COURSE CONTENT

Course Code / Title **:** HP4210 Data Analytics for Neuroimaging

Pre-requisites **:** Nil

No. of AUs. **:** 4

Contact Hours **:** 52

Course Aims

1. To provide exposure to an international online learning community for neuroimaging data analyses
2. To provide basic rubrics for neuroimaging tool exploration, international standards in Brain Imaging Data Structure, basics of coding for neuroimaging, and hands-on experience to develop a small project with these tools.
3. Develop and strengthen collaborative skills with international partner working on the proposed project (including an optional self-funded opportunity to visit partner university)
4. Strengthening self-directed learning by providing connection with the international community for potential future research collaborations
5. Obtain exposure to industry experience where cognitive neuroscience and neuroimaging expertise can also be applied

Intended Learning Outcomes (ILO)

By the end of the course, you should be able to:

1. Apply basic computational, coding and data analytics skills related to neuroimaging data (e.g. set up own Github site, install neuroimaging software, write bash scripts for terminal commands, describe basic machine learning methods for neuroimaging)
2. Communicate and summarize neuroimaging project information in a web-based presentation with data visualisation approaches, as well as make a short video clip for YouTube regarding the project
3. Work and collaborate effectively with an international partner student

Course Content

Data Analytics for Neuroimaging is designed to equip students with advanced neuroimaging data analytics skills in a collaborative, international learning environment. It will introduce students to practical tools for analyzing neuroimaging data, including hands-on coding, machine learning techniques, and data visualization. Key components include synchronous and asynchronous virtual learning, hybrid collaboration with overseas universities, and guest lectures from industry experts.

Students will work on projects in international teams, culminating in an oral presentation and a web-based showcase of their project. The course also includes a potential overseas field trip for further collaboration and networking opportunities.

By the end of the course, students will be proficient in neuroimaging analysis, coding in Python, and collaborating on international platforms like GitHub.

Course Assessment

CA1	Project report	: 40%
CA2	Presentation	: 20%
CA3	Reflection Essay	: 20%
CA4	Class Participation	: 20%
Total		**--------**
		100%

Reading and References

Required digital readings and assignments: https://school.brainhackmtl.org/

For fundamentals of MRI (optional): Huettel SA, Song AW, McCarthy G (2019). Functional Magnetic Resonance Imaging, 3rd Ed. Sinauer. (available at NTU library)

NOTE: The above listing comprises the foundational readings for the course, and more up-to-date relevant readings will be provided when they become available.

Planned Weekly Schedule (subject to changes, if any)

Week	Topics	ILO	Readings	Delivery Mode	Activities
10	Introduction to Data Analytics for Neuroimaging (5 contact hours)	1,2	Required digital readings and assignments: https://school.brainhackmtl.org/ For fundamentals of MRI (optional): Huettel SA, Song AW, McCarthy G (2019). Functional Magnetic Resonance Imaging, 3rd Ed. Sinauer. (available at NTU library)	In-person	Self-study of online modules (https://school.brainhackmtl.org/modules/). 20 modules categorized into: Data Science (e.g., terminal, containers, python scripting/testing, git/github, hpc) and Neuro data science (e.g., fMRI connectivity/parcellation, deep learning, open data, data visualisation); videos + assignments + hands-on

					practices. You are recommended to follow the sequence as listed here: https://school.brainhackmtl.org/weeks/ or the modules the NTULearn portal or the Discord server.
11	Preparation and Review	1	Nil	Online	Self-study of online modules (https://school.brainhackmtl.org/modules/). 20 modules categorized into: Data Science (e.g., terminal, containers, python scripting/testing, git/github, hpc) and Neuro data science (e.g., fMRI connectivity/parcellation, deep learning, open data, data visualisation); videos + assignments + hands-on practices. You are recommended to follow the sequence as listed here: https://school.brainhackmtl.org/weeks/ or the modules the NTULearn portal or the Discord server.
12	Preparation and Review	1	Nil	Online	Self-study of online modules (https://school.brainhackmtl.org/modules/). 20 modules categorized into: Data Science (e.g., terminal, containers, python scripting/testing, git/github, hpc) and Neuro data science (e.g., fMRI connectivity/parcellation, deep learning, open data, data visualisation); videos + assignments + hands-on practices. You are recommended to follow

