

Brain-Computer Interface (draft)

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Topics:

- What is brain-computer interface?
- How does the technology work?
- Why is the technology of brain-computer interface important?
- What are the challenges?
- What does the future look like?

The Human Brain is a super-computer

- Has an incredible transmission speed up to $\sim 6 \times 10^{16}$ bits per second.
- that is 60,000 Terabit per second or 7,500 Terabyte per second.
- Fastest internet speed world record from 2021 is only 319 Terabits per second

What is BCI?

- Is a direct communication pathway between the brain's electrical activity and an external device.
- Translates information from neurons into commands capable of controlling external software or hardware

BCI Technology is already here!

- Hearing aids
- Electroencephalography (EEG)

How does BCI technology work?

- A machine in the brain acquires brain signals, analyzes them, and translates them into commands that are relayed to an output device to carry out a desired action.
- Due to the processing speed of the brain, these signals come out nearly instantly.

BCI Categories:

- Invasive – Inside the brain tissue
- Partially invasive – inside the skull but outside the brain
- Non-invasive – outside the skull, on the scalp

Why is BCI technology important?

- Helps restore useful functions to people with disabilities.

What are the challenges?

- First, the technology is still in an "alpha" state. There are many unknowns in the space.
- Unwanted signals can interfere with current modern EEG based BCI
- Ethics of the technology

The Future

- BCI technology is a new field with numerous opportunities.
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Conclusion

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Sources

- <https://blog.malwarebytes.com/artificial-intelligence/2019/08/how-brain-machine-interface-bmi-technology-could-create-internet-of-thoughts/#:~:text=Brain%2Dmachine%20interface%20technology%20today&text=For%20example%2C%20there%20are%20hearing,otherwise%20be%20unable%20to%20process.>
- <https://www.networkworld.com/article/3635130/the-new-internet-speed-record-twice-as-fast-as-the-old-one.html#:~:text=For%20those%20who%20believe%20their,set%20just%20a%20year%20prior.>
- [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3497935/#:~:text=A%20brain%2Dcomputer%20interface%20\(BCI,carry%20out%20a%20desired%20action.&text=%E2%96%A0-,In%20principle%2C%20any%20type%20of%20brain%20signal%20could%20be,to%20control%20a%20BCI%20system.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3497935/#:~:text=A%20brain%2Dcomputer%20interface%20(BCI,carry%20out%20a%20desired%20action.&text=%E2%96%A0-,In%20principle%2C%20any%20type%20of%20brain%20signal%20could%20be,to%20control%20a%20BCI%20system.)
- <https://computer.howstuffworks.com/brain-computer-interface.htm>
- <https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/electroencephalogram-eeg#:~:text=An%20EEG%20is%20a%20test,activity%20of%20your%20brain%20cells.>