar S, editors. A New Approach to Classification of Upper Limb and Wrist Movements Using Eeg Signals. 13th IASTED International Conference on Biomedical Engineering; 2017; Innsbruck, Austria. 10.2316/P.2017.852-049.
89. Haddad RR, Bastos-Filho TF, Tello RJMG, editors. A Novel Digital Speller Based on a Hybrid Brain Computer Interface (hBCI) SSVEP with Eye Tracking. XXVI Brazilian Congress on Biomedical Engineering; 2019; Armacao de Buzio, Brazil. doi: 10.1007/978-981-13-2119-1_92.
90. Hanh NTH, Tuan HV, editors. Identification Of Some Brain Waves Signal And Applications. 12th IEEE Conference on Industrial Electronics and Applications (ICIEA); 2017; Siem Reap, Cambodia. doi: 10.1109/ICIEA.2017.8283061.
91. Hazrati MK, Hofmann UG, editors. Avatar navigation in Second Life using brain signals. 2013 IEEE 8th International Symposium on Intelligent Signal Processing (WISP); 2013; Funchal, Portugal: IEEE. doi: 10.1109/WISP.2013.6657473.
92. Heger D, Putze F, Schultz T, editors. Online recognition of facial actions for natural EEG-based BCI applications. Fourth International Conference on Affective Computing and Intelligent Interaction; 2011; Memphis, TN, USA: Springer. Retrieved from: https://link.springer.com/chapter/10.1007/978-3-642-24571-8_56.
93. Hjorungdal R-M, Sanfilippo F, Osen O, Rutle A, Bye RT, editors. A game-based learning framework for controlling brain-actuated wheelchairs. 30th European Conference on Modelling and Simulation; 2016; Regensburg, Germany,: ECMS European Council for Modelling and Simulation. Retrieved from: https://ntnuopen.ntnu.no/ntnu-xmlui/bitstream/handle/11250/2498925/ECMS2016Wheelchair.pdf?sequence=1.
94. Holewa K, Nawrocka A, editors. Emotiv EPOC neuroheadset in brain-computer interface. 2014 15th International Carpathian Control Conference (ICCC); 2014; Velke Karlovice, Czech Republic: IEEE. doi: 10.1109/CarpathianCC.2014.6843587.
95. Hooda N, Kumar N. Cognitive Imagery Classification of EEG Signals using CSP-based Feature Selection Method. IETE Technical Review. 2019. doi: 10.1080/02564602.2019.1620138. PubMed PMID: WOS:000472308200001.
96. Hooda N, Kumar N, editors. Multi-task Classification scheme for Cognitive Imagery EEG Acquired using a Commercial Wireless Headset. 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA); 2019; Coimbatore, India. doi: 10.1109/ICECA.2019.8822097.
97. Hou JY, Li YL, Liu HM, Wang SJ, editors. Improving the P300-based Brain-computer Interface with Transfer Learning. 2017 8th International IEEE/EMBS Conference on Neural Engineering (NER); 2017; Shanghai, China. doi: 10.1109/NER.2017.8008395.
98. Hsieh C-H, Chu H-P, Huang Y-H, editors. An HMM-based eye movement detection system using EEG brain-computer interface. 2014 IEEE International

Symposium on Circuits and Systems (ISCAS); 2014; Melbourne VIC, Australia: IEEE. doi: 10.1109/ISCAS.2014.6865222.
99. Hsieh C-H, Huang Y-H, editors. Low-complexity EEG-based eye movement classification using extended moving difference filter and pulse width demodulation. 2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2015; Milan, Italy: IEEE. doi: 10.1109/EMBC.2015.7320062.
100. Huang CK, Wang ZW, Chen GW, Yang CY, editors. Development of a Smart Wheelchair with Dual Functions: Real-time Control and Automated Guide. 2nd International Conference on Control and Robotics Engineering; 2017; Bangkok, Thailand. doi: 10.1109/ICCRE.2017.7935045.
101. Huang Z, Javaid A, Devabhaktuni VK, Li Y, Yang X. Development of Cognitive Training Program With EEG Headset. IEEE Access. 2019;7:126191-200. doi: 10.1109/ACCESS.2019.2937866.
102. Hurtado-Rincon J, Rojas-Jaramillo S, Ricardo-Cespedes Y, Alvarez-Meza AM, Castellanos-Dominguez G, editors. Motor imagery classification using feature relevance analysis: An Emotiv-based BCI system. 2014 XIX Symposium on Image, Signal Processing and Artificial Vision; 2014; Armenia, Colombia: IEEE. doi: 10.1109/STSIVA.2014.7010165.
103. Hwang T, Kim M, Hwangbo M, Oh E, editors. Optimal set of EEG electrodes for real-time cognitive workload monitoring. 18th IEEE International Symposium on Consumer Electronics; 2014; JeJu Island, South Korea: IEEE. doi: 10.1109/ISCE.2014.6884536.
104. Hwang T, Kim M, Hwangbo M, Oh E, editors. Comparative analysis of cognitive tasks for modeling mental workload with electroencephalogram. 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society; 2014; Chicago, IL, USA: IEEE. doi: 10.1109/EMBC.2014.6944170.
105. Jacoby JD, Tory M, Tanaka J, editors. Evoked response potential training on a consumer EEG headset. 2015 IEEE Pacific Rim Conference on Communications, Computers and Signal Processing (PACRIM); 2015; Victoria, BC, Canada: IEEE. doi: 10.1109/PACRIM.2015.7334885.
106. Jadav GM, Batistic L, Vlahinic S, Vrankic M, editors. Brain Computer Interface Communicator : A Response to Auditory Stimuli Experiment. 2017 40th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO); 2017; Opatija, Croatia. doi: 10.23919/MIPRO.2017.7973461.
107. Jadhav N, Manthalkar R, Joshi Y. Effect of meditation on emotional response: An EEG-based study. Biomedical Signal Processing and Control. 2017;34:101-13. doi: 10.1016/j.bspc.2017.01.008. PubMed PMID: WOS:000397549100011.
108. Jadhav N, Manthalkar R, Joshi Y, editors. Assessing Effect of meditation on Cognitive workload using EEG signals. 2017 Second International Workshop on Pattern Recognition; 2017; Singapore. doi: 10.1117/12.2280312.
109. Johar KL, C. Y.; hanapiah, F. A.; Jaffar, A.; Idris, F.; Kasim, M. A. A. Towards the development of a electro-encephalography based neuroprosthetic terminal device. Jurnal Teknologi. 2015;76(4).
110. Jumphoo T, Uthansakul M, Uthansakul P. Brainwave classification without the help of limb movement and any stimulus for character-writing application. Cognitive Systems Research. 2019;58:375-86. doi: http://dx.doi.org/10.1016/j.cogsys.2019.09.002.

111. Jun G, Smitha KG, editors. EEG based stress level identification. 2016 IEEE International Conference on Systems, Man, and Cybernetics (SMC); 2016; Budapest, Hungary: IEEE. doi: 10.1109/SMC.2016.7844738.
112. Kaewsutas M, Sarikaphuti A, Nararatwanchai T, Sittiprapaporn P, Patchanee P. Electroencephalographic study of microalgae DHA omega-3 egg consumption on cognitive function. Journal of Functional Foods. 2017;29:46-52. doi: 10.1016/j.jff.2016.12.004. PubMed PMID: WOS:000393847800006.
113. Kawala-Janik A, Podpora M, Gardecki A, Czuczwara W, Baranowski J, Bauer W, editors. Game controller based on biomedical signals. 2015 20th International Conference on Methods and Models in Automation and Robotics (MMAR); 2015; Miedzyzdroje, Poland: IEEE. doi: 10.1109/MMAR.2015.7284003.
114. Kaysa WA, Widyotriatmo A, editors. Design of Brain-computer interface platform for semi real-time commanding electrical wheelchair simulator movement. 2013 3rd International Conference on Instrumentation Control and Automation (ICA); 2013; Ungasan, Indonesia: IEEE. doi: 10.1109/ICA.2013.6734043.
115. Kha HH, editor Real-time brainwave-controlled interface using P300 component in EEG signal processing. 2016 IEEE RIVF International Conference on Computing & Communication Technologies, Research, Innovation, and Vision for the Future (RIVF); 2016; Hanoi, Vietnam: IEEE. doi: 10.1109/RIVF.2016.7800300.
116. Kha HH, Kha VA, Hung DQ, editors. Brainwave-controlled applications with the Emotiv EPOC using support vector machine. 2016 3rd International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE); 2016; Semarang, Indonesia: IEEE. doi: 10.1109/ICITACEE.2016.7892420.
117. Khai LQ, Anh DTN, Bao TH, Linh HQ, editors. Application of portable electroencephalograph device in controlling and identifying emotion. 2016 International Conference on Biomedical Engineering (BME-HUST); 2016; Hanoi, Vietnam: IEEE. doi: 10.1109/BME-HUST.2016.7782097.
118. Khalafallah A, Ibrahim A, Shehab B, Raslan H, Eltobgy O, Elbaroudy S, editors. A Pragmatic Authentication System Using Electroencephalography Signals. 2018 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP); 2018; Calgary, AB, Canada: IEEE. doi: 10.1109/ICASSP.2018.8461659.
119. Khan J, Bhatti MH, Khan UG, Iqbal R. Multiclass EEG motor-imagery classification with sub-band common spatial patterns. Eurasip Journal on Wireless Communications and Networking. 2019. doi: 10.1186/s13638-019-1497-y. PubMed PMID: WOS:000474211200001.
120. Khan QA, Hassan A, Rehman S, Riaz F, editors. Detection and Classification of Pilots Cognitive State using EEG. 2017 2nd IEEE International Conference on Computational Intelligence and Applications (ICCIA); 2017; Beijing, China. doi: 10.1109/CIAPP.2017.8167249.
121. Khan ZH, Hussain N, Tiwana MI. Classification of EEG signals for wrist and grip movements using echo state network. Biomedical Research. 2017;28(3):1095-102. doi: Retrieved from: https://www.biomedres.info/biomedical-research/classification-of-eeg-signals-for-wrist-and-grip-movements-using-echo-state-network.html. PubMed PMID: WOS:000396822900020.
122. Khelifa MMB, Lamti HA, Grillasca J, editors. A gaze/SSVEP based Wheelchair Command. 2018 IEEE/ACS 15th International Conference on Computer Systems and Applications (AICCSA); 2018; Aqaba, Jordan: IEEE. doi: 10.1109/AICCSA.2018.8612850.

