

Wo Brain-Computer-Interfaces auf Grundrechte treffen

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Quellen

https://github.com/CarolinKemper/rC3-BCI



Weiterführende Informationen

Über Brain-Computer-Interfaces

maiLab

Superintelligent durch Brain Machine Interface

funk, Video vom 28.11.2019, https://www.funk.net/channel/mailab-996/superintelligent-durch-brain-machineinterface-1645723

Urban

Neuralink and the Brain's Magical Future

Wait But Why vom 20.04.2017, https://waitbutwhy.com/2017/04/neuralink.html

Lebedev/ Nicolelis

<u>Brain-machine interfaces:</u>

<u>From basic science to neuroprostheses and neurorehabilitation</u>

Physiological reviews 97.2 (2017): 767-837 https://doi.org/10.1152/physrev.00027.2016

Heene

Gehirn-Computer-Schnittstellen:
Aufklärung, Datenschutz und Haftungsrecht

MPR 2018, 192 ff (Paywall)

Zu Neurosecurity

Denning/ Matsuoka/ Kohno
Neurosecurity: security and privacy for neural devices

Neurosurgical Focus FOC, 27 (2009), 1, E7 https://doi.org/10.3171/2009.4.FOCUS0985

Bernal et al.

Security in brain-computer interfaces:
State-of-the-art, opportunities, and future challenges

ACM Computing Surveys (CSUR) 54.1 (2021): 1-35 https://arxiv.org/abs/1908.03536

Bonaci/ Calo/ Chizeck

App stores for the brain:

Privacy & security in Brain-Computer Interfaces

2014 IEEE International Symposium on Ethics in Science, Technology and Engineering, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2788104

Matwyshyn
The Internet of Bodies

William & Mary Law Review Vol. 61 (2019), 77 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3452891

BCI-Modelle

Neurosky:

https://store.neurosky.com/collections/apps https://store.neurosky.com/pages/mindwave

EMOTIV:

https://www.emotiv.com/workplace-wellness-safety-and-productivity-mn8/

CorTec:

https://www.cortec-neuro.com/products-and-services/brain-interchange-one/

Cyberpunk 2077

Offizielles Bildmaterial:

https://www.cyberpunk.net/us/de/

Hotfix- und Patch-Updates:

Patches 1.1, 1.2, 1.3 Hotfixes 1.04, 1.06, 1.12

Quickhacks:

https://cyberpunk.fandom.com/wiki/Quickhacks_(Cyberpunk_2077)



Bildquellen

Neuroimplantate

- 7
- International Parkinson and Movement Disorder Society:
 https://www.mdsabstracts.org/abstract/effectiveness-and-micro-electrodes-findings-of-deep-brain-stimulation-of-the-stn-via-a-parietal-approach-in-post-infectious-previously-implanted-parkinsons-patients
- Utah Array: https://www.brainlatam.com/manufacturers/microelectrodes/utah-array-335
- CorTec: https://www.cortec-neuro.com/products-and-services/brain-interchange-one/

ECoG

- 8
- University of California, Irvine: http://bme240.eng.uci.edu/
 students/10s/kingce/Defining_Epileptogenic_Zones_Using_ECoG/Introduction.html

Deep Brain Stimulation

- 9
- MedGadget: https://www.medgadget.com/2018/10/global-deepbrain-stimulation-devices-market-average-growth-rate-is-11-8-in-thelast-several-years.html

Transkranielle Stimulation

- 10
- Transkranielle Magnetstimulation: https://leben-mit-depression.de/transkranielle-magnetstimulation/
- Stimulation des Vagusnervs: https://spectrum.ieee.org/ earbuds-electrically-stimulate-the-nervous-system-to-treat-rheumatoidarthritis

EEG-Headsets

- Psychologisches Institut der Universität Zürich: https://www.psychologie.uzh.ch/de/bereiche/ ehem/plasti/Labor.html
 - Brigham Young University: https://cogneuro.byu.edu/faq
- Emotiv EPOC+: https://www.amazon.de/Emotiv-EPOC-Mobiles-Kanal-Headset/dp/Bo7SRYY8ZX
 - Neurosky: https://www.pinterest.de/pin/ 84724036717467971/
 - Emotiv MN8: https://d2zok1elb7rxgj.cloudfront.net/ uploads/2019/10/Tan-MN8.jpg

fMRI

- 14
- Wikipedia: https://de.wikipedia.org/wiki/Funktionelle_ Magnetresonanztomographie#/media/Datei:Aktivitaethinten.jpg

Funktionsweise eines BCI

- 15
- CorTec: https://www.cortec-neuro.com/products-and-services/active-implant-technology/brain-interchange-technology/