					the sequence as listed here: https://school.brainhackmtl.org/weeks/ or the modules the NTULearn portal or the Discord server.
13	Preparation and Review	1	Brainhack school materials online	Online	Self-study of online modules (https://school.brainhackmtl.org/modules/). 20 modules categorized into: Data Science (e.g., terminal, containers, python scripting/testing, git/github, hpc) and Neuro data science (e.g., fMRI connectivity/parcellation, deep learning, open data, data visualisation); videos + assignments + hands-on practices. You are recommended to follow the sequence as listed here: https://school.brainhackmtl.org/weeks/ or the modules the NTULearn portal or the Discord server.
14	Preparation and Review	1	Nil	Online	Self-study of online modules (https://school.brainhackmtl.org/modules/). 20 modules categorized into: Data Science (e.g., terminal, containers, python scripting/testing, git/github, hpc) and Neuro data science (e.g., fMRI connectivity/parcellation, deep learning, open data, data visualisation); videos + assignments + hands-on practices. You are recommended to follow the sequence as listed here:

					https://school.brainhackmtl.org/weeks/ or the modules the NTULearn portal or the Discord server.
15	Preparation and Review	1	Nil	Online	Self-study of online modules (https://school.brainhackmtl.org/modules/). 20 modules categorized into: Data Science (e.g., terminal, containers, python scripting/testing, git/github, hpc) and Neuro data science (e.g., fMRI connectivity/parcellation, deep learning, open data, data visualisation); videos + assignments + hands-on practices. You are recommended to follow the sequence as listed here: https://school.brainhackmtl.org/weeks/ or the modules the NTULearn portal or the Discord server.
16	Introduction to BrainHack School materials (5 contact hours)	1,3	Overview of readings and assignments: https://school.brainhackmtl.org/ For fundamentals of MRI (optional): Huettel SA, Song AW, McCarthy G (2019). Functional Magnetic Resonance Imaging, 3rd Ed. Sinauer. (available at NTU library)	In-person	*Overview and familiarisation of online materials for BrainHack School *Connecting with classmates at partner university online (assignment to learning pods – team) *Start planning Project question *Neuroimaging site visit at NTU (CoNIC) optional
17	Tool exploration (2 contact hours per day)	1,2	Choose 6 of the following: ⭐ Installation of software for brainhack school	Online	*Introduce participants to a reproducible computational toolkit for neural data science, as well as a basic grounding in supervised and unsupervised machine

			☆ Introduction to the terminal ☆ Introduction to git and github * Python for data analysis * Machine learning - basics * Project management * High performance computing * Open data * Writing scripts in python ☆ are mandatory.		learning methods. *Short pre-recorded lectures and hands-on tutorials throughout the fi ve days will provide participants with familiarity applying these methods to real data. * Each participant will be required to complete 6 tutorials
18	Project definition (2 contact hours a day)	1, 2, 3	Choose 3 out of the following online modules: * Introduction to deep learning * Deep learning for neuroimaging * Machine learning for neuroimaging * Functional connectivity in fMRI * Functional parcellations in fMRI * The Brain Imaging Data Structure (BIDS) ecosystem * DataLad for reproducible research data management * Working with MNE-Python and EEG-BIDS * Neuroimaging data and fi le structures in Python * Introduction to dMRI * Introduction to spinal cord MRI analysis	In-person	* Students will start to defi ne and pilot the project. * Students will need to decide: o What general topic do you want to work on? o What skills do you want to learn, working on this project? o What resources do you want to work on? o What objectives do you want to achieve with the project? o What will be the outcome(s) of your project? o Project Clinic: Each project will be presented orally and in writing, with rounds of feedback, and revised by the end of next week.
19	Project implementat ion (2 contact hours a day)	1, 2, 3	Choose 1 of the following: * Data visualization * Python packaging	In-person	The content of a typical day will include: * Work on projects. * Most of the time will be reserved to actually doing the work. *

			* Testing and continuous integration * Containers		Project clinics. * Get daily feedback and support from instructors and TAs. * Collaborate. * Take time each day to help someone else with their project. * Time to work on training modules is minimal.
20	Project wrap-up (2 contact hours a day)	1, 2, 3	Nil	Online	A presentation on career paths by Instructors or Industry experts Students will concentrate on fi nalizing project results and producing deliverables. The daily structure will be similar to week4. Students will make a short oral presentation on their project.
21	Proposed Symposium Week (Visit to NTU.Taiwan)	1, 2, 3	Nil	In-person	Teams will participate in Data Blitz, participate and present at the cross university symposium either organized in Taiwan or Singapore
22	Submission of deliverables	1, 2, 3	Nil	Online	Participants will have to produce a written deliverable for their project, which will be published on the BrainHack School website (as well as the course site). Participants will submit a refl ection essay regarding cultural intelligence and collaboration through their BrainHack School Experience. These deliverables will have to be submitted by the end of this week.