

Nicolas Honnorat, Ph.D.

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San Francisco, CA 94103
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RESEARCH INTERESTS

Medical Image Analysis, Optimization, Machine Learning, MRI, resting-state fMRI.

EDUCATION

- 2014-2015 **Clinical Research Certificate**
Center for Clinical Epidemiology and Biostatistics,
Department of Biostatistics and Epidemiology, University of Pennsylvania, Philadelphia, PA
- 2009-2012 **Ph.D. (Applied Mathematics)**
Center for Visual Computing, Ecole Centrale Paris, Paris France GE Medical Systems, Buc France
Thesis: *Segmentation and Tracking of Surgical Devices in Interventional Images*. under the supervision of Prof. Nikos Paragios (Ecole Centrale Paris, INRIA) and Régis Vaillant (GE Medical Systems)
- 2007-2008 **M.Sc. in Applied Mathematics, Computer Vision and Machine Learning**
Ecole Centrale Paris, Ecole Normale Supérieure de Cachan, Paris, France
- 2005-2008 **Engineering degree**
Ecole Centrale Paris (top 3% French engineering schools), Paris, France
Specialization in Applied Mathematics and Computer Vision

EXPERIENCE

- 7/2018 **Research Scientist, SRI International**
I developed new processing methods for the clinical MRI data of the lab.
I processed the lab MRI data to study how HIV and alcohol use disorder affect brain function.
I published our clinical findings.
I developed new software to assess the quality of the clinical data acquired by our collaborators.
- 9/2017 - 6/2018 **Research Associate (faculty appointment), University of Pennsylvania**, Department of Radiology
I developed and I published new methods to analyze the functional brain connectivity derived from fMRI, including efficient methods to compute “effective” brain connectivity and functional causality.
I mentored graduate students and master’s students.
I studied how Cognitive Behavioral Therapy for Major Depressive Disorder improves brain function.
- 1/2013 - 9/2017 **Postdoctoral Fellow (postgraduate training), University of Pennsylvania**, Department of Radiology
I developed and I published new brain parcellation methods for functional MRI.
I mentored graduate students and master’s students.
I developed a new neuroimaging Data Mining method, that I used to reveal and characterize a set of Schizophrenia and Alzheimer’s Disease subtypes.
- 7/2010 - 8/2010 **Ph.D. internship, Yale University**, Yale School of Medicine (under the supervision of Prof. J.S. Duncan)
I developed and I published a method to segment microtubules (long curvilinear cell structures) observed using total internal reflection fluorescence microscopy (TIRFM).
- 5/2008 -11/2008 **Master’s Degree internship, CEA**, Fontenay-aux-Roses research center, France
I developed a new variant of AdaBoost able to classify photographic images into multiple categories.
I processed benchmark publicly available datasets to validate and publish the method.

PROGRAMMING SKILLS

Most significant experience in: Python (including Tensorflow, Keras), Java, C++ (including OpenCV), bash scripting
Statistical, mathematical, and editing software: R, Matlab, LaTeX

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Scientific Curriculum Vitae

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Education

2014-2015 **Clinical Research Certificate**
Center for Clinical Epidemiology and Biostatistics,
Department of Biostatistics and Epidemiology
University of Pennsylvania

2009-2012 **Ph.D.** (Applied Mathematics)
Center for Visual Computing, Ecole Centrale Paris, Paris FRANCE and
GE Medical Systems, Buc FRANCE.
Thesis: "Segmentation and Tracking of Surgical Devices in Interventional
Images." under the supervision of Prof. Nikos Paragios (Ecole Centrale
Paris, INRIA) and Régis Vaillant (GE Medical Systems)

2007-2008 **M.Sc. in Applied Mathematics, Computer Vision and Machine Learning**
Ecole Centrale Paris, Ecole Normale Supérieure de Cachan

2005-2008 **Engineering Degree**
Ecole Centrale Paris (top 3% French engineering schools) top 10%
Specialization in Applied Mathematics and Computer Vision

Current Appointment

7.2018 **Research Scientist,**
SRI International

Faculty Appointment

9.2017 6.2018 **Research Associate,**
Department of Radiology, University of Pennsylvania

Postgraduate Training

1.2013 9.2017 **Postdoctoral Fellow,**
Department of Radiology, University of Pennsylvania

Internships

7.2010 8.2010 **Ph.D. internship**
Image Processing and Analysis Group, Yale University, USA
Subject: "Microtubules segmentation in TIRFM images"
under the supervision of J.S. Duncan

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5.2008 11.2008 **Master's internship**
CEA research center, Fontenay-aux-Roses, France
Subject: "objects and photos classification"
under the supervision of Hervé Le Borgne

Research Interests

Medical Image Analysis, Optimization, Machine Learning, MRI, resting-state fMRI

Academic Honors and Grants

2018 **NVIDIA GPU grant**
granted for the development of CUDA libraries
dedicated to fMRI data processing.

