

## EDUCATION

**Ph.D., Electrical Engineering**

Aug. 2017 - Mar. 2020

Universidade Federal de Minas Gerais (UFMG)

Brazil

Title: *Learning nonlinear differentiable models for signals and systems: with applications*

Supervisor: Luis Antonio Aguirre

Co-supervisor: Thomas Schön.

Credits: A total of 23 credits (345 class-hours). Graded point average: 5.0 out of 5.0.

With one year, from *Sept. 2018 to Sept. 2019*, as a guest doctoral student at **Uppsala University** (Sweden) under the supervision of **Thomas Schön**.

**M.Sc., Electrical Engineering**

Jan. 2016 - Jul. 2017

Universidade Federal de Minas Gerais (UFMG)

Brazil

Title: *Recurrent Structures in System Identification*

Supervisor: Luis Antonio Aguirre

Credits: A total of 25 credits (375 class-hours). Graded point average: 5.0 out of 5.0.

**B.S.E., Electrical Engineering**

Jan. 2011 - Jan. 2016

Universidade Federal de Minas Gerais (UFMG)

Brazil

Credits: A total of 240 credits (3600 class-hours). Graded point average:<sup>1</sup>: 4.91 out of 5.00

## WORK EXPERIENCE

**Postdoctoral Researcher**

Fev. 2021 - Now

Department of Information Technology, Uppsala University

Uppsala, Sweden

- I am working under the supervision of Thomas Schön on the intersection of machine learning, signal processing, and control theory.

**Postdoctoral Associate**

Mar. 2020 - Fev. 2021

Department of Computer Science, Universidade Federal de Minas Gerais (UFMG)

Belo Horizonte, Brasil

- I worked on developing new machine learning algorithms and studying its application to engineering and health care. My position was funded by the Brazilian Agency CAPES, through the institutional internalization program (PRINT).

**Google Summer of Code**

May. 2017 - Aug. 2017

Software Developer

Scipy

- I have successfully completed Google Summer of Code program under the mentorship of Matt Haberland, Nikolay Mayorov and Ralf Gommers. My project was the implementation of an interior-point solver for large-scale nonlinear programming problems. The result is the method `trust-contr`, now openly available as part of the open source scientific library SciPy, in Python.

**Invent Vision**

Jan. 2015 - Dec. 2015

Hardware Team Intern

Belo Horizonte, Brazil

- I was part of the hardware development team and worked designing FPGA-based cameras. The major project I have worked on while there was the design and implementation of a stereo camera.

**Undergraduate Researcher Intern**

Jun. 2013 - Jan. 2015

Research and development project with Petrobras Oil Company, UFMG

Belo Horizonte, Brazil

- I worked on the development of methods for identification of oil well mathematical models under the supervision of Professor Luis Antonio Aguirre. My position was funded by the Petrobras Oil Company through the *Christiano Ottoni Foundation* (FCO) in the modality “*bolsa de inicio cientifica*”.

<sup>1</sup>Weighted average of my letter grade ( $A = 5.0$ ;  $B = 4.0$ ;  $C = 3.0$ ;  $D = 2.0$ ;  $E = 1.0$ ;  $F = 0.0$ ). Weighted according to the course number of credits.

## PROFESSIONAL MEMBERSHIP

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### Scipy core team member

Since Nov. 2017

- I am one of the 34 SciPy core development team members<sup>2</sup>. SciPy is one of the core scientific libraries in Python and I was invited to the core team for having contributed to optimization and signal processing packages with the implementation of signal filters: `iirnotch`, `iirpeak`; and optimization methods: `trust-exact`, `trust-constr`. My GitHub account: <https://github.com/antonior92> contain a complete list of my open-source contributions.

## PROFESSIONAL ACTIVITIES

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### Peer reviewing: journal papers

- *International Journal of System Science* (2021), *Proceedings of the National Academy of Sciences (PNAS)* (2020), *Automatica* (2020), *IEEE Transactions on Biomedical Engineering* (2020), *IEEE Control Systems Letters (L-CSS)* (2020), *Systems & Control Letters* (2020), *Chaos, Solutions & Fractals* (2020), *CHEST* (2020), *Journal of Electrocardiology* (2020), *Journal of Control, Automation and Electrical Systems* (2015-2018).

