ROGERS F SILVA

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SUMMARY OF QUALIFICATIONS

- 10+ years of experience in:
  - statistical and machine learning, image analysis, neural nets
  - multimodal neuroimaging (1000+ subject datasets: functional and structural MRI, EEG, DWI, genetic)
  - algos. for latent variable models (ICA, PCA, CCA, ISA, IVA)
  - mapping hard real-world problems into mathematical models, and optimizing solutions.
- Innovative developer: leading-edge program for multidataset multidimensional learning (MISA).
- Numerical optimization expert: constrained, combinatorial, multiobjective (Pareto), stochastic.
- Highly skilled in Matlab, Python and R; experience in C/C++.
- Prior exposure to Natural Language Processing using basic cepstral features and GMMs with EM.
- Proficient in design of experiments (DOE) using response surface methodology (RSM).
- Clear and effective writing of articles, and grant proposals.

EDUCATION

Ph.D. in Computer Engineering (with Distinction) May/2017
The University of New Mexico Albuquerque, NM
Biomedical Image Processing track GPA: 3.81/4.0

- Thesis: "Multidataset Independent Subspace Analysis: A Framework for Analysis of Multimodal, Multi-subject Brain Imaging Data"
- Courses in: Advanced machine learning, Pattern recognition, Statistical inference, Bayesian learning, Spatiotemporal statistics, MCMC, Gene microarray analysis, etc.

M.Sc. in Computer Engineering Dec/2011
The University of New Mexico Albuquerque, NM
Image Processing track GPA: (see Ph.D.)

- Graduate Minor in Statistics.
- Graduate Minor in Mathematics.

B.Sc. in Electrical Engineering Dec/2003
Catholic University (PUCRS) Porto Alegre, Brazil
Computer architecture track GPA: 3.5/4.0

- Thesis: "Deployment of Digital Filter Banks for Acoustic Tuning of Musical Instruments."
- Instructor of a special topics seminar: "Introduction to object-oriented programming."

B.Sc. in Computer Science (50% complete) 1999-2005
Federal University (UFRGS) Porto Alegre, Brazil

- Courses in: operations research, operating systems, SQL data bases, software engineering, computational logic, computer architecture and organization, and data structures.

PUBLICATIONS (COMPLETE LIST BELOW)

- 12 **journals**: 3 as first author, 9 as co-author.
- 11 **conference papers**: 4 as first-author, 7 as co-author.
- 1 **book chapter**: as first author
- 10 **abstracts**: 8 as first-author, 2 as co-author.

HONORS & AWARDS

- **"Top-of-the-class" Student Award**: Catholic University (PUCRS), Electrical Engineering Dept. (Class of 2003).
- **Research Assistantship Award**: UNM, Electrical and Computer Engineering Dept. (Fall 2006).
- **MNTP Travel Award**: Mellon Institute, CNBC / University of Pittsburgh / Carnegie Mellon University (Summer 2016).
- **First Prize**: UNM ASA DataFest hackathon, "The Visards" Team ("Best in Show" award, Apr/21-23/2017), http://www.dailylobo.com/article/2017/04/data-fest-recap
- **MNTP Symposium Travel Award**: Mellon Institute, CNBC / University of Pittsburgh / Carnegie Mellon University, (Summer 2017).
- **Contributed Talk**: "Multidataset Independent Subspace Analysis," MILA's Deep Learning Summer School (Jun/30/2017), http://videolectures.net/deeplearning2017_silva_subspace_analysis/
- **Magazine feature**: "Will Big Data Save Psychiatry?", Psychology Today (Sep/05/2017), https://www.psychologytoday.com/articles/201709/will-big-data-save-psychiatry
- **NeuroHackademy Travel Award**: University of Washington eScience Institute (Summer 2018)
- **Conference travel awards**: San Francisco, Barcelona, China, Toronto, Quebec-City, Hawaii, Pittsburgh (2008-2017).

