

Course Title: Assessing the understandability of AI solutions in psychiatry

Teacher

Dr. Cristina Berchio

Course description

This course aims at assessing the understandability of AI solutions in Psychiatry by investigating whether embedding clinical, behavioral, pathophysiological, and genetic information into AI models reduces uncertainty and generates more clinically relevant decisions. Psychiatric disorders show highly variable characteristics and risk factors. Therefore, AI prognostic and diagnostic solutions are fed with a wide variety of patient related information (e.g., symptoms, behaviors, brain-related data). Because different diagnostic categories are often associated with drastically different clinical manifestations and neurobiological substrates, explaining clinical phenomena with AI is challenging. We will address this challenge by presenting algorithms that discriminate between psychiatric diagnoses based on multimodal data informed by biological and clinical priors. We show AI solutions that are interpretable in clinical settings, besides generating a more comprehensive view of the pathophysiology of psychiatric conditions. Specific topics are: i) Multi-modal learning algorithms informed by pathophysiological information; ii) Comparison of categorical models obtained based on human knowledge and categories derived from AI models in neuroimaging; iii) Validation of deep-phenotyping based algorithms in less characterized individuals.

Course period

December 2024-February 2025

SSD

PSIC-01/B - Neuropsicologia e neuroscienze cognitive

Credits and Hours

3 CFU, 2 of lecture (8 Hours) and 1 of practice (15 hours), for a total of 31 hours.

Exam Modality

Two alternatives are available to the student to pass this exam:

- 1) Paper presentation. Students present the content of 2 papers suggested by the teacher. No groups are allowed.
- 2) Project. Students implement and experimentally validate an algorithm or its variation from a paper suggested by the teacher. Projects can be done in groups of 1-3 students, depending on the algorithm.

Teacher(s) CV

■ Personal data

- Cristina Berchio
- E-mail: cristina.berchio@unige.ch
- Professional address: Department of Translational Biomedicine and Neuroscience (DiBrain), University of Bari Aldo Moro, Piazza Giulio Cesare, 11, 70124 Bari, Italy

■ Education

- **Phd in Neuroscience**, University of Parma, Italy. 01/2009-12/2012, defence: 22.04.2013, Supervisor Prof.: V. Gallese. Title of the thesis: 'High-density EEG and the Mirror Mechanism in children. Two empirical studies conducted on Typical Development children and children with Autism Spectrum Disorder.' Final mark: Excellent
- **Master Degree in Developmental Psychology**, University of Torino, Italy. 10/2005-02/2008
Title of the thesis: "The treatment of Autism in Italy: a comparison between programs, methods and techniques". Final mark: 110 out of 110.
- **Bachelor in Developmental Psychology**, University of Torino, Italy. 09/2002-11/2005. Final mark: 110 out of 110 (with honors).
- **High school for science**, Acqui Terme (Piemonte), Italy. 09/1997-06/2002. Final mark: 100 out of 100.

■ Past and present positions

- RTDa, University of Bari Aldo Moro, DiBrain, Italy, 27.02-2023-present.
- Senior research scientist 'Maître Assistant-e', University of Geneva, Switzerland, Dept. of Child and Adolescent Psychiatry:
 - April 2019- February 2023. Head of the lab.: Prof. N. Micali (100%)Dept. of Adult Psychiatry,
 - May 2018-March 2019. Heads of the lab: Prof. A. Dayer/ Prof. Jean-Michel Aubry (100%).
- Postdoctoral researcher, University of Geneva, Switzerland, Dept. of Adult Psychiatry/Basic Neuroscience,
 - 02/2013-04/2018. Heads of the lab: Prof. A. Dayer, Jean-Michel Aubry, Prof. C.M. Michel (100%).
- Doctoral student: University of Parma, Italy. 01/2009-12/2012. Supervisor: Prof V. Gallese.

■ **Language skills** Italian: mother tongue; English: very good; French: very good

■ **Scientific background**

My research interests focus on understanding the neurobiology bases of psychiatric disorders, particularly to understand how the brain influences behaviour and emotional responses. Within this framework, I am specialized in applying neurophysiological techniques to assess brain and cognitive functions in psychiatric disorders.