123. Khushaba RN, Greenacre L, Kodagoda S, Louviere J, Burke S, Dissanayake G. Choice modeling and the brain: A study on the Electroencephalogram (EEG) of preferences. Expert Systems with Applications. 2012;39(16):12378-88. doi: 10.1016/j.eswa.2012.04.084. PubMed PMID: WOS:000307796300010.

124. Khushaba RN, Kodagoda S, Dissanayake G, Greenacre L, Burke S, Louviere J, editors. A neuroscientific approach to choice modeling: Electroencephalogram (EEG) and user preferences. The 2012 International Joint Conference on Neural Networks (IJCNN); 2012; Brisbane, QLD, Australia: IEEE. doi: 10.1109/IJCNN.2012.6252561.

125. Kimmatkar NV, Babu BV, editors. Initial analysis of brain EEG signal for mental state detection of human being. 2017 International Conference on Trends in Electronics and Informatics (ICEI); 2017; Tirunelveli, India: IEEE. doi: 10.1109/ICOEI.2017.8300934.

126. Kline A, Desai J, editors. SIMULINK® based robotic hand control using Emotiv™ EEG headset. 2014 40th Annual Northeast Bioengineering Conference (NEBEC); 2014; Boston, MA, USA: IEEE. doi: 10.1109/NEBEC.2014.6972839.

127. Koike-Akino T, Mahajan R, Marks TK, Wang Y, Watanabe S, Tuzel O, et al., editors. High-accuracy user identification using EEG biometrics. 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2016; Orlando, FL, USA: IEEE. doi: 10.1109/EMBC.2016.7590835.

128. Koles M, Szegletes L, Forstner B, editors. Towards a physiology based difficulty control system for serious games. 2015 6th IEEE International Conference on Cognitive Infocommunications (CogInfoCom); 2015; Gyor, Hungary: IEEE. doi: 10.1109/CogInfoCom.2015.7390612.

129. Kosinski J, Szklanny K, Wieczorkowska A, Wichrowski M, editors. An Analysis of Game-Related Emotions Using EMOTIV EPOC. Proceedings of the 2018 Federated Conference on Computer Science and Information Systems; 2018. 10.15439/2018f296.

130. Kotowski K, Stapor K, Leski J. Improved robust weighted averaging for event-related potentials in EEG. Biocybernetics and Biomedical Engineering. 2019;39(4):1036-46. doi: 10.1016/j.bbe.2019.09.002. PubMed PMID: WOS:000501571700007.

131. Kubacki A, Jakubowski A, Rybarczyk D, Owczarek P, editors. Controlling the direction of rotation of the motor using brain waves via Ethernet POWERLINK protocol. Challenges in Automation, Robotics and Measurement Techniques; 2016; Warsaw, Poland: Springer. doi: 10.1007/978-3-319-29357-8.

132. Kubacki A, Jakubowski A, Sawicki Ł, editors. Detection of artefacts from the motion of the eyelids created during EEG research using artificial neural network. Challenges in Automation, Robotics and Measurement Techniques; 2016; Warsaw, Poland: Springer. doi: 10.1007/978-3-319-29357-8.

133. Kubacki A, Sawicki L, Owczarek P, editors. Detection of facial gestures artefacts created during an EEG research using artificial neural networks. 2016 21st International Conference on Methods and Models in Automation and Robotics (MMAR); 2016; Miedzyzdroje, Poland: IEEE. doi: 10.1109/MMAR.2016.7575236.

134. Kucukyildiz G, Ocak H, Karakaya S, Sayli O. Design and Implementation of a Multi Sensor Based Brain Computer Interface for a Robotic Wheelchair. J Intell Robot Syst. 2017;87(2):247-63. doi: 10.1007/s10846-017-0477-x. PubMed PMID: WOS:000404671900004.

135. Kuremoto T, Baba Y, Obayashi M, Mabu S, Kobayashi K, editors. To extraction the feature of EEG signals for mental task recognition. 2015 54th Annual Conference of the Society of Instrument and Control Engineers of Japan (SICE); 2015; Hangzhou, China: IEEE. doi: 10.1109/SICE.2015.7285468.
136. Lamti HA, Khelifa MMB, Alimi AM, Gorce P, editors. Influence of mental fatigue on P300 and SSVEP during virtual wheelchair navigation. 2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society; 2014; Chicago, IL, USA: IEEE. doi: 10.1109/EMBC.2014.6943825.
137. Lange G, Low CY, Johar K, Hanapiah FA, Kamaruzaman F. Classification of Electroencephalogram Data from Hand Grasp and Release Movements for BCI Controlled Prosthesis. Procedia Technology. 2016;26:374-81. doi: doi: 10.1016/j.protcy.2016.08.048.
138. Li BR, Wang Y, Wang KS. A novel method for the evaluation of fashion product design based on data mining. Adv Manuf. 2017;5(4):370-6. doi: 10.1007/s40436-017-0201-x. PubMed PMID: WOS:000417945200007.
139. Li M, Zhang Y, Zhang H, Hu HS. An EEG based control system for intelligent wheelchair. Applied Mechanics and Materials. 2013;300:1540-5. doi: https://doi.org/10.4028/www.scientific.net/amm.300-301.1540.
140. Li YT, Zhou G, Graham D, Holtzhauer A. Towards an EEG-based brain-computer interface for online robot control. Multimedia Tools and Applications. 2016;75(13):7999-8017. doi: 10.1007/s11042-015-2717-z. PubMed PMID: WOS:000379924600026.
141. Liarokapis F, Debattista K, Vourvopoulos A, Petridis P, Ene A. Comparing interaction techniques for serious games through brain-computer interfaces: A user perception evaluation study. Entertainment Computing. 2014;5(4):391-9. doi: 10.1016/j.entcom.2014.10.004. PubMed PMID: WOS:000214855100022.
142. Liarokapis F, Vourvopoulos A, Ene A, editors. Examining user experiences through a multimodal BCI puzzle game. 2015 19th International Conference on Information Visualisation; 2015; Barcelona, Spain: IEEE. doi: 10.1109/iV.2015.87.
143. Lievesley R, Wozencroft M, Ewins D. The Emotiv EPOC neuroheadset: an inexpensive method of controlling assistive technologies using facial expressions and thoughts? Journal of Assistive Technologies. 2011;5(2):67-82. doi: doi.org/10.1108/17549451111149278.
144. Lim WL, Sourina O, Liu Y, Wang L, editors. EEG-based mental workload recognition related to multitasking. 2015 10th International Conference on Information, Communications and Signal Processing (ICICS); 2015; Singapore, Singapore: IEEE. doi: 10.1109/ICICS.2015.7459834.
145. Lin JS, Jiang ZY. An EEG-Based BCI System to Facial Action Recognition. Wireless Pers Commun. 2017;94(3):1579-93. doi: 10.1007/s11277-016-3700-3. PubMed PMID: WOS:000401758400070.
146. Lin YP, Wang Y, Jung TP. Assessing the feasibility of online SSVEP decoding in human walking using a consumer EEG headset. Journal of Neuroengineering and Rehabilitation. 2014;11:119. Epub 2014/08/12. doi: 10.1186/1743-0003-11-119. PubMed PMID: 25108604; PubMed Central PMCID: PMCPMC4245767.
147. Liu S, Xi N, Jia Y, editors. On-line operator skill assessment for telerobot operation using electroencephalo-graph (eeg). 2012 IEEE International Conference on Robotics and Biomimetics (ROBIO); 2012; Guangzhou, China: IEEE. doi: 10.1109/ROBIO.2012.6491195.