GRANT AWARDS

- **NIH Sub-award**: "DeepMISA: Gateway to Nonlinear Multimodal Fusion." Pre-approved pilot project. $25,000 (Dec/2018).

PROFESSIONAL EXPERIENCE

Postdoctoral Fellow Spring 2017 – Present
Medical Image Analysis Lab, The Mind Research Network (MRN) Albuquerque, NM

- Conduct and manage research on multimodal multidimensional models for brain data analysis.
- Develop new latent variable models and algorithms for exploratory data analysis of multiple datasets (ICA, PCA, CCA, ISA, IVA, MISA) utilizing numerical optimization techniques.
- Publish scientific articles on peer-reviewed journals and conferences.
- Review relevant scientific literature, and implement/test novel models for statistical signal processing, machine learning, and brain image analysis.
- Provide support on linear algebra, optimization, and simulations to peers and collaborators.
- Preparation of grant proposals.
- Reviewer for NeuroImage, IEEE Trans. Image Processing, Journal of Neuroscience Methods.

Data Scientist Spring 2017 – Present
Datalytic Solutions Albuquerque, NM

- Execute data analysis and web development projects for external and internal clients.
- Python, web frameworks, JavaScript, SQL

Visiting Postdoctoral Fellow 07/2018 – 08/2018
Machine Learning and Signal Processing Lab, UMBC Baltimore, MD

- Nonlinear ICA and Multimodal Fusion (mentored by Dr. Tulay Adali)

Research Fellow 05/2016 – 07/2016
Mellon Institute, CNBC / University of Pittsburgh / Carnegie Mellon University Pittsburgh, PA

- Multimodal Neuroimaging Training Program (MNTP) – Diffusion Imaging workgroup.

Visiting Fellow 04/2016 – 05/2016
Martinos Center, MGH / Harvard University / MIT Boston, MA

- MGH/HST Multimodality Short Course.

Graduate Research Assistant Spring 2007 – Fall 2016
Medical Image Analysis Lab, The Mind Research Network (MRN) Albuquerque, NM

- Developed a new latent variable model for analysis of multimodal datasets (MISA)
- Developed a novel simulation framework to test hypotheses and validate image analysis systems.
- Recruited subjects and performed data collection at an MRI scanner.
- Provided technical support in lab activities (e.g., courses sponsored by MIALAB).

Consulting Engineer Spring 2006
Maquinas Medianeira Porto Alegre, Brazil

Lecturer Fall 2005
Contestado University Contestado, Brazil

- Taught an undergraduate level class on robotics. Prepared class notes, homeworks and exams.

Electrical Engineer 10/2003 – 08/ 2005
MURI Assembly Systems Porto Alegre, Brazil

- Designed, supervised deployment of assembly lines for Brose Chicago, Magneti Marelli, DANA, Whirlpool.
- Interacted directly with clients to assess their needs and identify solutions.
- Consulting services to peers in different departments and in new incoming projects.

Research Assistant 03/2001 – 09/2003
MetroPOA Networks Communication Lab, Catholic University (PUCRS) Porto Alegre, Brazil

- Object-oriented programming with Delphi
- OO software engineering using UML.

Volunteer Laboratory Assistant 08/1999 – 07/2000
Automation and Systems Control Group, Catholic University (PUCRS) Porto Alegre, Brazil

