Valentina Giunchiglia

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Citizenship: Italian

RESEARCH INTERESTS

I am a second-year PhD student jointly affiliated with Imperial College London and Harvard University, under the supervision of Prof. Marinka Zitnik and Prof. Adam Hampshire. My work lies at the intersection of artificial intelligence and health, with a focus on neuroscience. I am interested in a holistic study of diseases across multiple levels — from cellular and genetic to brain structure and clinical phenotypes — to drive advancements in precision medicine. To achieve this, I work on research spanning bioinformatics, artificial intelligence, and clinical and behavioural analysis, with the aim to gain expertise that enables me to leverage diverse data types and insights for precision medicine.

EDUCATION

Imperial College London and Harvard University 2022 - 2027
PhD in Artificial Intelligence for Health

PhD Project - Advisors: *Marinka Zitnik, Adam Hampshire*
From single cell to clinical phenotypes: development of single cell foundation models with clinical applications that aim to identify molecular biomarkers of clinical and disease phenotypes and study diseases across different scales.

Imperial College London 2020 - 2021
MRes Data Science (Biomedical Research) Distinction (4.0 GPA)

Master Project - Advisors: *Adam Hampshire*
Analysis of cognitive and multi-modal imaging (PET, DTI and sMRI) data of Alzheimer's patients using artificial intelligence to establish the best predictors of Alzheimer's progression.

Master Project - Advisors: *Zoltan Takats, James McKenzie*
Development of Artificial Intelligence pipeline that uses convolutional neural networks (CNN) and weakly supervised learning to localize cancer regions in Whole Slide Images and Tissue Microarrays. Published in Metabolites 2021 (6).

University College London 2019 - 2020
MA Health Humanities Distinction (4.0 GPA)

Master Project - Advisors: *Andrew Steptoe, Eleonora Iob*
Analysis of data from the English Longitudinal Study of Ageing (ELSA) to investigate the relationship between the quality of different types of social interactions (both negative and positive) and inflammation, as a measure of C-reactive protein.

Heidelberg University (Germany) 2016 - 2019
BSc Molecular Biotechnology and Bioinformatics 1.9/1.0

Bachelor Project - Advisors: *Benedikt Brors, Charles Imbusch*
Analysis of single cell RNA-seq data to estimate RNA velocity using spliced and unspliced RNAs in developing regulatory T-cells. Published in Cell Immunity 2021 (13).

HONORS AND AWARDS

- Teaching Award, Imperial College London — July 2024
- Award for Exceptional Achievement in Biomedical Data Science, Imperial College London — October 2023
- Merit Travel Award, ECTRIMS conference — October 2023
- Medical Research Council PhD Scholarship, Imperial College London — August 2022
- NIHR Biomedical Research Grant (£60K), Imperial College London — February 2022
- Dean's Prize for MRes Data Science (Top in the class), Imperial College London — October 2021
- Collegiate Award for Biomedical Research, Imperial College London — October 2021
- Award for best Grant Proposal, Imperial College London — March 2021
- Award for best 3-minutes thesis presentation, Imperial College London — February 2021
- John Alero Scholarship (Full tuition scholarship), Imperial College London — October 2020
- Dean's List 2020 (Top in the class), University College London — September 2020

WORK EXPERIENCE

Harvard University
Visiting Researcher - Advisors: *Marinka Zitnik* March 2022 - Present

- Case study analysis of a multimodal and multi-knowledge domain foundation model of human proteins. In submission to Nature 2024 (5).
- Work on AI agents: a) development of a KG+LLM agent designed for knowledge-intensive medical QA - under review at ICML 2024 (4), b) Design of AI agents for biomedical research - perspective published in Cell 2024 (3).
- Development of protein graph representation learning method for protein structures that derives dataset and task dependent protein representations.

Graduate Student Researcher - Advisors: *Chirag Agarwal* July 2022 - October 2022

- Development of a novel explanation-directed neural message passing framework for GNNs which aggregates only embeddings from nodes and edges identified as important by a GNN explanation method. Published in LOG conference 2022 (1).