148. Liu Y, Sourina O, editors. EEG databases for emotion recognition. 2013 International Conference on Cyberworlds; 2013; Yokohama, Japan: IEEE. doi: 10.1109/CW.2013.52.
149. Liu Y, Sourina O, editors. EEG-based subject-dependent emotion recognition algorithm using fractal dimension. 2014 IEEE International Conference on Systems, Man, and Cybernetics (SMC); 2014; San Diego, CA, USA: IEEE. doi: 10.1109/SMC.2014.6974415.
150. Liu Y, Sourina O, Shah E, Chua J, Ivanov K. EEG-based monitoring of the focused attention related to athletic performance in shooters. International Journal of Psychophysiology. 2018;131(Supplement):S55. doi: http://dx.doi.org/10.1016/j.ijpsycho.2018.07.161.
151. Lu Y, Hu Y, Liu R, Wang H, Asama H, Duan F, editors. The design of simulation vehicle system controlled by multichannel EEG based on imaginary movements. 2016 35th Chinese Control Conference (CCC); 2016; Chengdu, China: IEEE. doi: 10.1109/ChiCC.2016.7554127.
152. Ma W, Tran D, Le T, Lin H, Zhou S-M, editors. Using EEG artifacts for BCI applications. 2014 International Joint Conference on Neural Networks (IJCNN); 2014; Beijing, China. doi: 10.1109/IJCNN.2014.6889496.
153. Magee R, Givigi S, editors. A genetic algorithm for single-trial P300 detection with a low-cost EEG headset. 2015 Annual IEEE Systems Conference (SysCon) Proceedings; 2015; Vancouver, BC, Canada: IEEE. doi: 10.1109/SYSCON.2015.7116757.
154. Mahajan R, Bansal D. Real Time EEG Based Cognitive Brain Computer Interface for Control Applications via Arduino Interfacing. Procedia Computer Science. 2017;115:812-20. doi: doi: 10.1016/j.procs.2017.09.158. PubMed PMID: WOS:000426436900099.
155. Malik AN, Iqbal J, Tiwana MI, editors. EEG signals classification and determination of optimal feature-classifier combination for predicting the movement intent of lower limb. 2016 2nd International Conference on Robotics and Artificial Intelligence (ICRAI); 2016; Rawalpindi, Pakistan: IEEE. doi: 10.1109/ICRAI.2016.7791226.
156. Martisius I, Damasevicius R. A prototype SSVEP based real time BCI gaming system. Computational Intelligence and Neuroscience. 2016;2016:18. doi: http://dx.doi.org/10.1155/2016/3861425.
157. McMahan T, Parberry I, Parsons TD. Evaluating player task engagement and arousal using electroencephalography. Procedia Manuf. 2015;3:2303-10. doi: https://doi.org/10.1016/j.promfg.2015.07.376. PubMed PMID: WOS:000383740302058.
158. McMahan T, Parberry I, Parsons TD. Modality specific assessment of video game player's experience using the Emotiv. Entertainment Computing. 2015;7:1-6. doi: https://doi.org/10.1016/j.entcom.2015.03.001.
159. Meattini R, Scarcia U, Melchiorri C, Belpaeme T, editors. Gestural art: A Steady State Visual Evoked Potential (SSVEP) based Brain Computer Interface to express intentions through a robotic hand. The 23rd IEEE International Symposium on Robot and Human Interactive Communication; 2014; Edinburgh, UK: IEEE. doi: 10.1109/ROMAN.2014.6926255.
160. Mehmood RM, Lee HJ, editors. Toward an analysis of emotion regulation in children using late positive potential. 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2016; Orlando, FL, USA: IEEE. 10.1109/EMBC.2016.7590694.

161. Mendoza-Palechor F, Menezes ML, Sant'Anna A, Ortiz-Barrios M, Samara A, Galway L. Affective recognition from EEG signals: an integrated data-mining approach. Journal of Ambient Intelligence and Humanized Computing. 2019;10(10):3955-74. doi: 10.1007/s12652-018-1065-z. PubMed PMID: WOS:000487047400018.
162. Mheich A, Guilloton J, Houmani N, editors. Monitoring visual sustained attention with a low-cost EEG headset. 2017 Fourth International Conference on Advances in Biomedical Engineering (ICABME); 2017; Beirut, Lebanon: IEEE. doi: 10.1109/ICABME.2017.8167572.
163. Mijani AM, Shamsollahi MB, Hassani MS, Jalilpour S, editors. Comparison between Single, Dual and Triple Rapid Serial Visual Presentation Paradigms for P300 Speller. 2018 IEEE International Conference on Bioinformatics and Biomedicine (BIBM); 2018; Madrid, Spain: IEEE. doi: 10.1109/BIBM.2018.8621505.
164. Moldovan A-N, Ghergulescu I, Weibelzahl S, Muntean CH, editors. User-centered EEG-based multimedia quality assessment. 2013 IEEE International Symposium on Broadband Multimedia Systems and Broadcasting (BMSB); 2013; London, UK: IEEE. doi: 10.1109/BMSB.2013.6621743.
165. Moro R, Berger P, Bielikova M, editors. Towards Adaptive Brain-Computer Interfaces: Improving Accuracy of Detection of Event-Related Potentials. 2017 12th International Workshop on Semantic and Social Media Adaptation and Personalization (SMAP); 2017; Bratislava, Slovakia. doi: 10.1109/SMAP.2017.8022664.
166. Mouli S, Palaniappan R, editors. Hybrid BCI Utilising SSVEP and P300 Event Markers for Reliable and Improved Classification Using LED Stimuli. 2017 IEEE Symposium on Computer Applications & Industrial Electronics (ISCAIE); 2017; Langkawi, Malaysia. doi: 10.1109/ISCAIE.2017.8074963.
167. Mulla F, Eya E, Ibrahim E, Alhaddad A, Qahwaji R, Abd-Alhameed R, editors. Neurological Assessment of Music Therapy on the Brain using Emotiv Epoc. 2017 Internet Technologies and Applications (ITA); 2017; Wrexham, UK. doi: 10.1109/ITECHA.2017.8101950.
168. Murugappan M, Murugappan S, Gerard C, editors. Wireless EEG signals based neuromarketing system using Fast Fourier Transform (FFT). 2014 IEEE 10th International Colloquium on Signal Processing and its Applications; 2014; Kuala Lumpur, Malaysia: IEEE. doi: 10.1109/CSPA.2014.6805714.
169. Mustafa I, Mustafa I, editors. Smart thoughts: BCI based system implementation to detect motor imagery movements. 2018 15th International Bhurban Conference on Applied Sciences and Technology (IBCAST); 2018; Islamabad, Pakistan: IEEE. doi: 10.1109/IBCAST.2018.8312250.
170. Mutasim AK, Bashar MR, Tipu RS, Islam MK, Amin MA, Ieee, editors. Effect of Artefact Removal Techniques on EEG Signals for Video Category Classification. 2018 24th International Conference on Pattern Recognition (ICPR); 2018; Beijing, China. doi: 10.1109/ICPR.2018.8545416.
171. Nakanishi I, Hattori M, editors. Biometric Potential of Brain Waves Evoked by Invisible Visual Stimulation. 2017 International Conference on Biometrics and Kansei Engineering (ICBAKE); 2017; Kyoto, Japan. doi: 10.1109/ICBAKE.2017.8090644.
172. Nashed NN, Eldawlatly S, Aly GM, editors. A deep learning approach to single-trial classification for P300 spellers. 2018 IEEE 4th Middle East Conference on Biomedical Engineering (MECBME); 2018; Tunis, Tunisia: IEEE. doi: 10.1109/MECBME.2018.8402397.

173. Neubig T, Sellami L, editors. Recognition of Imagined Speech using Electroencephalogram Signals. Smart Biomedical and Physiological Sensor Technology XV; 2019. doi: 10.1117/12.2519028.
174. Ousterhout T, Dyrholm M, editors. Cortically coupled computer vision with emotiv headset using distractor variables. 2013 IEEE 4th International Conference on Cognitive Infocommunications (CogInfoCom); 2013; Budapest, Hungary: IEEE. doi: 10.1109/CogInfoCom.2013.6719250.
175. Ouyang W, Cashion K, Asari VK, editors. Electroencephelograph based brain machine interface for controlling a robotic arm. 2013 IEEE Applied Imagery Pattern Recognition Workshop (AIPR); 2013; Washington, DC, USA: IEEE. doi: 10.1109/AIPR.2013.6749312.

