Curriculum Vitae: Kuldeep Kumar

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Education

2013/09 - 2018/09 **Ph.D.**, Computer Science (*Best thesis award*), ETS Montreal, Canada GPA: 4.3/4.3
Thesis: Data-driven methods for characterizing individual differences in brain MRI
Advisor: Prof. Christian Desrosiers, Computer Science

2011/07 - 2012/06 **Master of Technology**, E&ECE, IIT Kharagpur, India GPA: 8.6/10
Thesis: Manifold Prediction of a Time Evolving Structure

2007/07 - 2011/05 **Bachelor of Technology** (*Honours*), IIT Kharagpur, India GPA: 8.6/10
Electronics and Electrical Communication Engineering (E&ECE)

Research Experience

2024/12 - 2025/4 **Visiting Researcher**, *Autism Research Centre*, University of Cambridge, UK

2018/09 - PRESENT **Postdoctoral Researcher**, *Lab Jacquemont*
CHU Sainte-Justine Research Center, University of Montreal, Canada
Developed methods that integrate neuroimaging, psychiatric genetics, cognition, and psychopathology to characterize the effect of genetic risk on human brain

2016/10 - 2017/3 **Visiting Researcher**, *Aramis lab*, ICM, Inria Paris, France
Developed method for white matter fiber segmentation using functional varifolds

2012/06 - 2013/08 **Scientist**, *Indian Space Research Organization (ISRO)*, SAC Ahmedabad, India
Developed satellite image registration algorithms; deployed satellite image based crop forecasting software (FASALSoft); calibrated thermal imaging data for Mars Orbiter Mission

2011/05 - 2011/07 **Research Assistant**, *LIVIA*
MITACS Globalink Research Internship, ETS Montreal, Canada
Developed manifold learning models to predict future states of time-evolving structure

2010/05 - 2010/07 **Research Assistant**, *GREYC Lab*, Universite de Caen Basse-Normandie, France
Compared deep neural networks, and other classifiers for diffusion MRI data classification

Scholarships and Awards

2024/11 Reviewers' Choice Abstract Award, ASHG 2024
American Society of Human Genetics 2024, Denver, USA

2018/11 - 2020/10 IVADO Postdoctoral Scholarship (Genetics and Artificial Intelligence (AI), C$ 140,000)
Institute for Data Valorization (IVADO), Apogée/CFREF, Canada

2020/09 Outstanding Reviewer Award, MICCAI 2020

2019/03 *Best* thesis award, Prix d'excellence du Conseil d'administration de l'ÉTS
ETS Montreal, Canada

2018/05 *Best* poster award, Artificial Intelligence in Medicine (IAM) (C$ 1,000)
Faculté de Médecine, Université de Montréal, Canada

2016/10 - 2017/3 FRQNT-REPARTI International training scholarship (C$ 15,000)
Fonds de recherche du Québec - Nature et technologies (FRQNT), Canada

2016/10 - 2017/3 Mitacs Globalink Research Award-Inria (C$ 10,000)
MITACS and Inria, Canada-France

2013/9 - 2015/8 Mitacs Globalink Graduate Fellowship (C$ 60,000)
MITACS, Canada

2011/7 - 2012/4 Dual degree Assistantship Merit Award (GPA based, C$ 1,200)
Indian Institute of Technology Kharagpur, India

2011/5 - 2011/7 Mitacs Globalink Internship Award (C$ 7,500)
MITACS, Canada

2007/7 - 2011/4 Merit Cum Means Scholarship (C$ 3,000)
Indian Institute of Technology Kharagpur, India

Publications

Scholar profile: https://scholar.google.ca/citations?user=Ujqe9DsAAAAJ&hl=en
ORCID: https://orcid.org/0000-0003-3313-135X

Manuscript in-preparation/under-review

1. Engchuan, W., Shanta, O., **Kumar, K.**, MacDonald, J. R., et al. (2025). Psychiatric disorders converge on common pathways but diverge in cellular context, spatial distribution, and directionality of genetic effects. medRxiv (2025): 2025-07. Part of the **PGC-CNV package**.
2. **Kumar, K.**, Liao, Z., et al. (2025). Cortical differences across psychiatric disorders and associated common and rare genetic variants. medRxiv (2025): 2025-04.
3. Kazem*, S., **Kumar*, K.**, et al. (2025). Gene dosage architecture across complex traits. medRxiv (2025): 2025-02. *: Joint first author.
4. **Kumar*, K.**, Kazem*, S., et al. (2025). Mirror effect of genomic deletions and duplications on cognitive ability across the human cerebral cortex. To be submitted soon. bioRxiv (2025): 2025-01. *: Joint first author. Part of the **PGC-CNV package**.
5. **Kumar*, K.**, Kazem, S., et al. (2025). Copy number variant architecture of the human cerebral cortex. To be submitted soon. Results presented at ASHG 2024.