Imperial College London
Research Assistant - Advisors: *Adam Hampshire, Richard Nicholas* November 2021 - Present

- Analysis of longitudinal data collected from the NSHD birth cohort (1946): modeling of cognitive and behavioral data collected through online/computerised cognitive assessments, data processing and quality control, association with imaging biomarkers, comparison with state of the art pen and paper tests. Three papers under review in Alzheimer's and Dementia and Assessment 2024 (1, 3, 2, 9).
- Development of pre-processing and statistical analysis pipeline for large scale cognitive and behavioral data (around 500 thousand participants). Application of pipeline to different clinical populations. Published in npj Nature Digital Medicine 2024 (Parkinson's) (11), EclinicalMedicine 2023 (Alzheimer's) (14), under review in Nature Communications (Multiple Sclerosis) and under review in Assessment (Sleep disorders) (5).
- Development of top down and bottom up computational models to study cognition and detect cognitive and motor impairment from online cognitive assessments. Published in npj Nature Digital Medicine 2024 (2) and presented at Connectome 2022 (5).
- Modeling of cognitive and motor impairments in patients with Multiple Sclerosis, Stroke and COVID-19. Presented at ECTRIMS 2023 (3) and OPSYRIS 2023 (2, 4), under review in Nature Communications, published in NEJM 2024 (10), EclinicalMedicine 2023 (7) and Nature Medicine 2024 (12).
- Application of speech-to-text foundation models to detect aphasia in stroke.
- Development and application of image analysis algorithm to detect changes in cell density in whole slide image and identify areas of the brain that are impaired in patients with Multiple Sclerosis and Parkinson's. Presented at Movement Disorders conference 2022 (6, 7) and ECTRIMS 2024 (8).
- Application of machine learning (e.g., graph neural networks and autoencoders) to DWI and structural and functional MRI data to predict cognitive and motor changes in different clinical populations. In submission to Human Brain Mapping and published in Imaging Neuroscience 2024 (1).
- Cognitive and behavioral data collection for UK Brain Tissue Bank, writing of ethics application and set up of online website and user interface for data collection.
- Students teaching and supervision

University College London
Data Science Intern - Advisors: *Andrew Steptoe, Eleonora Iob* May 2020 - May 2021

- Analysis of data from the Avon Longitudinal Study of Parents and Children to investigate the association of adverse childhood experiences with inflammatory and neuroendocrine biomarkers and depressive symptoms in childhood/early adulthood. Published in Molecular Psychiatry 2022 (8).
- Rapid media analysis, rapid appraisal and rapid policy review to study the impact and response to COVID-19 in Italy. Published as book chapter in *Caring on the Frontline during COVID-19* 2021 (9).

Janssen Pharmaceutica
Bioinformatics Intern - Advisors: *Joke Reumers* August 2018 - October 2018

- Automated annotation of (immune) cell populations in single cell RNAseq data
- Literature review on (automated) annotation of cell types and assembly of database of "cell type signatures"
- Implementation and testing of R/Python pipeline for the automated annotation of (immune) cells

TALKS AND SEMINARS

- Poster presenter, Alzheimer's and Dementia conference, 2024
- Speaker and Poster presenter, ECTRIMS conference, 2023
- Poster presenter, Connectome, 2023
- Speaker, Quantumblack AI consulting Data Science meetup, 2022
- Speaker, Imperial College Data Science society, 2022
- Speaker, Imperial College London Bioinformatics seminars, 2022
- Poster presenter, LOG Conference, 2022
- Poster presenter, Movement Disorders Conference, 2022
- Speaker, Imperial College London Honors and Scholars Programs Scholar Series, 2020.
- Speaker, Jannsen Pharmaceutica Computational Biology meetup, 2018