176. Oyama K, Takeuchi A, Chang CK, editors. Brain lattice: Concept lattice-based causal analysis of changes in mental workload. 2013 IEEE International Multi-Disciplinary Conference on Cognitive Methods in Situation Awareness and Decision Support (CogSIMA); 2013; San Diego, CA, USA: IEEE. doi: 10.1109/CogSIMA.2013.6523824.
177. Parmonangan IH, Santoso J, Budiharto W, Gunawan AAS, editors. Fast brain control systems for electric wheelchair using support vector machine. First International Workshop on Pattern Recognition; 2016; Tokyo, Japan: International Society for Optics and Photonics. https://doi.org/10.1117/12.2243126.
178. Penaloza CI, Mae Y, Cuellar FF, Kojima M, Arai T. Brain Machine Interface System Automation Considering User Preferences and Error Perception Feedback. Ieee T Autom Sci Eng. 2014;11(4):1275-81. doi: 10.1109/Tase.2014.2339354. PubMed PMID: WOS:000343609500028.
179. Penaloza CI, Mae Y, Kojima M, Arai T, editors. BMI-based framework for teaching and evaluating robot skills. 2014 IEEE International Conference on Robotics and Automation (ICRA); 2014; Hong Kong, China: IEEE. doi: 10.1109/ICRA.2014.6907749.
180. Perakakis M, Potamianos A, editors. Affective evaluation of a mobile multimodal dialogue system using brain signals. 2012 IEEE Spoken Language Technology Workshop (SLT); 2012; Miami, FL, USA: IEEE. doi: 10.1109/SLT.2012.6424195.
181. Pham TD, Tran D, editors. Emotion recognition using the emotiv epoc device. International Conference on Neural Information Processing; 2012; Doha, Qatar: Springer. doi: 10.1007/978-3-642-34500-5.
182. Phutke S, Jadhav N, Manthalkar R, Joshi Y, editors. Analyzing Effect of Meditation Using Higher Order Crossings and Functional Connectivity. 2018 Computing, Communication and Signal Processing (ICCASP); 2019. doi: https://doi.org/10.1007/978-981-13-1513-8.
183. Pierguidi L, Guazzini A, Imbimbo E, Righi S, Sorelli M, Bocchi L, editors. Validation of a low-cost EEG device in detecting neural correlates of social conformity. 2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2019 2019-Jul; Berlin, Germany. doi: 10.1109/embc.2019.8856716.
184. Pomer-Escher AG, de Souza MDP, Bastos Filho TF, editors. Methodology for analysis of stress level based on asymmetry patterns of alpha rhythms in EEG signals. 5th ISSNIP-IEEE Biosignals and Biorobotics Conference (2014): Biosignals and Robotics for Better and Safer Living (BRC); 2014; Salvador, Brazil: IEEE. doi: 10.1109/BRC.2014.6880963.

185. Poorna S, Baba PS, Ramya GL, Poreddy P, Aashritha L, Nair G, et al., editors. Classification of EEG based control using ANN and KNN—A comparison. 2016 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC); 2016; Chennai, India: IEEE. doi: 10.1109/ICCIC.2016.7919524.
186. Prince D, Edmonds M, Sutter A, Cusumano M, Lu W, Asari V, editors. Brain machine interface using Emotiv EPOC to control robai cyton robotic arm. 2015 National Aerospace and Electronics Conference (NAECON); 2015; Dayton, OH, USA: IEEE. doi: 10.1109/NAECON.2015.7443080.
187. Puzi NM, Jailani R, Norhazman H, Zaini NM, editors. Alpha and Beta brainwave characteristics to binaural beat treatment. 2013 IEEE 9th International Colloquium on Signal Processing and its Applications; 2013; Kuala Lumpur, Malaysia: IEEE. doi: 10.1109/CSPA.2013.6530069.
188. Raheel A, Majid M, Anwar SM, editors. Facial Expression Recognition based on Electroencephalography. 2019 2nd International Conference on Computing, Mathematics and Engineering Technologies (iCoMET); 2019; Sukkur, Pakistan, Pakistan. doi: 10.1109/icomet.2019.8673408.
189. Rao SN, Prapulla SB, Shobha G, Hariprasad S, Gupta M, Reddy SA, editors. Using virtual reality to boost the effectiveness of brain-computer interface applications. 2019 4th International Conference on Computational Systems and Information Technology for Sustainable Solution (CSITSS); 2019 20-21 Dec. 2019; Bengaluru, India, India. doi: 10.1109/CSITSS47250.2019.9031021.
190. Reder EE, de Quadros Martins AR, Ferreira VRT, Kalil F, editors. Neural Interface Emotiv EPOC and Arduino: Brain-Computer Interaction in a Proof of Concept. International Conference on Human-Computer Interaction; 2014: Springer. https://doi.org/10.1007/978-3-319-07230-2_58.
191. Ren Z, Qi X, Zhou G, Wang HN. Exploiting the Data Sensitivity of Neurometric Fidelity for Optimizing EEG Sensing. Ieee Internet Things. 2014;1(3):243-54. doi: 10.1109/Jiot.2014.2322331. PubMed PMID: WOS:000209672300004.
192. Reshmi K, Muhammed PI, Priya V, Akhila V. A Novel Approach to Brain Biometric User Recognition. Procedia Technology. 2016;25:240-7. doi: doi:10.1016/j.protcy.2016.08.103.
193. Reyes CE, Rugayan JLC, Jason C, Rullan G, Oppus CM, Tangonan GL, editors. A study on ocular and facial muscle artifacts in EEG signals for BCI applications. TENCON 2012 IEEE Region 10 Conference; 2012; Cebu, Philippines: IEEE. doi: 10.1109/TENCON.2012.6412241.
194. Risangtuni AG, Widyotriatmo A, editors. Towards online application of wireless EEG-based open platform Brain Computer Interface. 2012 IEEE Conference on Control, Systems & Industrial Informatics; 2012; Bandung, Indonesia: IEEE. doi: 10.1109/CCSII.2012.6470489.
195. Robinson N, Vinod AP, editors. Bi-directional imagined hand movement classification using low cost EEG-based BCI. 2015 IEEE International Conference on Systems, Man, and Cybernetics; 2015; Kowloon, China: IEEE. doi: 10.1109/SMC.2015.544.
196. Rodriguez A, Rey B, Clemente M, Wrzesien M, Alcaniz M. Assessing brain activations associated with emotional regulation during virtual reality mood induction procedures. Expert Systems with Applications. 2015;42(3):1699-709. doi: 10.1016/j.eswa.2014.10.006. PubMed PMID: WOS:000345734700056.
197. Roh T, Song K, Cho H, Shin D, Ha U, Lee K, et al., editors. A 2.14 mW EEG neuro-feedback processor with transcranial electrical stimulation for mental health management. 2014 IEEE International Solid-State Circuits Conference Digest of

Technical Papers (ISSCC); 2014; San Francisco, CA, USA: IEEE. doi: 10.1109/ISSCC.2014.6757451.

198. Roh T, Song K, Cho H, Shin D, Yoo HJ. A wearable neuro-feedback system with EEG-based mental status monitoring and transcranial electrical stimulation. IEEE Transactions on Biomedical Circuits and Systems. 2014;8(6):755-64. Epub 2015/01/15. doi: 10.1109/TBCAS.2014.2384017. PubMed PMID: 25585425.

199. Rosas-Cholula G, Ramirez-Cortes JM, Alarcon-Aquino V, Gomez-Gil P, Rangel-Magdaleno Jde J, Reyes-Garcia C. Gyroscope-driven mouse pointer with an EMOTIV(R) EEG headset and data analysis based on Empirical Mode Decomposition. Sensors (Basel). 2013;13(8):10561-83. Epub 2013/08/21. doi: 10.3390/s130810561. PubMed PMID: 23948873; PubMed Central PMCID: PMCPMC3812618.

200. Rudas A, Laki S, editors. On Activity Identification Pipelines for a Low-Accuracy EEG Device. 2019 18th IEEE International Conference On Machine Learning And Applications (ICMLA); 2019; Boca Raton, FL, USA. doi: 10.1109/ICMLA.2019.00238.

201. Saini R, Kaur B, Singh P, Kumar P, Roy PP, Raman B, et al. Don't just sign use brain too: A novel multimodal approach for user identification and verification. Information Sciences. 2018;430:163-78. doi: 10.1016/j.ins.2017.11.045. PubMed PMID: WOS:000424174700011.