2017 **Center for Biomedical Image Computing and Analytics seed grant**, University of Pennsylvania
"Creating a Scalable Infrastructure to Accelerate Clinical Applications of Functional
Connectomics" TD. Satterthwaite, DS. Bassett, P Cook, Nicolas Honorat, Yong Fan

2009 2012 **Ph.D. grant**, Association Nationale Recherche Technologie (ANRT), a French public agency
supporting public-private research collaborations

2010 **Best conference paper**, 2010 International Workshop on Content Based
Multimedia Indexing (CBMI)

Publications

1. **Honorat N**, Fama R, Müller-Oehring EM, Zahr NM, Pfefferbaum A, Sullivan EV, Pohl KM. "Alcohol Use Disorder and its Comorbidity with HIV Infection Disrupt Anterior Cingulate Cortex Functional Connectivity." Biological Psychiatry: Cognitive Neuroscience and Neuroimaging. In press
2. **Honorat N**, Pfefferbaum A, Sullivan EV, Pohl KM. "Deep Parametric Mixtures for Modeling the Functional Connectome." International Workshop on Predictive Intelligence In Medicine (PRIME) 133-143, 2020
3. **Honorat N**, Saranathan M, Pohl KM, Sullivan EV, Pfefferbaum A, Zahr NM. "Alcohol use disorder alters functional connectivity of the thalamic nuclei." Alcoholism: Clinical and Experimental Research, volume 44 (Issue S1): 140A, 2020
4. Chanraud S, Abdallah M, **Honorat N**, Saranathan M, Zahr NM, Sullivan EV. "Fronto-cerebellar connectivity dynamics in alcoholism." Alcoholism: Clinical and Experimental Research, volume 44 (Issue S1): 137A, 2020
5. Zhao Q, Sullivan EV, Müller-Oehring EM, **Honorat N**, Adeli E, Podhajsky S, Baker FC, Colrain IM, Prouty D, Tapert SF, Brown SA, Meloy MJ, Brumback T, Nagel BJ, Morales AM, Clark DB, Luna B, De Bellis MD, Voyvodich JT, Nooner KB, Pfefferbaum A, Pohl KM. "Adolescent alcohol use disrupts functional neurodevelopment in sensation seeking girls." Addiction biology. e12914 . 2020, in press
6. **Honorat N**, Adeli E, Zhao Q, Pfefferbaum A, Sullivan EV, Pohl KM. "Covariance shrinkage for dynamic functional connectivity." Connectomics in Neuroimaging (CNI), 32-41, 2019 (**oral presentation**)
7. Zhao Q, Adeli E, **Honorat N**, Leng T, Pohl KM. "Variational AutoEncoder For Regression: Application to Brain Aging Analysis." International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) Part II:823-831, 2019
8. Zhao Q, **Honorat N**, Adeli E, Pfefferbaum A, Sullivan EV, Pohl KM. "Variational Autoencoder with Truncated Mixture of Gaussians for Functional Connectivity Analysis." Information Processing in Medical Imaging (IPMI) 2019
9. Batta I, **Honorat N**, Davatzikos C. "Regularized topological data analysis for extraction of coherent brain regions." SPIE Medical Imaging 2019 (oral presentation)
10. Sahoo D, **Honorat N**, Davatzikos C. "Sparse low-dimensional causal modeling for the analysis of brain function." SPIE Medical Imaging 2019