STUDENT SUPERVISOR

- **Saheli Moorjani, MSc Thesis, Imperial College London, 2024**
  Exploring the IDoCT model on IC3-derived speech data with validation from structural imaging: a longitudinal observational study of aphasia post-stroke.
- **Milena Davudova, MSc Thesis, Imperial College London, 2024**
  Application of speech-to-text foundation models to detect aphasia in stroke.
- **Rou Ann, MSc Thesis, Imperial College London, 2024**
  Computational modeling of motor and cognitive impairment in ageing.
- **Iona Biggart, MSc Thesis, Imperial College London, 2024**
  Application of graph neural networks on functional and structural MRI data to predict motor and cognitive impairment.
- **Ziyuan Cai, MSc Thesis, Imperial College London, 2023**
  Development of an end-to-end artificial intelligence pipeline for post-stroke language impairment assessment.
- **Alexander Moore, MSc Thesis, Imperial College London, 2023**
  Modelling executive dysfunction in stroke by iterative decomposition of cognitive task data.
- **Adrija Mahapatra, MSc Thesis, Imperial College London, 2023**
  White Matter Hyperintensity (WMH) and Lesion Segmentation in Stroke using machine learning.
- **Octavia Leahy, MSc Thesis, Imperial College London, 2022**
  A free-text analysis of the impact of the COVID-19 pandemic on mental health and effective coping strategies: a longitudinal study.
- **Manini Jain, Undergraduate Internship, Imperial College London, 2022**
  Developing a rational approach to automated analysis of human brain tissue pathology.

TEACHING EXPERIENCE

Imperial College London - Introduction to Computational Methods for the Brain Sciences (MSc)
Lead Teaching Assistant 2021 - Present

- Design of lecture and workshop materials on supervised and unsupervised machine learning, programming in Python and MATLAB, data pre-processing and quality control, statistical analysis of cognitive and behavioural data, functional and structural MRI analysis, graph theory and connectivity applied to functional MRI data, and natural language processing.
- Design of a 12 lecture course on Python programming that includes hands-on exercises.
- Delivery of lectures and teaching assistance during workshops
- Marking of reports and presentations

Imperial College London - Brain Imaging (MSc)
Lead Teaching Assistant 2021 - Present

- One hour long lecture preparation and delivery on: 1) Principles of functional MRI (fMRI), 2) MRI Voxel-based morphometry (VBM) and Biomarkers, and 3) MRI Diffusion tensor imaging (DTI)
- Teaching assistance during workshops on MRI VBM, MRI DTI analysis and MATLAB programming
- Review and correction of workshop material

Imperial College London - Data Science for Biomedical Research (MSc)
Teaching Assistant 2022 - 2023

- Workshop material preparation on: 1) Model Validation and Performance, 2) Univariate Statistics, 3) Topic Modelling using Natural Language Processing
- Teaching assistance during workshops

Data Science Helper Team - Biomedical Data Science (MSc)
Main organiszer and lecturer 2021

- Preparation and delivery of lectures in: 1) Introduction to clustering and dimensionality reduction of single cell RNA-seq data, 2) Introduction to differential gene expression analysis, 3) Introduction to statistics and statistical analysis in R
- One-to-one helper sessions on different topics in bioinformatics, machine learning and statistics

GirlsWhoML - Machine Learning (BSc, MSc, PhD)
Machine Learning Demonstrator 2021

- Demonstration of Machine Learning tutorials focused specifically how to code from scratch and apply linear and logistic regression algorithms.

Heidelberg University - Introduction to Bioinformatics (BSc)
Tutor 2018 - 2019

- Tutoring of 20 students in the second year of BS Molecular Biotechnology in the completion of a R project on Cancer Methylome analysis.
- The project analysis included data cleaning, data visualization, batch effect correction (wilcoxon rank test, kruskal wallis test, permutation test), feature selection, k-means clustering, principal component analysis (PCA), logistic regression.

EVENT MANAGEMENT AND ORGANIZATION

- Organizer of data analysis workshop, BRAINN summer school `https://cyprusconferences.org/brainnss/` 2024
- Organizer of LOGML summer school (London Geometry and Machine Learning) `https://www.logml.ai/` 2023-2024
- Organizer of Imperial College research networking event "Research and Careers at Imperial College London" 2021
- Organizer of Data Science Helper Team `https://github.com/valegiunchiglia/DS_sessions` 2020 - 2021
- Organizer of TEDxUniHeidelberg 2017-2018

LEADERSHIP AND VOLUNTEERING

- NeuroNight - talk on AI for lay audience in support of UniArk charity `https://uniark.org/` 2023
- Volunteer in weekend long hackathons for social good organized by DataKind `https://datakind.org.uk/` 2023
- Volunteer during one-day hackathon (Hello World Hack) for girls aged 7-10 2023
- Student Representative for MRes Data Science (Biomedical Research) 2020 - 2021
- Career consultant for YourGuide `https://www.linkedin.com/company/yourguidecareer/` 2020 - 2021
- Student Representative for MA Health Humanities 2019 - 2020

PUBLICATIONS

Journals

1. **Giunchiglia, V.**, et al. Neural correlates of cognitive ability and visuo-motor speed: validation of IDoCT on UK Biobank Data. *Imaging Neuroscience*, 2: 1-25 (2024).