PROJECTS

- Multidataset ISA (MISA): multimodal data fusion for thousands of datasets. Developed a new latent variable model with statistical independence at a deeper layer of the neural network, combining combinatorial optimization with interior point nonlinear-constraint optimization using L-BFGS-B. Result: a robust generalization of ICA, IVA and ISA models in one single algorithm. Outcomes: *1 conference paper, 2 journal articles in prep*. Ongoing.
- Parallel ICA with IVA: fusion of brain imaging-genetics data by extending the traditional Parallel ICA framework in order to incorporate IVA with Gaussian distribution for detection of multimodal features with similar subject expression profiles. Ongoing.
- DeepMISA: a pre-approved NIH pilot project for mathematical derivation and prototyping of an extension of MISA to the nonlinear case using deep learning architectures. Ongoing.
- Decentralized joint ICA: joint ICA model for distributed processing of decentralized data. Algorithm development and a simulation using GARCH time-series model that demonstrated the benefit of decentralized joint ICA over regular joint ICA. Mentoring a graduate student. Outcomes: *2 conference papers, 1 journal article (In Press)*. Ongoing.
- BCA: application of a biologically-inspired implementation of bounded component analysis for extraction of dynamic subgaussian connectivity features from dFNC graphs. Ongoing.

- NICE: consulting feedback on the theory, interpretation and testing of nonlinear ICA using NICE. 2015.
- Stochastic Neuroimaging simulation: combinatorial optimization technique using simulated annealing to conform data samples into meaningful (non-stationary) features. Outcome: 2 *journal articles*. 2012-2014.
- Sparse ICA: combining independence and nonlinear sparse projections in a flexible framework for genetic SNP data. Mentoring a graduate student. Development and proof-of-concept demos. Automatic differentiation and stochastic optimization. Outcomes: *1 conference paper*. Ongoing.
- Sparse Parallel ICA: leveraging the results from the sparse ICA project to identify sparse features in a multimodal imaging-genetics fusion setting using Parallel ICA. Ongoing.
- Parallel GICA+ICA: combining group ICA (GICA) of functional MRI scans and ICA of structural MRI scans into a Parallel ICA framework that can directly leverage temporal information in the data. Ongoing.
- Cross-frequency dependence in fMRI: multiset CCA to identify cross-frequency dependence in Hilbert transformed fMRI data. Model development and evaluation. Outcomes: *1 abstract, 1 conference paper, 1 journal article (in prep.)*. Ongoing.
- Record linkage: Django web app to identify linked records in SQL Server database from incomplete queries. Damerau-Levenshtein distance, SQL querying, ranking records based on classifier scores, Google Drive API for report generation. Outcomes: *application deployed for client*. Ongoing.
- Online Data Analysis: JavaScript and Django web app. Managed the concept and development: wireframe design, PostgreSQL, Python statsmodels package. Outcomes: *prototype application completed with simple multiple linear regression*.
- DIM: Simulations to verify the performance of Deep Infomax. Ongoing.
- Decentralized IVA: extension of IVA for distributed processing of decentralized data. Mentored an undergraduate student. Outcome: *1 conference paper, 1 journal article (in prep.)*. Ongoing.
- Memory Efficient group PCA: identified connections and trade-offs between different group PCA algorithms using Pareto-optimal analysis, leading to two optimized implementations. Extensive writing contributions. Outcome: *2 journal articles*. 2014-2015.
- Multimodal Kaggle competition: designed and managed a machine learning Kaggle challenge: classify schizophrenic patients using real data features from multimodal MRI data. Outcome: *348 players (2244 entries), 1 conference paper*. 2014.
- COINSTAC: an open-source platform for federated data analysis. Distributed processing of decentralized data for collaborative research. Decentralization of several models, including linear regression, group PCA, group ICA, dFNC, joint ICA, and IVA. Outcomes: *1 journal article (accepted)*. Ongoing.
- Medical Record Analysis: Python modules for data extraction from photocopied tabular records. Scikit-image and pandas packages, OCR, data consistency assessments and cleaning, summarization and report generation. Outcomes: *reports delivered to client for use in court*.
- Joint-IVA diffusion: new approach to combine multimodal diffusion and structural MRI features
- Diffusion from BOLD-fMRI: fusion of DTI- and BOLD-fMRI-derived tensors using IVA and joint ICA. Exploring similarities and limitations of each modality. Ongoing.
- Test-Retest Reliability of Diffusion Imaging: Assess the reproducibility of diffusion indices and network measures derived from DTI and DSI data. Outcome: *1 journal article (in prep.)*. Ongoing.