Refereed Journals

6. Liao, Z., **Kumar, K.**, et al. (2025). Copy Number Variants and the Tangential Expansion of the Cerebral Cortex. Nature Communications 16.1 (2025), 1697.
7. Silva, A. I., et al. (2025). Penetrance of neurodevelopmental copy number variants is associated with variations in cortical morphology. Biological Psychiatry: Cognitive Neuroscience and Neuroimaging (2025).
8. Kopal, J., Huguet, G., Marotta, J., Aggarwal, S., Osayande, N., **Kumar, K.**, Saci, Z., Jean-Louis, M., et al. (2025). A pattern-learning algorithm associates copy number variations with brain structure and behavioural variables in an adolescent population cohort. Nature Biomedical Engineering (2025): 1-16.
9. Schleifer, C., Chang, S., ..., **Kumar, K.**, Hoftman, G., Bearden, C.E., (2025). Unique functional neuroimaging signatures of genetic versus clinical high risk for psychosis. Biological Psychiatry, 97(2), 178-187.
10. Huguet, G., Renne, T., Poulain, C., Dubuc, A., **Kumar, K.**, Kazem, S., Engchuan, W. B., Shanta, O., et al. (2024). Effects of gene dosage on cognitive ability: A function-based association study across brain and non-brain processes. Cell Genomics 4.12 (2024).
11. Kopal, J., **Kumar, K.**, Shafighi, K., Saltoun, K., Modenato, C., Moreau, C. A., Huguet, G., Jean-Louis, M., Martin, C.-O., Saci, Z., et al. (2024). Using rare genetic mutations to revisit structural brain asymmetry. Nature Communications, 15(1), 2639
12. Boen, R., Kaufmann, T., Van der Meer, D., et al. (2024). Beyond the global brain differences: Intraindividual variability differences in 1q21. 1 distal and 15q11. 2 bp1-bp2 deletion carriers. Biological Psychiatry, 95(2), 147–160
13. Harvey, A., Moreau, C. A., **Kumar, K.**, Urchs, S., et al. (2024). Challenges in multi-task learning for fmri-based diagnosis: Benefits for psychiatric conditions and cnvs would likely require thousands of patients. Imaging Neuroscience 2 (2024): 1-20.
14. **Kumar, K.***, Modenato, C.*, Moreau, C., Ching, C. R., Harvey, A., et al. (2023). Subcortical brain alterations in carriers of genomic copy number variants. American Journal of

Psychiatry, 180(9), 685–698. *: Joint first author.

15. Kopal, J., **Kumar, K.**, Saltoun, K., et al. (2023). Rare cnvs and phenome-wide profiling highlight brain structural divergence and phenotypical convergence. Nature Human Behaviour, 7(6), 1001–1017

16. Moreau, C. A., **Kumar, K.**, Harvey, A., et al. (2023). Brain functional connectivity mirrors genetic pleiotropy in psychiatric conditions. Brain, 146(4), 1686–1696

17. Moreau, C. A., Harvey, A., **Kumar, K.**, et al. (2023). Genetic heterogeneity shapes brain connectivity in psychiatry. Biological Psychiatry, 93(1), 45–58

18. Mollon, J., Schultz, L. M., Huguet, G., Knowles, E., Mathias, S. R., Rodrigue, A., Alexander-Bloch, A., Saci, Z., Jean-Louis, M., **Kumar, K.**, et al. (2023). Impact of copy number variants and polygenic risk scores on psychopathology in the uk biobank. Biological Psychiatry, 94(7), 591–600

19. Sønderby, I. E., Ching, C. R., Thomopoulos, S. I., et al. (2022). Effects of copy number variations on brain structure and risk for psychiatric illness: Large-scale studies from the enigma working groups on cnvs. Human Brain Mapping, 43(1), 300–328

20. Chauvin, L., **Kumar, K.**, Desrosiers, C., Wells, W., and Toews, M. (2021). Efficient pairwise neuroimage analysis using the soft jaccard index and 3d keypoint sets. IEEE transactions on Medical Imaging, 41(4), 836–845

21. Modenato, C.*, **Kumar, K.***, Moreau, C., Martin-B., S., et al. (2021). Effects of eight neuropsy- chiatric copy number variants on human brain structure. Translational Psychiatry, 11(1), 399. *: Joint first author.