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11. **Honorat N**, Dong A, Meisenzahl-Lechner E, Koutsouleris N, Davatzikos C. "Neuroanatomical Heterogeneity of Schizophrenia Revealed by Semi-supervised Machine Learning Methods." Schizophrenia Research. 214:43 - 50, 2019
12. Zhen Yang, Shi Gu, **Nicolas Honorat**, Kristin A. Linn, Russell T. Shinohara, Irem Aselcioglu, Steven Bruce, Desmond J. Oathes, Christos Davatzikos, Theodore D. Satterthwaite, Danielle S. Bassett, Yvette I. Sheline. "Network Changes Associated with Transdiagnostic Depressive Symptom Improvement Following Cognitive Behavioral Therapy in MDD and PTSD." Molecular Psychiatry, 23(12):2314 – 2323, 2018
13. Harini Eavani, Theodore D Satterthwaite, Yang An, Meng-Kang Hsieh, **Nicolas Honorat**, Guray Erus, Jimit Doshi, Luigi Ferrucci, Lori L Beason-Held, Susan M Resnick, Christos Davatzikos. "Heterogeneity of Structural and Functional Imaging Patterns of Advanced Brain Aging Revealed via Machine Learning Method." Neurobiology of Aging, 71:41-50, 2018
14. Sahoo D, **Honorat N**, Davatzikos C. "GPU accelerated extraction of sparse Granger causality patterns." IEEE International Symposium on Biomedical Imaging (ISBI) 2018 (oral presentation)
15. **Honorat N**, Davatzikos C. "Extrapolated nonnegative decompositions for the analysis of functional connectivity." SPIE Medical Imaging 2018 (oral presentation)
16. **Honorat N**, Davatzikos C. "High resolution robust and smooth precision matrices to capture functional connectivity." SPIE Medical Imaging 2018
17. **Honorat N**, Satterthwaite TD, Gur RE, Gur RC, Davatzikos C. "sGraSP: A graph-based method for the derivation of subject-specific functional parcellations of the brain." Journal of neuroscience methods, 277:1-20, 2017
18. Dong A, Toledo JB, **Honorat N**, Doshi J, Varol E, Sotiras A, Wolk D, Trojanowski JQ, Davatzikos C. "Heterogeneity of neuroanatomical patterns in prodromal Alzheimer's disease: links to cognition, progression and biomarkers." Brain, 140(3):735-747, 2017
19. **Honorat N**, Parker D, Tunc B, Davatzikos C, Verma R. "Subject-specific Structural Parcellations Based on Randomized AB-divergences." International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) 2017
20. **Honorat N**, Davatzikos C. "Riccati-regularized Precision Matrices for Neuroimaging." Information Processing in Medical Imaging (IPMI), 275-86, 2017 **(oral presentation, top 15%)**
21. *Gross P, ***Honorat N**, *Varol E, Wallner M, Trappanese DM, Sharp TE, Starosta T, Duran JM, Koller S, Davatzikos C, Houser SR. "Nuquantus: Machine learning software for the characterization and quantification of cell nuclei in complex immunofluorescent tissue images." Scientific reports, 6:23431, 2016
*These authors contributed equally to this work.
22. Dong A, **Honorat N**, Gaonkar B, Davatzikos C. "CHIMERA: Clustering of Heterogeneous Disease Effects via Distribution Matching of Imaging Patterns." IEEE transactions on medical imaging (TMI), 35(2):612-21, 2016
23. **Honorat N**, Eavani H, Satterthwaite TD, Gur RE, Gur RC, Davatzikos C. "GraSP: geodesic Graph-based Segmentation with Shape Priors for the functional parcellation of the cortex." NeuroImage, 106:207-21, 2015
24. Le Borgne H, **Honorat N**. "Fast shared boosting for large-scale concept detection." Multimedia Tools and Applications, 60(2):389-402, 2012
25. **Honorat N**, Eavani H, Satterthwaite TD, Davatzikos C. "A Graph-based Brain Parcellation Method Extracting Sparse Networks." International Workshop on Pattern Recognition in Neuroimaging (PRNI), 157-60, 2013
26. **Honorat N**, Vaillant R, Paragios N. "Graph-based Guide-wire Segmentation through Fusion of Contrast-enhanced and fluoroscopic Images." IEEE International Symposium on Biomedical Imaging (ISBI), 948-51, 2012 **(oral presentation, top 20%)**
27. **Honorat N**, Vaillant R, Paragios N. "Graph-based geometric-iconic guide-wire tracking." International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI), 14(Pt 1):9-16, 2011
28. **Honorat N**, Vaillant R, Duncan JS, Paragios N. "Curvilinear structures extraction in cluttered bioimaging data with discrete optimization methods." IEEE International Symposium on Biomedical Imaging (ISBI), 1353-1357, 2011
29. **Honorat N**, Vaillant R, Paragios N. "Guide-wire extraction through perceptual organization of local segments in fluoroscopic images." International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI), 13(Pt 3):440-8, 2010

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30. **Honorat N**, Vaillant R, Paragios N. "Robust guidewire segmentation through boosting, clustering and linear programming." IEEE International Symposium on Biomedical Imaging (ISBI), 924-927, 2010
31. Le Borgne H, **Honorat N**. "Fast shared boosting for large-scale concept detection." International Workshop on Content Based Multimedia Indexing (CBMI), 1-6, 2010 (best paper award)
32. **Honorat N**, Le Borgne H. "Accélérer le boosting avec partage de caractéristiques." Proceedings of CORESA 2009, 203-8, 2009 (in French)