202. Saitis C, Kalimeri K. Multimodal Classification of Stressful Environments in Visually Impaired Mobility Using EEG and Peripheral Biosignals. IEEE Transactions on Affective Computing. 2018. doi: 10.1109/TAFFC.2018.2866865.

203. Salisbury DB, Parsons TD, Monden KR, Trost Z, Driver SJ. Brain–computer interface for individuals after spinal cord injury. Rehabilitation psychology. 2016;61(4):435. doi: 10.1037/rep0000099.

204. Salvador MDV, Carlo RHB, Joel SMJC, Paolo TQV, Tungala KL, Prado SV, editors. Correlation of emotion to film rating classification using EEG signal analysis. 2017 International Electrical Engineering Congress (iEECON); 2017; Pattaya, Thailand: IEEE. doi: 10.1109/IEECON.2017.8075866.

205. Salvaro M, Benatti S, Kartsch V, Guermandi M, Benini L. A Minimally Invasive Low-Power Platform for Real-Time Brain Computer Interaction based on Canonical Correlation Analysis. Ieee Internet Things. 2018;6(1):967-77. doi: 10.1109/JIOT.2018.2866341.

206. Samadi H, Daliri MR, editors. Solve the Rubik's cube with robot based on non-invasive brain computer interface. 2014 Iranian Conference on Intelligent Systems (ICIS); 2014; Bam, Iran: IEEE. doi: 10.1109/IranianCIS.2014.6802558.

207. Samadi MRH, Cooke N, editors. EEG signal processing for eye tracking. 2014 22nd European Signal Processing Conference (EUSIPCO); 2014; Lisbon, Portugal: IEEE. Retrieved from: https://ieeexplore.ieee.org/abstract/document/6952746.

208. Sayegh F, Fadhli F, Karam F, BoAbbas M, Mahmeed F, Korbane JA, et al., editors. A Wearable Rehabilitation Device for Paralysis. 2017 2nd International Conference on Bio-engineering for Smart Technologies (BioSMART); 2017; Paris, France. doi: 10.1109/BIOSMART.2017.8095334.

209. Schiatti L, Faes L, Tessadori J, Barresi G, Mattos L, editors. Mutual information-based feature selection for low-cost BCIs based on motor imagery. 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2016 Aug; Orlando, FL, USA. doi: 10.1109/EMBC.2016.7591305.

210. Schreiber MA, Trkov M, Merryweather A, editors. Influence of Frequency Bands in EEG Signal to Predict User Intent. 2019 9th International IEEE/EMBS Conference on Neural Engineering (NER); 2019 20-23 March 2019; San Francisco, CA, USA. doi: 10.1109/NER.2019.8716947.
211. Schwarz J, Fuchs S, editors. Test-Retest Stability of EEG and Eye Tracking Metrics as Indicators of Variations in User State—An Analysis at a Group and an Individual Level. International Conference onNeuroergonomics and Cognitive Engineering; 2016; Orlando, FL, USA: Springer International Publishing. doi: 10.1007/978-3-319-41691-5.
212. Seco GBS, Gerhardt GJL, Biazotti AA, Molan AL, Schonwald SV, Rybarczyk-Filho JL. EEG alpha rhythm detection on a portable device. Biomedical Signal Processing and Control. 2019;52:97-102. doi: 10.1016/j.bspc.2019.03.014. PubMed PMID: WOS:000473381100010.
213. Sequeira S, Diogo C, Ferreira FJ, editors. EEG-signals based control strategy for prosthetic drive systems. 2013 IEEE 3rd Portuguese Meeting in Bioengineering (ENBENG); 2013; Braga, Portugal: IEEE. doi: 10.1109/ENBENG.2013.6518399.
214. Serhani MA, El Menshawy M, Benharref A, Navaz AN, editors. Real time EEG compression for energy-aware continous mobile monitoring. 2015 27th International Conference on Microelectronics (ICM); 2015; Casablanca, Morocco: IEEE. doi: 10.1109/ICM.2015.7438046.
215. Shah MA, Sheikh AA, Sajjad AM, Uppal M, editors. A Hybrid Training-Less Brain-Machine Interface Using SSVEP and EMG Signal. 2015 13th International Conference on Frontiers of Information Technology (FIT); 2015; Islamabad, Pakistan: IEEE. doi: 10.1109/FIT.2015.26.
216. Shahin MK, Tharwat A, Gaber T, Hassanien AE. A Wheelchair Control System Using Human-Machine Interaction: Single-Modal and Multimodal Approaches. Journal of Intelligent Systems. 2019;28(1):115-32. doi: 10.1515/jisys-2017-0085. PubMed PMID: WOS:000455277600009.
217. Shankar S, Verma A, Rai R, editors. Creating by Imagining: Use of Natural and Intuitive BCI in 3D CAD Modeling. ASME 2013 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference; 2013; Portland, OR, USA: American Society of Mechanical Engineers.
218. Shankar SS, Rai R. Human factors study on the usage of BCI headset for 3D CAD modeling. Computer-Aided Design. 2014;54:51-5. doi: 10.1016/j.cad.2014.01.006. PubMed PMID: WOS:000338604400005.
219. Shedeed HA, Issa MF, El-Sayed SM, editors. Brain EEG signal processing for controlling a robotic arm. 2013 8th International Conference on Computer Engineering & Systems (ICCES); 2013; Cairo, Egypt. doi: 10.1109/ICCES.2013.6707191.
220. Shi M, Liu X, Zhou C, Chao F, Liu C, Jiao X, et al., editors. Towards portable SSVEP-based brain-computer interface using Emotiv EPOC and mobile phone. 2018 Tenth International Conference on Advanced Computational Intelligence (ICACI); 2018; Xiamen, China: IEEE. doi: 10.1109/ICACI.2018.8377615.
221. Shiqi Z, Xiaoxin C, Yuanning F, Chenglong Z, Dunshan Y, editors. Binary Convolutional Neural Network for Brain Computer Interfaces. 2019 China Semiconductor Technology International Conference (CSTIC); 2019 2019. 10.1109/cstic.2019.8755742.
222. Sinharay A, Chatterjee D, Pal A, editors. Cognitive Load Detection on Commercial EEG Devices: An Optimized Signal Processing Chain. First International

Conference on Cognitive Internet of Things Technologies 2015; Rome, Italy: Springer. doi: 10.1007/978-3-319-19656-5.
223. Sinharay A, Chatterjee D, Sinha A, editors. Evaluation of different onscreen keyboard layouts using EEG signals. 2013 IEEE International Conference on Systems, Man, and Cybernetics; 2013; Manchester, UK: IEEE. doi: 10.1109/SMC.2013.88.
224. Soman S, Murthy B. Using Brain Computer Interface for Synthesized Speech Communication for the Physically Disabled. Procedia Computer Science. 2015;46:292-8. doi: 10.1016/j.procs.2015.02.023.
225. Sourina O, Liu Y, Nguyen MK, Wang Q. Neurofeedback systems and emotions monitoring. International Journal of Psychophysiology. 2012;85(3):345-. doi: 10.1016/j.ijpsycho.2012.06.148. PubMed PMID: WOS:000308784300147.
226. Stein A, Yotam Y, Puzis R, Shani G, Taieb-Maimon M. EEG-triggered dynamic difficulty adjustment for multiplayer games. Entertainment Computing. 2018;25:14-25. doi: 10.1016/j.entcom.2017.11.003. PubMed PMID: WOS:000425850100002.
227. Stock VN, Balbinot A, editors. Movement imagery classification in EMOTIV cap based system by Naive Bayes. 2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC); 2016 Aug; Orlando, FL, USA. doi: 10.1109/EMBC.2016.7591711.
228. Stoica A, editor Multimind: Multi-brain signal fusion to exceed the power of a single brain. 2012 Third International Conference on Emerging Security Technologies; 2012; Lisbon, Portugal: IEEE. doi: 10.1109/EST.2012.47.
229. Sunny TD, Aparna T, Neethu P, Venkateswaran J, Vishnupriya V, Vyas PS. Robotic Arm with Brain – Computer Interfacing. International Conference on Emerging Trends in Engineering, Science and Technology. 2016;24:1089-96. doi: 10.1016/j.protcy.2016.05.241. PubMed PMID: WOS:000387696400142.
230. Suprijanto x, Rezi MH, Widyotriatmo A, Turnip A, editors. Evaluation of stimulation scheme for mu rhythm based-Brain computer interface user. 2013 3rd International Conference on Instrumentation Control and Automation (ICA); 2013; Ungasan, Indonesia: IEEE. doi: 10.1109/ICA.2013.6734041.
231. Swansi V, Herradura T, Suarez MT, editors. Analyzing Novice Programmers' EEG Signals using Unsupervised Algorithms. 25th International Conference on Computers in Education; 2017; New Zealand.
232. Swee SK, Kiang KDT, You LZ, editors. EEG Controlled Wheelchair. 2016 International Conference on Mechanical, Manufacturing, Modeling and Mechatronics (IC4M 2016); 2016: EDP Sciences. https://doi.org/10.1051/matecconf/20165102011.
233. Swee SK, You LZ, Kiang KT, editors. Brainwave Controlled Electrical Wheelchair. 2016 7th International Conference on Mechanical, Industrial, and Manufacturing Technologies (MIMT 2016); 2016. doi: 10.1051/matecconf/20165403005.
234. Szajerman D, Warycha M, Antonik A, Wojciechowski A, editors. Popular Brain Computer Interfaces for Game Mechanics Control. 10th International Conference on Multimedia and Network Information Systems (MISSI); 2017; Warsaw, Poland: Springer. doi: 10.1007/978-3-319-43982-2.
235. Szalowski A, Picovici D, editors. Investigating colour's effect in stimulating brain oscillations for BCI systems. 2016 4th International Winter Conference on Brain-Computer Interface (BCI); 2016; Yongpyong, South Korea. doi: 10.1109/IWW-BCI.2016.7457449.