Teacher(s) Main Publications

Berchio, C., Rihs, T. A., Piguet, C., Dayer, A. G., Aubry, J. M., & Michel, C. M. (2016). Early averted gaze processing in the right Fusiform Gyrus: An EEG source imaging study. *Biological psychology*, 119, 156-170.
<https://pubmed.ncbi.nlm.nih.gov/27381931/>

Berchio, C., Piguet, C., Michel, C. M., Cordera, P., Rihs, T. A., Dayer, A. G., & Aubry, J. M. (2017). Dysfunctional gaze processing in bipolar disorder. *Neuroimage: clinical*, 2017, 16, 545-556.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5608173/>

Berchio, C., Piguet, C., Gentsch, K., Küng, A. L., Rihs, T. A., Hasler, R., ... & Perroud, N. (2017). Face and gaze perception in borderline personality disorder: An electrical neuroimaging study. *Psychiatry Research: Neuroimaging*, 269, 62-72.
<https://www.ncbi.nlm.nih.gov/pubmed/28941875>

Perizzolo, V. C., **Berchio, C.**, Moser, D. A., Gomez, C. P., Vital, M., Arnautovic, E., ... & Schechter, D. S. (2019). EEG recording during an emotional face-matching task in children of mothers with interpersonal violence-related posttraumatic stress disorder. *Psychiatry Research: Neuroimaging*, 283, 34-44.
<https://www.ncbi.nlm.nih.gov/pubmed/30530040>

Berchio, C., Küng, A. L., Kumar, S., Cordera, P., Dayer, A. G., Aubry, J. M., ... & Piguet, C. (2019). Eye-gaze processing in the broader bipolar phenotype revealed by electrical neuroimaging. *Psychiatry Research: Neuroimaging*, 291, 42-51.
<https://www.ncbi.nlm.nih.gov/pubmed/31398614>

Berchio, C., Rodrigues, J., Strasser, A., Michel, C. M., & Sandi, C. (2019). Trait anxiety on effort allocation to monetary incentives: a behavioral and high-density EEG study. *Translational psychiatry*, 9(1), 1-13.
<https://www.ncbi.nlm.nih.gov/pubmed/31300637>

Damborská, A., Piguet, C., Aubry, J. M., Dayer, A. G., Michel, C. M., & **Berchio, C.** (2019). Altered electroencephalographic resting-state large-scale brain network dynamics in euthymic bipolar disorder patients. *Frontiers in psychiatry*, 10: 826.
<https://pubmed.ncbi.nlm.nih.gov/31803082/>

Micali, N., & **Berchio, C.** (2019). Towards robust biomarkers of psychosocial interventions. *European Child Adolescent Psychiatry*. 2019 Feb;28(2):153-154.
<https://www.ncbi.nlm.nih.gov/pubmed/30684087>

Berchio, C., & Micali, N. (2022). Cognitive assessment using ERP in child and adolescent psychiatry: difficulties and opportunities. *Psychiatry Research: Neuroimaging*, 319, 111424.
IF: 2.88
<https://pubmed.ncbi.nlm.nih.gov/34883368/>

Berchio, C., Cambi, S., Pappaianni, S. & Micali, N. (2022). EEG biomarkers in children and adolescents with feeding and eating disorders: current evidence and future directions. *Frontiers in Psychiatry*, 13.
<https://pubmed.ncbi.nlm.nih.gov/35463489/>

Mauriello, C., Pham, E., Kumar, S., Piguet, C., Aubry, J. M., Dayer, A., ... & **Berchio, C.** (2022). Dysfunctional temporal stages of eye-gaze perception in adults with ADHD: a high-density EEG study. *Biological Psychology* (2022): 108351.
<https://pubmed.ncbi.nlm.nih.gov/35568095/>

Berchio, C., Annen, L.C., Bouamoud, Y., Micali, N., (2023). Temporal dynamics of cognitive flexibility in adolescents with anorexia nervosa: a high-density EEG study. *European Journal of Neuroscience*. 2023 Jan 22. doi: 10.1111/ejn.15921.

Berchio, C., Kumar, S. S., & Micali, N. (2023). EEG Spatial-temporal Dynamics of Resting-state Activity in Young Women with Anorexia Nervosa: Preliminary Evidence. *Brain Topography*, 1-14. doi: 10.1007/s10548-023-01001-7.

Deiber, M. P., Piguet, C., **Berchio, C.**, Michel, C. M., Perroud, N., & Ros, T. (2023). Resting-State EEG Microstates and Power Spectrum in Borderline Personality Disorder: A High-Density EEG Study. *Brain Topography*, 1-13. doi: 10.1007/s10548-023-01005-3.

Cambi, S., Solcà, M., Micali*, N., & **Berchio***, C. (2023). Cardiac interoception in Anorexia Nervosa: A resting-state heartbeat-evoked potential study. *European Eating Disorders Review*. doi: 10.1002/erv.3049.