RELATED COURSES

- Summer Schools: NeuroHackademy at University of Washington eScience Institute (2018),
  Deep Learning and Reinforcement Learning at University of Montreal (MILA) (2017),
  Mathematics in Brain Imaging at UCLA (NITP) (2008).
- FMRI Analysis Courses: NIBL (UNC), NC (2017),
  MRN (LBERI), NM (2012).
- Web scrapping and content mining with Python (Practical Programming, Aug/2017).
- JavaScript 101 with Google Script (Fullstack Academy, Aug/2017).
- Business Plan and Entrepreneurship course (Summer 2005).
- DELL Short Course on Linux Cluster Setup (Spring 2004).

RELATED EXPERIENCE, SKILLS, AND MEMBERSHIPS

- numpy, nilearn, nibabel, nipype, scikit-learn, scikit-image, ggplot2, LASSO, SAS, LaTeX, Git, virtual environments.
- Fluent in English, Portuguese, Spanish.
- Member: IEEE, Organization for Human Brain Mapping (OHBM).

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PUBLICATION LIST

Journal

[1] **R.F. Silva**, S.M. Plis, T. Adalı, M.S. Pattichis, V.D. Calhoun, "Multidataset Independent Subspace Analysis," IEEE Trans Image Process, 2018. (in prep.)

[2] S. Qi, J. Sui, J. Chen, J. Liu, R. Jiang, **R. Silva**, A. Iraji, E. Damaraju, M. Salman, D. Lin, Z. Fu, D. Zhi, J. Bustillo, J.A. Turner, D.H. Mathalon, J.M. Ford, J. Voyvodic, B.A. Mueller, A. Belger, S. McEwen, S.G. Potkin, A. Preda, V.D. Calhoun, "Parallel Group ICA + ICA: Joint Estimation of Linked Functional Network Variability and Structural Covariation with Application to Schizophrenia," IEEE Trans Med Imaging, 2018. (submitted)

[3] B.T. Baker, A. Abrol, **R.F. Silva**, E. Damaraju, A.D. Sarwate, V.D. Calhoun, S.M. Plis "Decentralized Temporal Independent Component Analysis: Leveraging fMRI Data in Collaborative Settings," NeuroImage, vol. 186, pp. 557-569, 2019.

[4] H. Gazula, B.T. Baker, E. Damaraju, S.M. Plis, S.R. Panta, **R.F. Silva**, V.D. Calhoun, "Decentralized Analysis of Brain Imaging Data: Voxel-based Morphometry and Dynamic Functional Network Connectivity," Front Neuroinform, vol 12, p 55, 2018

[5] J. Ming, E. Verner, A. Sarwate, R. Kelly, C. Reed, T. Kahleck, **R.F. Silva**, S. Panta, J. Turner, S.M. Plis, V.D. Calhoun, "COINSTAC: Decentralizing the future of brain imaging analysis," F1000 Research, eCollection, 2017, PMID: 29123643.

[6] **R.F. Silva**, S.M. Plis, J. Sui, M.S. Pattichis, T. Adalı, V.D. Calhoun, "Blind Source Separation for Unimodal and Multimodal Brain Networks: A Unifying Framework for Subspace Modeling," IEEE JSTSP, vol. 10 (7), pp.1134-1149, 2016.

[7] D.A. Bridwell, S.Rachakonda, **R.F. Silva**, G.D. Pearlson, V.D. Calhoun, "Spatiospectral decomposition of multi-subject EEG: evaluating blind source separation algorithms on real and realistic simulated data," Brain Topography, pp. 1-15, 2016. PMID: 26909688

[8] S. Rachakonda, **R.F. Silva**, J. Liu, "Memory efficient PCA methods for large group ICA," Frontiers in Neuroscience, Brain Imaging Methods, vol. 10, p.17, 2016.