236. Szalowski A, Picovici D, editors. Testing performance of multicolour checkerboard flickers against their greyscale versions for SSVEP-based BCI. 2019 7th International Winter Conference on Brain-Computer Interface; 2019. 10.1109/iww-bci.2019.8737261.

237. Szegletes L, Forstner B, editors. Reusable framework for the development of adaptive games. 2013 IEEE 4th International Conference on Cognitive Infocommunications (CogInfoCom); 2013; Budapest, Hungary: IEEE. doi: 10.1109/CogInfoCom.2013.6719173.

238. Taher FB, Amor NB, Jallouli M, editors. EEG control of an electric wheelchair for disabled persons. 2013 International Conference on Individual and Collective Behaviors in Robotics (ICBR); 2013; Sousse, Tunisia: IEEE. doi: 10.1109/ICBR.2013.6729275.

239. Thomas KP, Vinod AP, Guan C, editors. Evaluation of EEG features during overt visual attention during neurofeedback game. 2014 IEEE International Conference on Systems, Man, and Cybernetics (SMC); 2014; San Diego, CA, USA: IEEE. doi: 10.1109/SMC.2014.6974188.

240. Tjandrasa H, Djanali S, editors. Classification of P300 event-related potentials using wavelet transform, MLP, and soft margin SVM. 2018 Tenth International Conference on Advanced Computational Intelligence (ICACI); 2018; Xiamen, China: IEEE. doi: 10.1109/ICACI.2018.8377481.

241. Tjandrasa H, Djanali S, Arunanto FX, editors. Classification of P300 in EEG Signals for Disable Subjects Using Singular Spectrum Analysis. 2017 International Conference on Intelligent Informatics and Biomedical Sciences (ICIIBMS); 2017; Okinawa, Japan. doi: 10.1109/ICIIBMS.2017.8279747.

242. Tobing TAML, Prawito, Wijaya SK, editors. Classification of Right-Hand Grasp Movement Based on EMOTIV Epoc. International Symposium on Current Progress in Mathematics and Sciences; 2017. doi: 10.1063/1.4991173.

243. Trevisan DG, Reis IMBP, Moran MBH, Salgado LCD, editors. Evaluating the User Experience of Adult Users in Pokemon GO game. 2017 19th Symposium on Virtual and Augmented Reality (SVR); 2017; Curitiba, Brazil. doi: 10.1109/Svr.2017.29.

244. Trigui O, Zouch W, Messaoud MB, editors. A comparison study of SSVEP detection methods using the Emotiv Epoc headset. 2015 16th International Conference on Sciences and Techniques of Automatic Control and Computer Engineering (STA); 2015; Monastir, Tunisia: IEEE. doi: 10.1109/STA.2015.7505108.

245. Vargic R, Chlebo M, Kacur J, editors. Human computer interaction using BCI based on sensorimotor rhythm. 2015 IEEE 19th International Conference on Intelligent Engineering Systems (INES); 2015; Bratislava, Slovakia: IEEE. doi: 10.1109/INES.2015.7329645.

246. Vega IM, Adarve CA, Villar-Vega HF, Paramo CA. Serious game for real-time brain-computer interface training. Journal of Physics: Conference Series. 2019;1418:012011. doi: 10.1088/1742-6596/1418/1/012011. PubMed PMID: INSPEC:19310023.

247. Vidugiriene A, Vaskevicius E, Kaminskas V, editors. Modeling of affective state response to a virtual 3D face. 2013 European Modelling Symposium; 2013; Manchester, UK: IEEE. doi: 10.1109/EMS.2013.31.

248. Vourvopoulos A, Liarokapis F. Evaluation of commercial brain-computer interfaces in real and virtual world environment: A pilot study. Computers & Electrical

Engineering. 2014;40(2):714-29. doi: 10.1016/j.compeleceng.2013.10.009. PubMed PMID: WOS:000334978500037.

249. Wang S, Gwizdka J, Chaovalitwongse WA. Using Wireless EEG Signals to Assess Memory Workload in the n-Back Task. IEEE Transactions on Human-Machine Systems. 2016;46(3):424-35. doi: 10.1109/THMS.2015.2476818.

250. Wang S, Yu Y-C, Jouny I, Gabel L, editors. Development of assistive technology devices using an EEG headset. 2013 39th Annual Northeast Bioengineering Conference; 2013; Syracuse, NY, USA: IEEE. doi: 10.1109/NEBEC.2013.169.

251. Wang Y, Markham C, Deegan C, editors. Assessing the time synchronisation of EEG systems. 2019 30th Irish Signals and Systems Conference (ISSC); 2019 17-18 June 2019; Maynooth, Ireland. doi: 10.1109/ISSC.2019.8904947.

252. Wiederhold B, Riva G. Measuring presence during the navigation in a virtual environment using EEG. Annual Review of Cybertherapy and Telemedicine. 2013;191:136. doi: 10.323/978-1-61499-282-0-136.

253. Wijayasekara D, Manic M, editors. Human machine interaction via brain activity monitoring. 2013 6th International Conference on Human System Interactions (HSI); 2013; Sopot, Poland: IEEE. doi: 10.1109/HSI.2013.6577809.

254. Williams G, Lee YS, Ekanayake S, Pathirana PN, Andriske L, editors. Facilitating communication and computer use with EEG devices for non-vocal quadriplegics. 7th International Conference on Information and Automation for Sustainability; 2014; Colombo, Sri Lanka: IEEE. doi: 10.1109/ICIAFS.2014.7069604.

255. Wu D, editor Active semi-supervised transfer learning (ASTL) for offline BCI calibration. 2017 IEEE International Conference on Systems, Man, and Cybernetics (SMC); 2017; Banff, AB, Canada: IEEE. doi: 10.1109/SMC.2017.8122610.

256. Wu D, Lawhern VJ, Hairston WD, Lance BJ. Switching EEG Headsets Made Easy: Reducing Offline Calibration Effort Using Active Weighted Adaptation Regularization. Ieee T Neur Sys Reh. 2016;24(11):1125-37. doi: 10.1109/Tnsre.2016.2544108. PubMed PMID: WOS:000389345500001.

257. Wu DR. Online and Offline Domain Adaptation for Reducing BCI Calibration Effort. IEEE Transactions on Human-Machine Systems. 2017;47(4):550-63. doi: 10.1109/Thms.2016.2608931. PubMed PMID: WOS:000405732000011.

258. Xu H, Plataniotis KN, editors. Affect recognition using EEG signal. 2012 IEEE 14th International Workshop on Multimedia Signal Processing (MMSP); 2012; Banff, AB, Canada: IEEE. doi: 10.1109/MMSP.2012.6343458.

259. Yaomanee K, Pan-ngum S, Ayuthaya PIN, editors. Brain signal detection methodology for attention training using minimal EEG channels. 2012 Tenth International Conference on ICT and Knowledge Engineering; 2012; Bangkok, Thailand: IEEE. doi: 10.1109/ICTKE.2012.6408576.

260. Yehia AG, Eldawlatly S, Taher M, editors. WeBB: A Brain-Computer Interface Web Browser Based on Steady-State Visual Evoked Potentials. 2017 12th International Conference on Computer Engineering and Systems (ICCES); 2017; Cairo, Egypt. doi: 10.1109/ICCES.2017.8275277.

261. Younis H, Ramzan F, Khan J, Khan MUG, editors. Wheelchair Training Virtual Environment for People with Physical and Cognitive Disabilities. 2019 15th International Conference on Emerging Technologies (ICET); 2019 2-3 Dec. 2019; Peshawar, Pakistan. doi: 10.1109/ICET48972.2019.8994550.