22. Modenato, C., Martin-B., S., Moreau, C. A., Rodriguez-H., B., **Kumar, K.**, Dra- ganski, B., Sønderby, I. E., and Jacquemont, S. (2021). Lessons learned from neuroimaging studies of copy number variants: A systematic review. Biological Psychiatry, 90(9), 596– 610

23. Moreau, C. A., Ching, C. R., **Kumar, K.**, Jacquemont, S., and Bearden, C. E. (2021). Structural and functional brain alterations revealed by neuroimaging in cnv carriers. Current opinion in genetics and development, 68, 88–98

24. Sønderby, I. E., Van der Meer, D., Moreau, C., Kaufmann, T., Walters, G. B., Ellegaard, M., Abdellaoui, A., Ames, D., Amunts, K., Andersson, M., et al. (2021). 1q21. 1 distal copy number variants are associated with cerebral and cognitive alterations in humans. Translational Psychiatry, 11(1), 182

25. Moreau, C. A., Urchs, S. G., **Kumar, K.**, Orban, P., Schramm, C., Dumas, G., Labbe, A., Huguet, G., Douard, E., Quirion, P.-O., et al. (2020). Mutations associated with neuropsychiatric conditions delineate functional brain connectivity dimensions contributing to autism and schizophrenia. Nature Communications, 11(1), 1–12

26. Chauvin, L., **Kumar, K.**, Wachinger, C., Vangel, M., de Guise, J., Desrosiers, C., Wells, W., and Toews, M. (2019). Neuroimage signature from salient keypoints is highly specific to individuals and shared by close relatives. NeuroImage 204 (2020): 116208.

27. **Kumar, K.**, Siddiqi, K., and Desrosiers, C. (2019). White matter fiber analysis using kernel dictionary learning and sparsity priors. Pattern Recognition, 95, 83–95

28. **Kumar, K.**, Toews, M., Chauvin, L., Colliot, O., and Desrosiers, C. (2018). Multi-modal brain fingerprinting: A manifold approximation based framework. NeuroImage, 183, 212–22622.

29. **Kumar, K.**, Desrosiers, C., Siddiqi, K., Colliot, O., and Toews, M. (2017). Fiberprint: A subject fingerprint based on sparse code pooling for white matter fiber analysis. NeuroImage, 158, 242–259

Peer-reviewed Conferences papers (published as proceedings)

30. Chauvin, L., **Kumar, K.**, Desrosiers, C., De Guise, J., Wells, W., and Toews, M. (2019). Analyzing brain morphology on the bag-of-features manifold. Information Processing in Medical Imaging (IPMI), 11492, 45–56

31. **Kumar, K.**, Chauvin, L., Toews, M., Colliot, O., and Desrosiers, C. (2017). Multi-modal analysis of genetically-related subjects using sift descriptors in brain MRI. Computational diffusion MRI, Miccai 2017 (pp. 219–228). Springer International Publishing (*Oral presentation*)

32. **Kumar, K.**, Gori, P., Charlier, B., Durrleman, S., Colliot, O., and Desrosiers, C. (2017). White matter fiber segmentation using functional varifolds. Mathematical Foundations of Computational Anatomy (MFCA), MICCAI 2017, 10551, 92–100

33. Chauvin, L., **Kumar, K.**, Desrosiers, C., De Guise, J., and Toews, M. (2017). Diffusion orientation histograms (DOH) for diffusion weighted image analysis. Workshop on Computational Diffusion MRI, MICCAI 2017

34. **Kumar, K.**, Desrosiers, C., Chaddad, A., and Toews, M. (2016). Spatially constrained sparse regression for the data-driven discovery of neuroimaging biomarkers. 2016 23rd International Conference on Pattern Recognition (ICPR), 2162–2167

35. Zhang, M., **Kumar, K.**, and Desrosiers, C. (2016). A weighted total variation approach for the atlas-based reconstruction of brain MR data. 2016 IEEE International Conference on Image Processing (ICIP), 4329–4333

36. **Kumar, K.**, and Desrosiers, C. (2016). A sparse coding approach for the efficient representation and segmentation of white matter fibers. 2016 IEEE 13th International Symposium on Biomedical Imaging (ISBI), 915–919

37. **Kumar, K.**, Desrosiers, C., and Siddiqi, K. (2015). Brain fiber clustering using non-negative kernelized matching pursuit. Machine Learning in Medical Imaging: 6th International Workshop, MLMI 2015, Held in Conjunction with MICCAI 2015, Munich, Germany, October 5, 2015, Proceedings 6, 144–152