2. **Giunchiglia, V.**, et al. An iterative approach for estimating domain specific cognitive abilities from large scale online cognitive data. *npj Nature Digital Health*, (in press, 2024).

3. Gao, S., Fang, A.*, Huang, Y.*, **Giunchiglia, V.***, Noori, A.*, et al. Empowering biomedical discovery with AI agents. *Cell*, 187(22), 6125-6151 (2024).

4. Kurtin, D. L., **Giunchiglia, V.**, et al. Moving from phenomenological to predictive modelling: Progress and pitfalls of modelling brain stimulation insilico. *Neuroimage*, 272, 120042 (2023).

5. Queen, O.*, Huang, Y.*, Calef R.*, **Giunchiglia, V.**, et al. ProTeus: A Multi-Knowledge Domain Foundation Model of Human Proteins. *In submission, Nature.*

6. Isberg OG, **Giunchiglia V**, et al. Automated Cancer Diagnostics via Analysis of Optical and Chemical Images by Deep and Shallow Learning. *Metabolites*, 12(5):455 (2022).

7. Cheetham, N. J., Penfold, R., **Giunchiglia, V.**, The effects of COVID-19 on cognitive performance in a communitybased cohort: a COVID symptom study biobank prospective cohort study. *EClinicalMedicine*, 62 (2023)

8. Iob, E., Lacey, R., **Giunchiglia, V.** et al. Adverse childhood experiences and severity levels of inflammation and depression from childhood to young adulthood: a longitudinal cohort study. *Nature Molecular Psychiatry.* 27, 2255–2263 (2022) .

9. Lewis-Jackson, S., Iob, E , **Giunchiglia, V.**, et al. Policies and politics: an analysis of the public policies aimed at the reorganization of healthcare delivery during the COVID-19 pandemic. In *Caring on the Frontline during COVID-19* (pp. 39-64). Palgrave Macmillan, Singapore (2021).

10. Hampshire, A., Azor, A., Atchison, C., Trender, W., Hellyer, P.J., **Giunchiglia, V.**, et al. Cognition and memory after Covid-19 in a large community sample.*New England Journal of Medicine.* 390(9), pp.806-818 (2024).

11. Bălăeţ, M., Alhajraf, F., Zerenner, T., Welch, J., Razzaque, J., Lo, C., **Giunchiglia, V.**, et al. Online cognitive monitoring technology for people with Parkinson's disease and REM sleep behavioural disorder. *npj Digital Medicine.* 7(1), p.118 (2024).

12. Wood, G. K., Sargent, B. F., Ahmad, Z. U. A., Tharmaratnam, K., Dunai, C., Egbe, F. N., Martin, H. N., Facer, B., Pendered, S. L., Rogers, H. C., Hübel, C., van Wamelen, D. J., Bethlehem, R., **Giunchiglia, V.**, et al. Post-hospitalisation COVID-19 cognitive deficits at one year are global and associated with elevated brain injury markers and grey matter volume reduction. *Nature Medicine.* 1-1 (2024).

13. Delacher, M., Imbusch, C.D., Hotz Wagenblatt, A., Mallm, J.P., Bauer, K., Simon, M., Riegel, D., Rendeiro, A.F., Bittner, S., Sanderink, L., Pant, A., Schmidleithner, L., Braband, K.L., Echtenachter, B., Fischer, A., **Giunchiglia, V.**, er al. Precursors for nonlymphoid-tissue Treg cells reside in secondary lymphoid organs and are programmed by the transcription factor BATF. *Immunity.* 52(2), pp.295-312 (2020).