Bildquellen

Medizinische Anwendungsgebiete

- **Epilepsy Foundation:** https://www.epilepsy.com/learn/diagnosis/looking-brain/spect
 - The Guardian: https://www.theguardian.com/science/2019/jul/30/neuroscientists-decode-brain-speech-signals-into-actual-sentences
- **Kübler/Neuper**, Gehirn-Computer-Schnittstellen, e-Neuroforum, Vol. 14 (2008), S. 204 (209), https://doi.org/10.1515/nf-2008-0205
 - Scientific American: https://www.scientificamerican.com/article/scientists-take-a-step-toward-decoding-speech-from-the-brain/
- Brown University: https://news.brown.edu/articles/2012/05/braingate2

Computerspiele

- Neuralink: https://www.youtube.com/watch?v=rsCul1sp4hQ
 - **Gamestar:** https://www.gamestar.de/artikel/gabe-newell-pc-gehirn-schnittstellen,3366390.html

Selbstoptimierung und Produktivität am Arbeitsplatz

◆ **Emotiv:** https://www.emotiv.com/workplace-wellness-safety-and-productivity-mn8/

Wellness, Self-Tracking, Meditation

• Neurosky: https://store.neurosky.com/collections/apps

BrainNet: BCI als Kommunikationsmittel

- **Golem:** https://www.golem.de/news/brain-to-brain-interface-mensch-steuert-anderen-mit-gedanken-fern-1308-101246.html
 - University of Washington: https://www.washington.edu/news/ 2013/08/27/researcher-controls-colleagues-motions-in-1st-human-brainto-brain-interface/

Telepathie?

- Twitter: https://twitter.com/elonmusk/status/1299512615001964544
 - Wired: https://www.wired.com/2009/05/pentagon-preps-soldiertelepathy-push/

Verschmelzen Mensch und Computer?

- Twitter: https://twitter.com/elonmusk/status/1281121339584114691
 - ◆ Youtube: https://www.youtube.com/watch?v=4fGYT-gIICA
 - Cyberpunk Fandom: https://cyberpunk.fandom.com/wiki/Relic
 - Cyberpunk 2077: https://cdn-l-cyberpunk.cdprojektred.com/ wallpapers/1080p/You look like youve seen a ghost-en.jpg
 - **Blairwitch.de:** https://www.blairwitch.de/news/transcendence-deutscher-trailer-johnny-depp-55319/
- **SZ-Magazin:** https://sz-magazin.sueddeutsche.de/sagen-sie-jetzt-nichts/markus-gabriel-interview-89829
 - **Spektrum:** https://www.spektrum.de/magazin/philosophie-des-geistes-das-leib-seele-problem/1373785
 - Ullstein: https://www.ullstein-buchverlage.de/nc/buch/details/der-sinn-des-denkens-9783548061207.html

Bildquellen

	Cybersicherheit von BCIs
27	◆ BSI: https://www.bsi.bund.de/SharedDocs/Downloads/DE/BSI/ DigitaleGesellschaft/ManiMed_Abschlussbericht.html
28	 Understanding and Exploiting Implanted Medical Devices, BlackHat, Youtube: https://www.youtube.com/watch?v=l9XskAF-1Lc Marie Moe, Eireann Leverett: Unpatchable, media.ccc.de, Youtube: https://www.youtube.com/watch?v=O7b1udukTIA
30	 Washington Post: https://www.washingtonpost.com/news/ the-switch/wp/2013/10/21/yes-terrorists-could-have-hacked-dick-cheneys- heart/
32	 New Yorker: https://www.newyorker.com/magazine/2021/04/26/do-brain-implants-change-your-identity Thomson/Segrave/Carter: https://link.springer.com/article/10.1007/s12152-019-09419-2
34	 MedTechDive: https://www.medtechdive.com/news/cyber-attacks-security-medical-devices-kevin-fu-advamed/607483/
37	 Martinovic et al.: https://www.usenix.org/conference/ usenixsecurity12/technical-sessions/presentation/martinovic
38	 New York Times: https://www.nytimes.com/2019/12/16/us/strobe-attack-epilepsy.html Gizmodo: https://gizmodo.com/hackers-attack-epileptics-forum-with-snow-crash-like-se-373768

Regulierung von BCIs

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- **Emotiv:** https://www.emotiv.com/product/emotiv-epoc-x-14-channel-mobile-brainwear/
- ◆ Wikipedia: https://de.wikipedia.org/wiki/Neuralink#/media/ Datei:Elon_Musk_presenting_the_Neuralink_master_plan.jpg