Peer-reviewed Abstracts

1. Yang Z, Gu S, **Honorat N**, Oathes D, Bruce S, Shinohara T, Aselcioglu I, Cook PA, Linn KA, Satterthwaite TD, Bassett DS, Sheline YI. "*Intrinsic functional organization and network roles in MDD and PTSD change with Cognitive Behavioral Therapy (CBT).*" 56th Annual meeting of the American College of Neuropsychopharmacology (ACNP) 2017
2. Eavani H., Habes M., An Y., Hsieh M.-K., **Honorat N**, Erus G., Doshi J., Ferrucci L., Beason-Held L.L., Resnick S.M., Davatzikos C. *Mapping the heterogeneity of neuroanatomy and functional connectivity deviation from typical brain aging: a pattern analysis and machine learning study.* Alzheimer's and Dementia 13(7):P1464, 2017
3. Peifer M, **Honorat N**, Davatzikos C. "*Randomized voxel based morphometry for the study of cortical myelin group differences.*" Organization for Human Brain Mapping (OHBM) 2017
4. Sahoo D, **Honorat N**, Davatzikos C. "*GPU accelerated extraction of sparse Granger causality patterns.*" Organization for Human Brain Mapping (OHBM) 2017
5. **Honorat N**, Davatzikos C. "*Functional Stability of the Human Connectome Project Parcellation.*" Organization for Human Brain Mapping (OHBM) 2017
6. **Honorat N**, Satterthwaite T, Gur RC, Gur RE, Davatzikos C. "*Relations between local cortical geometry and functional homogeneity: a replication study.*" Organization for Human Brain Mapping (OHBM) 2017
7. Eavani H, **Honorat N**, An Y, Hsieh M, Erus G, Doshi J, Ferrucci L, Beason-Held L, Resnick S, Davatzikos C. "*Discovering heterogeneous patterns of advanced brain aging: a BLSA study.*" Organization for Human Brain Mapping (OHBM) 2016 (oral presentation, top 1%)
8. **Honorat N**, Satterthwaite T, Gur RE, Gur RC, Davatzikos C. "*Reproducible and Efficient Computation of Functional Partial Correlations for the Entire Brain.*" Organization for Human Brain Mapping (OHBM) 2016
9. **Honorat N**, Eavani H, Satterthwaite T, Gur R, Gur R, Davatzikos C. "*Subject-specific Parcellations Detect Reduced Local Functional Coherence during Neuro Development.*" Organization for Human Brain Mapping (OHBM) 2015
10. **Honorat N**, Satterthwaite T, Vandekar S, Shinohara R, Gur R, Gur R, Davatzikos C. "*Correlation and Spatial Coherence of Functional Homogeneity, Cortical Curvature and Thickness.*" Organization for Human Brain Mapping (OHBM) 2015
11. **Honorat N**, Eavani H, Satterthwaite T, Gur RE, Gur RC, Davatzikos C. "*Discrete functional parcellation of the cortex with clustering methods and MRF.*" Fourth Biennial Conference on Resting State-Brain Connectivity 2014
12. **Honorat N**, Eavani H, Satterthwaite T, Gur RE, Gur RC, Davatzikos C. "*Functional Parcellation of the Cortex from rs-fMRI with Graph-based Methods and shape priors.*" Organization for Human Brain Mapping (OHBM) 2014 (oral presentation, top 1%)

Book chapter

Sotiras A, Gaonkar B, Eavani H, **Honorat N**, Varol E, Dong A, Davatzikos C. Chapter 10, Machine learning as a means toward precision diagnostics and prognostics. in Machine Learning and Medical Imaging. pp:299-334. Wu G, Shen D, Sabuncu M, editors. London, United Kingdom: Academic Press is an imprint of Elsevier 2016