[9] V.D. Calhoun, **R.F. Silva**, T. Adalı, S. Rachakonda, "Comparison of PCA approaches for very large group ICA," in NeuroImage, vol. 118, pp. 662-666, 2015.

[10] **R.F. Silva**, S.M. Plis, T. Adali, V.D. Calhoun, "A statistically motivated framework for simulation of stochastic data fusion models applied to multimodal neuroimaging," NeuroImage, vol. 102 Pt 1, pp. 92-117, 2014.

[11] V.D. Calhoun, V. Potluru, R. Phlypo, **R.F. Silva**, B. Pearlmutter, A. Caprihan, S.M. Plis, T. Adalı, "Independent component analysis for brain fMRI does indeed select for maximal independence," PLoS ONE, vol. 8, 2013.

[12] E. Allen, E. Erhardt, E. Damaraju, W. Gruner, J. Segall, **R.F. Silva**, M. Havlicek, S. Rachakonda, J. Fries, R. Kalyanam, A. Michael, J. Turner, T. Eichele, S. Adelsheim, A. Bryan, J. R. Bustillo, V. P. Clark, S. Feldstein, F. M. Filbey, C. Ford, K. Hutchison, R. Jung, K. A. Kiehl, P. Kodituwakku, Y. Komesu, A.R. Mayer, G.D. Pearlson, J. Phillips, J. Sadek, M. Stevens, U. Teuscher, R.J. Thoma, V.D. Calhoun, "A baseline for the multivariate comparison of resting state networks," Frontiers in Systems Neuroscience, vol. 5, p. 12, 2011.

Book Chapter

[1] **R.F. Silva**, S.M. Plis, "How to integrate data from multiple biological layers in mental health?," in Personalized and Predictive Psychiatry - Big Data Analytics in Mental Health, Ed.1, Springer-Nature, 2018. In Press.

Conference

[1] K. Duan, **R.F. Silva**, J. Chen , D. Lin, V. D. Calhoun, J. Liu, "Sparse Infomax based on Hoyer Projection and its application to simulated structural MRI and SNP data," in Proc. IEEE ISBI 2018. (submitted)

[2] M. Yaesoubi, **R.F. Silva**, V.D. Calhoun, "In-between and cross-frequency dependence-based summarization of resting-state fMRI data," in Proc. IEEE SSIAI 2018, pp. 93-96, Las Vegas, NV, 2018.

[3] N.P. Wojtalewicz, **R.F. Silva**, V.D. Calhoun, A.D. Sarwate, S.M. Plis, "Decentralized Independent Vector Analysis," in Proc. IEEE ICASSP 2017, New Orleans, LA, 2017.

[4] H. Imtiaz, A.D. Sarwate, B. Baker, **R.F. Silva**, S.M. Plis, V.D. Calhoun, "Differentially private source separation for distributed data using independent component analysis," in Proc. IEEE CISS 2016, Princeton, NJ, 2016.

[5] B.T. Baker, **R.F. Silva**, V.D. Calhoun, A.D. Sarwate, S.M. Plis, "Large scale collaboration with autonomy: decentralized data ICA," in Proc. IEEE MLSP 2015, Boston, MA, 2015.

[6] **R.F. Silva**, S.M. Plis, T. Adalı, and V.D. Calhoun, "Multidataset Independent Subspace Analysis Extends Independent Vector Analysis," in Proc. IEEE ICIP 2014, Paris, France, 2014.

[7] **R.F. Silva**, E. Castro, N. Gupta, M. Cetin, M. Arbabshirani, V. Potluru, S.M. Plis, and V.D. Calhoun, "The Tenth Annual MLSP Competition: Schizophrenia Classification Challenge," in Proc. IEEE MLSP 2014, Reims, France, 2014.