262. Yu JH, Sim KB. Classification of color imagination using Emotiv EPOC and event-related potential in electroencephalogram. Optik. 2016;127(20):9711-8. doi: 10.1016/j.ijleo.2016.07.074. PubMed PMID: WOS:000394632900065.

263. Yurdem B, Akpinar B, Ozkurt A, editors. EEG Data Acquisition and Analysis for Human Emotions. 2019 11th International Conference on Electrical and Electronics Engineering (ELECO); 2019 28-30 Nov. 2019; Bursa, Turkey. 10.23919/ELECO47770.2019.8990539.

264. Zgallai W, Brown JT, Ibrahim A, Mahmood F, Mohammad K, Khalfan M, et al., editors. Deep Learning AI Application to an EEG Driven BCI Smart Wheelchair. 2019 Advances in Science and Engineering Technology International Conferences (ASET); 2019; Dubai, United Arab Emirates. doi: 10.1109/icaset.2019.8714373.

265. Zhang M, Zhang J, Zhang D, editors. ATVR: An Attention Training System using Multitasking and Neurofeedback on Virtual Reality Platform. 2019 IEEE International Conference on Artificial Intelligence and Virtual Reality (AIVR); 2019; San Diego, CA, USA. 10.1109/AIVR46125.2019.00032.

266. Zhao Y, Wang Z, Liu J, Chen L, Meng G, Qi H, et al., editors. The research on cross-platform transplantation of generic model on subject-independent BCI. 2015 IEEE 7th International Conference on Awareness Science and Technology (iCAST); 2015; Qinhuangdao, China: IEEE. doi: 10.1109/ICAwST.2015.7314045.

267. Zhou Y, Xu T, Cai Y, Wu X, Dong B, editors. Monitoring Cognitive Workload in Online Videos Learning Through an EEG-Based Brain-Computer Interface. International Conference on Learning and Collaboration Technologies; 2017; Vancouver, BC, Canada: Springer International Publishing. doi: 10.1007/978-3-319-58509-3.

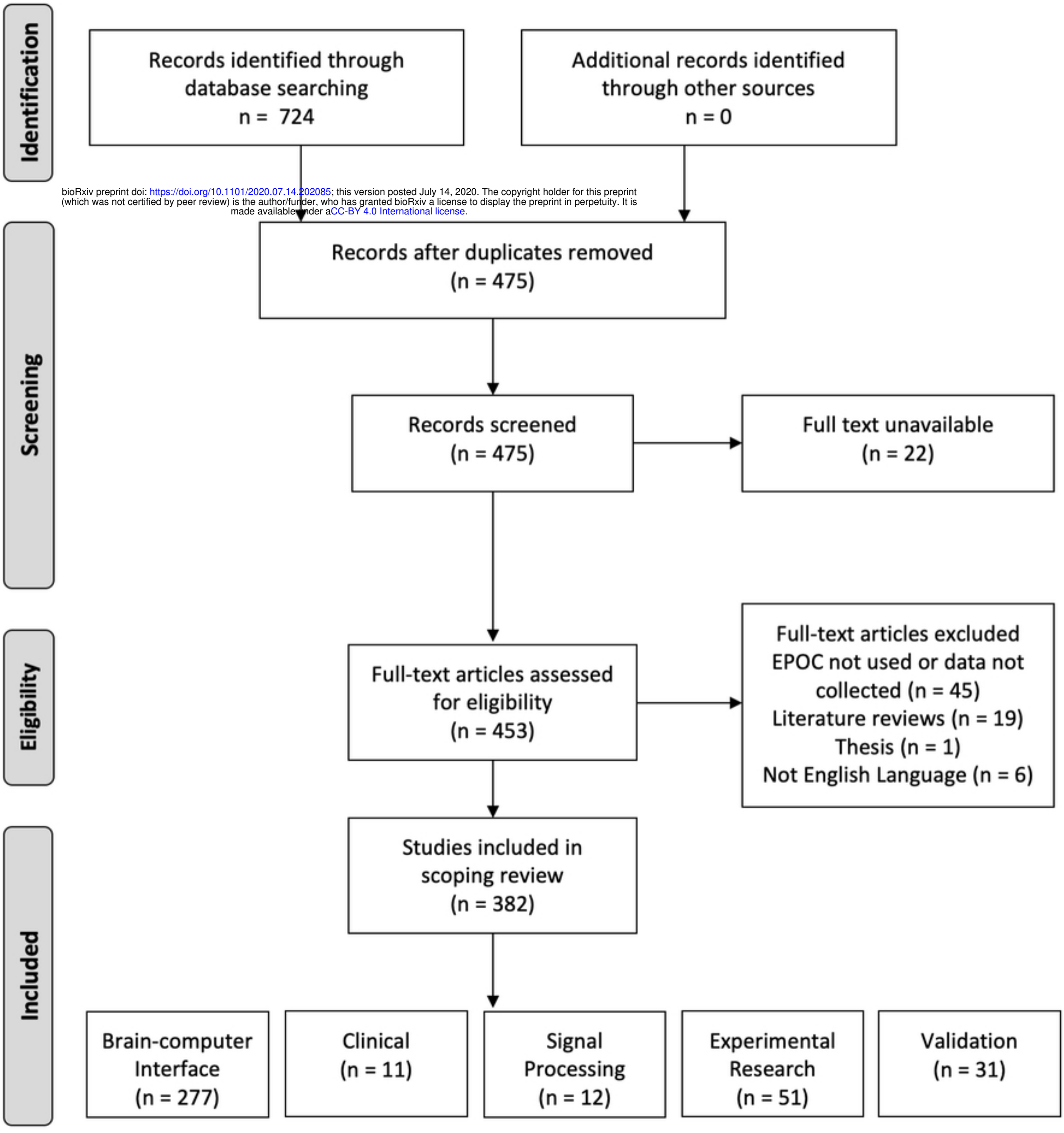
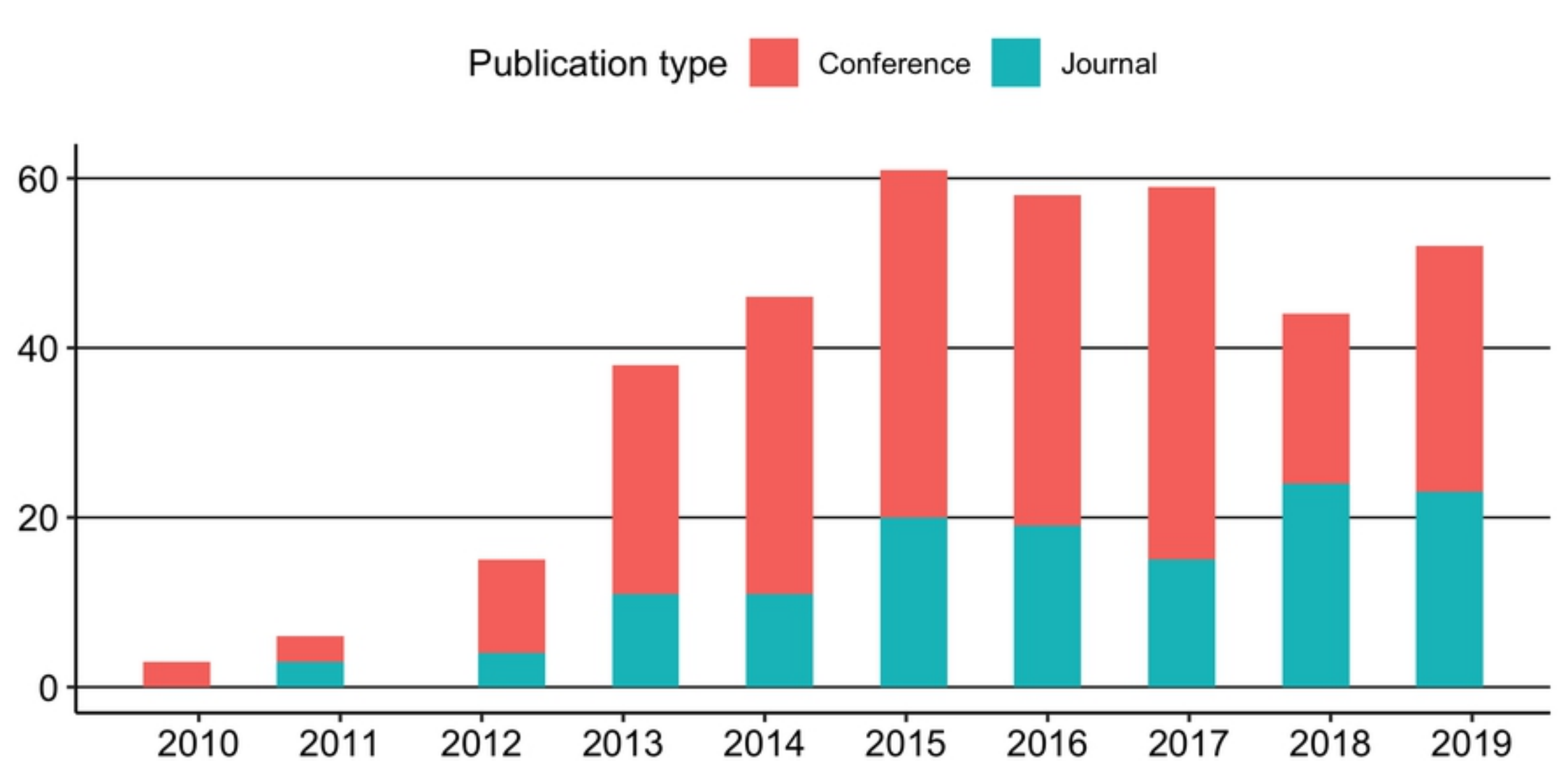