38. **Kumar, K.**, and Desrosiers, C. (2014). Group sparse kernelized dictionary learning for the clustering of white matter fibers. STMI, MICCAI Workshop 2014

Select Conference Abstracts

- **Kumar, K.**, Liao, Z., et al. (ACNP 2024). P568. Copy Number Variants and Psychiatric Disorders Show Differential Effects on Cortical Thickness and Surface Area. Neuropsychopharmacol. 49 (Suppl 1), 236–417 (2024).
- Kazem*, S., **Kumar*, K.**, et al. (ASHG 2024). Gene dosage architecture across complex traits and common diseases. American Society of Human Genetics 2024.
- **Kumar, K.**, Kazem, S., Liao, Z., et al. (OHBM 2024). Rare variant genetic architecture of human cortical organization. OHBM 2024
- Kazem, S.*, **Kumar, K.***, et al. (2024). Gene dosage architecture across complex traits and Common diseases. Machine Learning in Computational and Systems Biology, MLCSB, ISMB 2024
- **Kumar, K.**, et al. (SOBP 2024). Subcortical brain alterations across copy number variants converge with those in severe mental illnesses. Biological Psychiatry, 95(10), SOBP 2024
- **Kumar, K.**, Kazem, S., Liao, Z., et al. (SOBP 2024). 295. rare variant genetic architecture of the human cortical MRI phenotypes in general population. Biological Psychiatry,

95(10), S220–S221.

- Schleifer, C.,..., **Kumar, K.**, Hoftman, G., Bearden, C.E., (SOBP 2024). 36. unique functional neuroimaging signatures of genetic versus clinical high risk for psychosis. Biological Psychiatry, 95(10), S89–S90.

Select Oral Presentations

2024/11	Discordant Cortical Patterns between Psychiatric Disorders and Corresponding Common and Rare Genetic Risks. Society of Biological Psychiatry (SOBP) 2025, Toronto, Canada
2024/11	Rare Copy Number Variant architecture of the cortical organization of the human brain. American Society of Human Genetics (ASHG) 2024, Denver, USA
2024/05	Subcortical brain alterations across copy number variants converge with those in severe mental illnesses. SOBP 2024, Austin, USA
2023/11	Autism and cognitive ability: insights from gene dosage and large scale brain networks. American Society of Human Genetics (ASHG) 2023, DC, USA
2023/09	Gene dosage across the human brain and effects on cognition and ASD risk. Genes to Mental Health (G2MH) annual meeting, NIMH, USA (2023)

Teaching and Mentoring

2025	Teaching assistant (N=52), Neuromatch Academy 2025 Computational Neuroscience course
2024	Teaching assistant (N=27), Neuromatch Academy 2024 Computational Neuroscience course
2022; 2023	Neuromatch Academy 2022 (N=6) / and 2023 Mentor (N=7) Mentored Neuromatch Academy students for their final projects
2018-present	PhD students supervision (N=2)
2019; 2021	CHU Sainte-Justine undergraduate Internship supervision (N=2)
2016, 2015	Globalink Mentor, MITACS (N=6,6) Mentored Globalink Research Interns (GRIs) from Tunisia, China, & France
2011-12	Teaching assistant, Digital signal processing; Basic Electronics; IIT Kharagpur

Grants

2025	Co-I on CIHR grant, "Multifeature brain investigation of genetic liability for neurodevelopmental and psychiatric disorders" (PI: Sebastien Jacquemont)
2023	Part of NIH R01 grant on Neuroimaging & CNVs (PI: Sebastien Jacquemont, Paul Thompson, and Carrie Bearden) Power analysis, and preliminary results for aims 1,2, and 3.
2023	Part of CIHR grant, "Combining Space, Time, and cell types to decode and explain the effect sizes of rare genomic variants on cognition and psychopathology." (PI: Sebastien Jacquemont) Power analysis, and preliminary results for aims 1,2, and 3.
2023	Part of NIH R01 grant on 22q11.2 deletion (PI: Carrie Bearden) Power analysis and preliminary results for aim 3.

Other scientific activities

Working group member	PGC-CNV; ENIGMA-CNV; CAMP project, Genes to Mental Health Network
Society membership	SfN; ASHG; SOBP
Reviewing	IEEE Transactions on Medical Imaging (IEEE TMI) Biological Psychiatry; Human Brain Mapping (HBM); IAPR International Conference on Machine Vision Applications (MVA) Journal of Psychiatric Research; OHBM; MICCAI;