[8] E.A. Allen, E.B. Erhardt, E. Damaraju, W. Gruner, J.M. Segall, **R.F. Silva**, M. Havlicek, S. Rachakonda, J. Fries, R. Kalyanam, A.M. Michael, A. Caprihan, J.A. Turner, T. Eichele, S. Adelsheim, A. Bryan, J. Bustillo, V.P. Clark, S. Feldstein-Ewing, F.M. Filbey, C. Ford, K. Hutchison, R.E. Jung, K.A. Kiehl, P. Kodituwakku, Y. Komesu, A.R. Mayer, G.D. Pearlson, J. Phillips, J. Sadek, M. Stevens, U. Teuscher, R.J. Thoma, and V.D. Calhoun, "A baseline for the multivariate comparison of resting state networks," in Biennial Conference on Resting State / Brain Connectivity, Milwaukee, WI, 2010.

[9] **R.F. Silva** and V.D. Calhoun, "Identification of Brain Image Biomarkers by Optimized Selection of Multimodal Datasets," in Proc. ISMRM 2008, Toronto, Canada, 2008.

[10] **R.F. Silva** and V.D. Calhoun, "Identification of Brain Imaging Biomarkers by Optimized Selection of Multimodal Independent Components," in Proc. IEEE SSIAI, Santa Fe, NM, 2008.

[11] V.D. Calhoun, **R.F. Silva**, and J. Liu, "Identification of Multimodal MRI and EEG Biomarkers Using Joint-ICA and Divergence Criteria," in Proc. IEEE MLSP 2007, Thessaloniki, Greece, 2007.

Abstract

[1] M. Yaesoubi, **R.F. Silva**, V.D. Calhoun, "In-between and cross-frequency dependence-based summarization of resting-state fMRI data," in Proc. OHBM, Singapore, 2018.

[2] **R.F. Silva**, S.M. Plis, M.S. Pattichis, T. Adali, V.D. Calhoun. "Incorporating Second-Order Statistics in Multidataset Independent Subspace Analysis," in Proc OHBM, Honolulu, HI, 2015.

[3] **R.F. Silva**, S.M. Plis, T. Adalı, and V.D. Calhoun, "Multidataset Independent Subspace Analysis," in Proc. OHBM, Hamburg, Germany, 2014.

[4] **R.F. Silva** and V.D. Calhoun, "A Statistically Motivated Simulation Framework for Data Fusion Models Applied to Neuroimaging," in Proc. OHBM, Seattle, WA, 2013.

[5] V.D. Calhoun, V. Potluru, R. Phlypo, **R.F. Silva**, B. Pearlmutter, A. Caprihan, S.M. Plis, and T. Adalı, "Independent component analysis for brain fMRI does indeed select for maximal independence," in Proc. OHBM, Seattle, WA, 2013.

[6] **R.F. Silva** and V.D. Calhoun, "An Assessment of the Limitations of Joint ICA in Multimodal Data Fusion," in Proc. OHBM, Beijing, China, 2012.

[7] **R.F. Silva** and V.D. Calhoun, "Validating Divergence as a Tool for Assessment of Group Differences in a JICA Fusion Framework," in Proc. OHBM, Quebec-City, CA, 2011.

[8] **R.F. Silva** and V.D. Calhoun, "Evaluating Joint Histograms in a JICA Fusion Framework: Feature Extraction and Component Selection," in Proc. OHBM, Barcelona, Spain, 2010.

[9] **R.F. Silva** and V.D. Calhoun, "Divergence Measurements for the Optimal Identification of Multimodal Biomarkers," in Proc. OHBM, San Francisco, CA, 2009.

[10] **R.F. Silva**, J.G. Silveira, R. Balbinot, "Plataforma DeskEaD para Aplicações de Educação a Distância (DeskDE Platform for Distance Education Applications)," in Proc. 4th RNP2 Workshop, 2003, Catholic University (PUCRS), Porto Alegre, Brazil.

REFERENCES

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