Figure 1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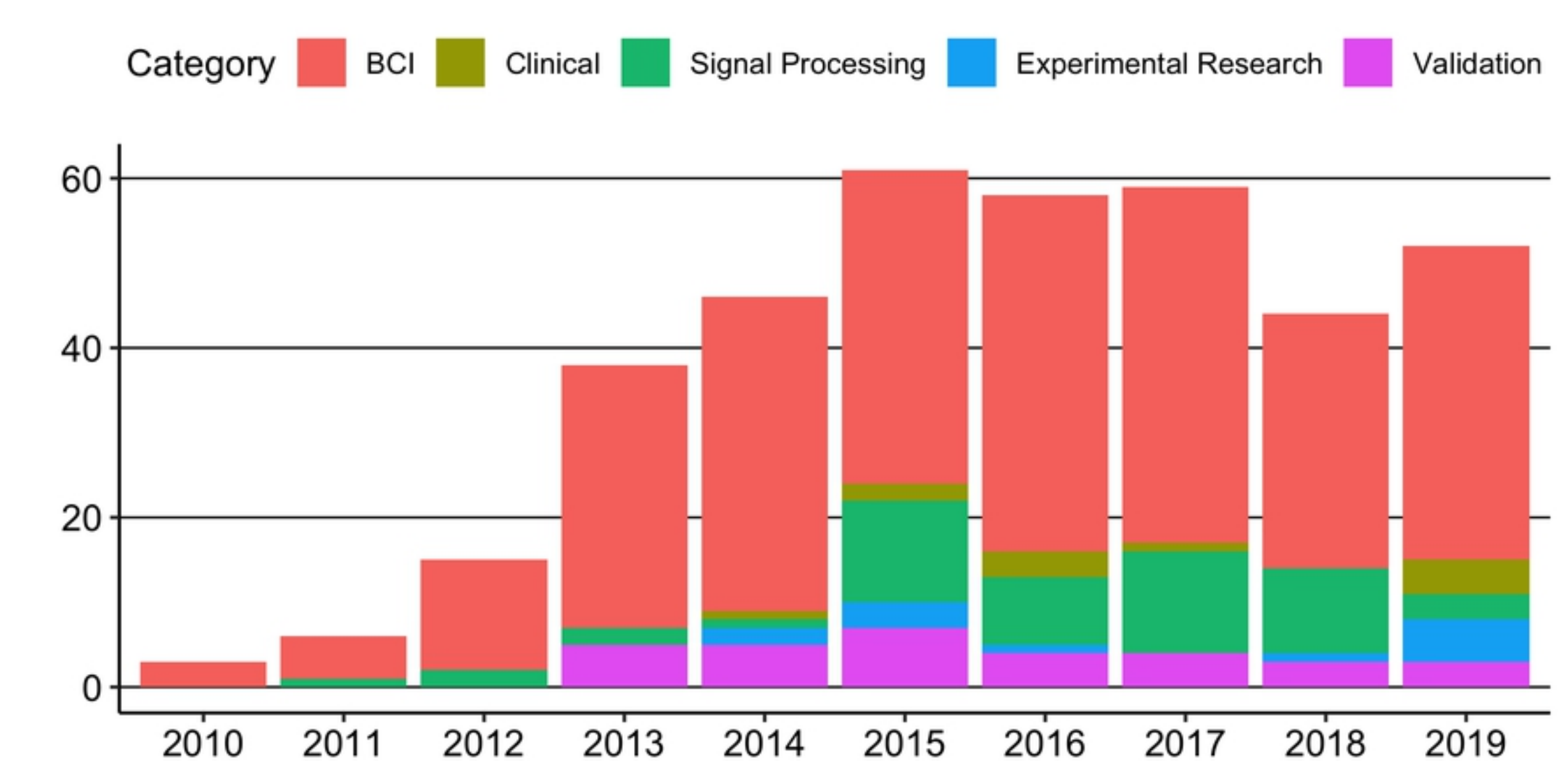
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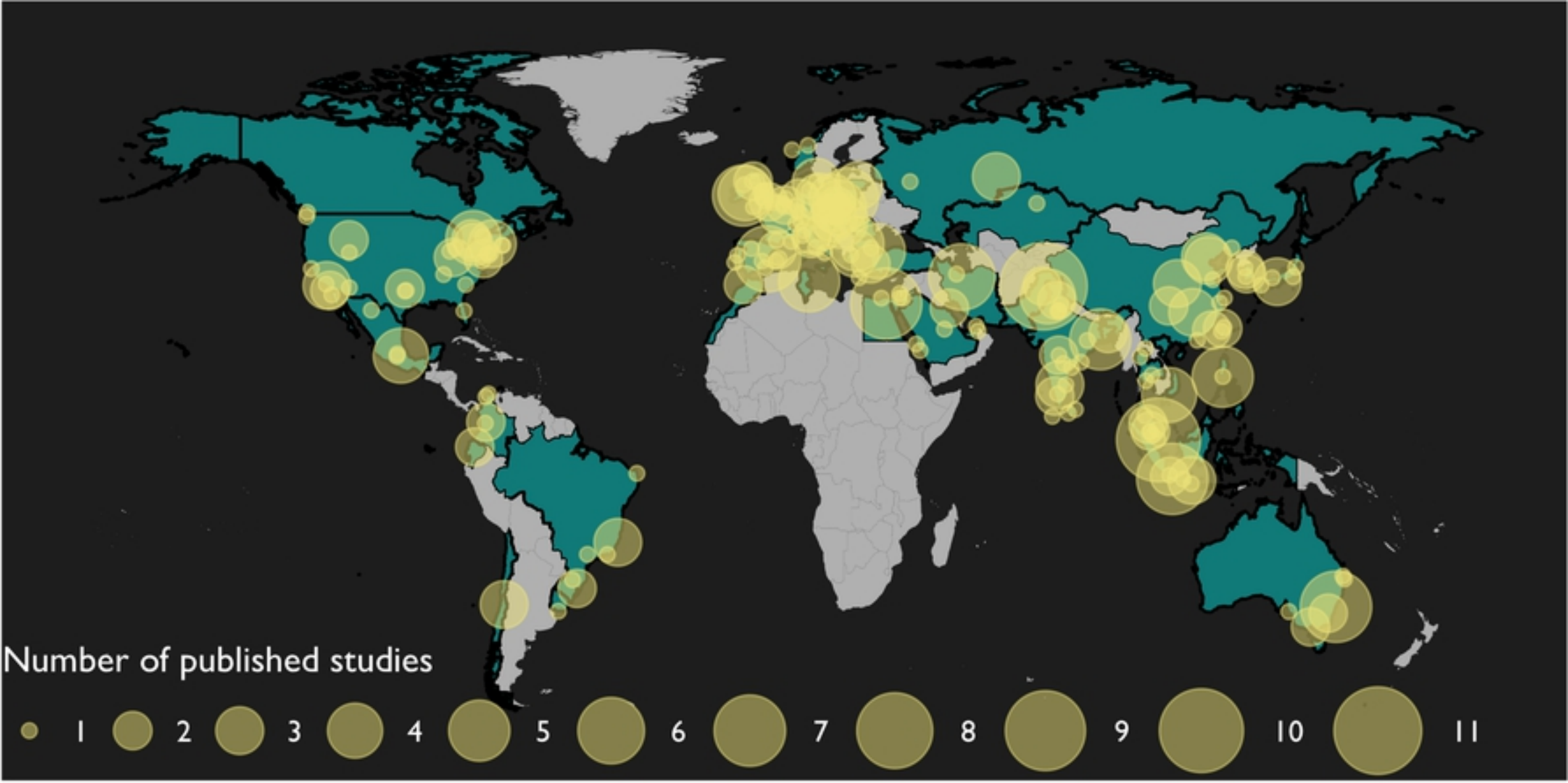

Figure 4