14. Del Giovane, M., Trender, W.R., Bălăeţ, M., Mallas, E.J., Jolly, A.E., Bourke, N.J., Zimmermann, K., Graham, N.S., Lai, H., Losty, E.J. and Oiarbide, G.A., Hellyer, P.j., Faiman, I., Daniels, S.J.C., Batey, P., Harrison, M., **Giunchiglia, V.**, et al. Computerised cognitive assessment in patients with traumatic brain injury: an observational study of feasibility and sensitivity relative to established clinical scales. *EClinicalMedicine.* 59 (2023).

Preprints

1. Cai, Z.*, **Giunchiglia, V.***, Street, R.*, et al. Online46: online cognitive assessments in elderly cohorts-the British 1946 birth cohort case study. medRxiv (2024): 2024-09.

2. Gruia, D. C., **Giunchiglia, V.**, et al. Online monitoring technology for deep phenotyping of cognitive impairment after stroke. medRxiv (2024): 2024-09.

3. Del Giovane, M., **Giunchiglia, V.**, et al. Remote cognitive tests predict neurodegenerative biomarkers in the Insight 46 cohort. medRxiv (2024): pp.2024-09.

4. Su, X., Wang, Y., Gao, S., Liu, X., **Giunchiglia, V.**, et al. Knowledge Graph Based Agent for Complex, Knowledge-Intensive QA in Medicine. arXiv preprint arXiv:2410.04660 (2024).

5. Rida, L., Ioannidis, K., Chamberlain, S.R., Grant, J.E., Hellyer, P., **Giunchiglia, V.**, et al. Validation of the Comprehensive Online Sleep Monitoring Scale (COSMOS) in a Large Population Sample. medRxiv (2024): pp.2024-10.

Conferences

1. **Giunchiglia, V.***, Shukla CV.*, et al. Towards Training GNNs using Explanation Directed Message Passing. In *LOG Conference* (2022).
2. **Giunchiglia, V.**, et al. Usability and Compliance of Online Cognitive Assessments in the British 1946 Birth Cohort. In *Alzheimer's Association International Conference* (2024).
3. **Giunchiglia, V.***, Lerede, A.*, et al. The motor and cognitive components of impaired performance in online cognitive tasks and their association to patients' reported outcomes. In *ECTRIMS conference, Journal of Multiple Sclerosis* (2023).
4. Gruia, D.*, **Giunchiglia, V***, et al. Disentangling hand motor-control and cognitive deficits during self-administered cognitive assessments in patients with stroke. In *Opsyris Conference* (2023).
5. **Giunchiglia, V.**, et al. A novel fixed-point method for fractionating motor, device and cognitive variability in online and computerised cognitive data. In *Connectome Conference: Dementia Research Institute* (2023).
6. Magliozzi, R.*, **Giunchiglia, V.***, Mensi, A.*, et al. Diffusely abnormal white matter and elevated grey matter demyelination imply rapid and severe progression in atypical multiple sclerosis. In *ECTRIMS conference, Journal of Multiple Sclerosis* (2022).
7. **Giunchiglia, V.**, et al. An automated data cleaning approach to remove preparation artefacts from brain histology slide images. In *Congress of Parkinson's Disease and Movement Disorder, Journal of Movement Disorders* (2022).
8. Mahapatra, A., **Giunchiglia, V.**, et al. Widespread cell loss in the Superior Frontal Gyrus of Multiple Sclerosis subjects detected using a novel automated cell counting algorithm. In *ECTRIMS conference, Journal of Multiple Sclerosis* (2024).
9. Del Giovane, M., Leoni, M., **Giunchiglia, V.**, et al. Remote cognitive testing in Insight46: relationship to standard cognitive assessments and biomarkers of neurodegeneration. In *Alzheimer's Association International Conference, Alzheimer's and Dementia Journal* (2024).
10. Giovane, M.D., Parker, T.D., David, M.C., Kolanko, M.A., **Giunchiglia, V.**, et al. Computerised cognitive testing and multi-domain structural Magnetic Resonance Imaging in patients with idiopathic Normal Pressure Hydrocephalus and Alzheimer's disease. In *Alzheimer's Association International Conference, Alzheimer's and Dementia Journal* (2023).

* denotes equal contribution