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Ph.D. Thesis

Curvilinear Structures Segmentation and Tracking in Interventional Imaging 2013

Talks, Poster Presentations, Oral Presentations

1. *Deep Parametric Mixtures for Modeling the Functional Connectome. International Workshop on Predictive Intelligence In Medicine (PRIME)*, Lima Peru (online), 2020
2. *Cardinality-constrained Functional Connectivity Estimation to Quantify Neurodevelopment*. Symposium of the Stanford Neuroscience Institute, Stanford University, Palo Alto, CA, USA, 2018
3. *Extrapolated nonnegative decompositions for the analysis of functional connectivity*. SPIE Medical Imaging Conference, Houston, TX, USA, 2018
4. *High resolution robust and smooth precision matrices to capture functional connectivity*. SPIE Medical Imaging Conference, Houston, TX, USA, 2018
5. *16th Annual Biomedical Postdoctoral Research Symposium*, University of Pennsylvania, 2017
6. *Subject-specific Structural Parcellations Based on Randomized AB-divergences*. MICCAI Conference, Quebec city, Canada, 2017
7. *Riccati-regularized Precision Matrices for Neuroimaging*. IPMI Conference, Boone, NC, USA, 2017
8. *Discovering heterogeneous patterns of advanced brain aging: a BLSA study*. OHBM Conference, Geneva, Switzerland, 2016
9. *Reproducible and Efficient Computation of Functional Partial Correlations for the Entire Brain*. OHBM Conference, Geneva, Switzerland, 2016
10. *Subject-specific Parcellations Detect Reduced Local Functional Coherence during Neuro Development*. OHBM Conference, Honolulu, HI, USA, 2015
11. *Correlation and Spatial Coherence of Functional Homogeneity, Cortical Curvature and Thickness*. OHBM Conference, Honolulu, HI, USA, 2015
12. *Graph-based Segmentation with Shape Priors for the functional parcellation of the cortex*, Paris, 2014
13. *Discrete functional parcellation of the cortex with clustering methods and MRF*. Fourth Biennial Conference on Resting State-Brain Connectivity, MIT, Boston, MA, USA, 2014
14. *Functional Parcellation of the Cortex from rs-fMRI with Graph-based Methods and shape priors*. OHBM Conference, Hamburg, Germany, 2014
15. *A Graph-based Brain Parcellation Method Extracting Sparse Networks.* PRNI Conference, University of Pennsylvania, PA, USA, 2013
16. *Graph-based Guide-wire Segmentation through Fusion of Contrast-enhanced and fluoroscopic Images*. ISBI Conference, Barcelona, Spain, 2012
17. *Graph-based geometric-ionic guide-wire tracking*. MICCAI Conference, Toronto, Canada, 2011
18. *Curvilinear structures extraction in cluttered bioimaging data with discrete optimization methods*. ISBI Conference, Chicago, IL, USA, 2011
19. *Guide-wire extraction through perceptual organization of local segments in fluoroscopic images*. MICCAI Conference, Beijing, China, 2010
20. *Robust guidewire segmentation through boosting, clustering and linear programming*. ISBI conference, Rotterdam, The Netherlands, 2010

Patent

Honorat A, **Honorat N.** "Smartphone-authenticable paper." FR3035819 (A1), November 11, 2016

Teaching and mentoring

Graduate students mentoring

- Sahoo D. (2017-present) University of Pennsylvania
- Dong A. (2015-2017) University of Pennsylvania
- Peifer M. (Fall 2016) University of Pennsylvania

Undergraduate students mentoring (Internships)

- Bhatta I. (2017-present) University of Pennsylvania
- Sahoo D. (2016-2017) University of Pennsylvania

Undergraduate students research projects mentoring

- Andrew M. (Spring 2017)
Introduction to Electrical & Systems Engineering Research Methodology & Design (ESE 291)
University of Pennsylvania
- Computer vision research projects for two groups of five first-year students at Ecole Centrale Paris (Spring 2012)

Teaching assistant

2010-2012 Teaching Assistant for the Computer Vision lecture
Ecole Centrale Paris, second year engineering students

Teaching preparation

Fall 2017 Course in college teaching, Center for teaching and learning, University of Pennsylvania

Memberships in Professional and Scientific Societies

2010-2011-2017 MICCAI society (Medical Image Computing and Computer-Assisted Intervention)

2014-2019 Organization for Human Brain Mapping (OHBM)

2011-2019 Institute of Electrical and Electronics Engineers (IEEE)

Peer review

Journals

NeuroImage, IEEE Transactions on Medical Imaging (TMI), Medical Image Analysis, IEEE Signal Processing Letters

Conferences

- The 22th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2019)
- The 21th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2018)
- The 20th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2017)
- The 18th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2015)
- The 5th International Workshop on Pattern Recognition in Neuroimaging (PRNI 2015)
- The 16th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2013)

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Program committee

- International Workshop on Radiomics and Radiogenomics in Neuro-oncology (RNO-AI) 2019, held in Conjunction with MICCAI 2019, Shenzhen, China, October 13, 2019
- International Workshop on Radiomics and Radiogenomics in Neuro-oncology (RNO-AI) 2020, held in Conjunction with MICCAI 2020, Lima, Peru, October 8, 2020