### Peer reviewing: conference papers

- *19th IFAC Symposium on System Identification* (2021), *Learning for Dynamics and Control (L4DC)* (2021), *European Control Conference (ECC)* (2021), *IEEE Conference on Decision and Control (CDC)* (2020), *The 21st IFAC World Conference* (2020), *The American Control Conference* (2018), *The 12th International Conference on Modelling, Identification and Control* (2017), *The 20th IFAC World Conference* (2017).

### Expert assignments

- *ELLIS (European Laboratory for Learning and Intelligent Systems) PhD Program: Recruitment evaluator* (2020)

## AWARDS

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### Best Poster Award

2019

*SciLifeLab Science Summit*

*Uppsala, Sweden*

- We have been awarded the best poster award for the work “Automatic Diagnosis of Short-Duration 12-Lead ECG using a Deep Convolutional Network” presented at SciLifeLab Science Summit (Uppsala, 2019).

### Travel Award

2018

*Machine Learning for Health (ML4H) Workshop at NeurIPS*

*Montreal, Canada*

- We have been awarded the travel award for the work “Automatic Diagnosis of Short-Duration 12-Lead ECG using a Deep Convolutional Network” presented at Machine Learning for Health (ML4H) Workshop at NeurIPS (Montreal, 2019).

## SCHOLARSHIPS

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### Split-site Ph.D. Scholarship

2019

*CNPq*

*Uppsala, Sweden*

- I have been granted a scholarship from the Brazilian Agency CNPq for staying one year of my Ph.D. in Uppsala University, Sweden.

### Ph.D. Scholarship

2018-2020

*CNPq*

*Belo Horizonte, Brasil*

- I have been granted a scholarship from the Brazilian Agency CNPq during my doctoral studies .

### M.S. Scholarship

2016 - 2017

*CAPES*

*Belo Horizonte, Brasil*

- I have been granted a scholarship from the Brazilian Agency CAPES during my master studies.

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<sup>2</sup>Checked on February 20, 2020

## TEACHING

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### Teaching assistant

Deep learning

Uppsala University, Sweden

Spring - 2021

### Teaching assistant

Engenharia de Controle (*Control Engineering*)

Universidade Federal de Minas Gerais, Brazil

1st semester - 2017

### Teaching assistant

Controle Digital (*Digital Control*)

Universidade Federal de Minas Gerais, Brazil

2nd semester - 2016

## SUPERVISION

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### Master Thesis Reviewer

ADAS scenario classification of in-vehicle sensor data using ML (Sai Abhishek Guraja)

Uppsala University, Sweden

Spring - 2021 (In progress)

## RESEARCH PROJECTS

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### *Clinical Outcomes in Eletrocardiography (CODE)*

2018-Present

I integrate the CODE group. The group conducts clinical studies and develops artificial intelligence in electrocardiography. The research project is led by the Professor Antonio Luiz Pinho Ribeiro and is funded by the Brazilian Agency CNPq.

### Research and Development - Petrobras

2013-2015

The project “*Desenvolvimento de ferramenta computacional para identificação de modelos matemáticos de poços de produção de petróleo*” (project name in Portuguese), was funded by the Brazilian oil company Petrobras and led by the Professor Luis Antonio Aguirre. This follow-up project focused on the development of tools to easily generate models for an oil well and in the integration of these tools.

### Research and Development - Petrobras

2013

The project “*Desenvolvimento de metodologia para a identificação de modelos matemáticos de poços de produção de petróleo*” (project name in Portuguese), was funded by the Brazilian oil company Petrobras and led by the Professor Luis Antonio Aguirre. The project focused on the development of models for oil well’s dynamic behavior.

## ADDITIONAL EDUCATION

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### Mini-course on Nonlinear System Identification

2019

- I took part on the 3 days mincourse on nonlinear system identification to take place on Eindhoven University of Technology.

### Probabilistic Graphical Models Specialization

2018

Coursera

Stanford

- I have successfully completed the 3 online courses about probabilistic graphical models offered by *Stanford*: “*Representation*”, “*Inference*”, “*Learning*”.

### Deep Learning Specialization

2018

Coursera

deeplearning.ai

- I have successfully completed the 5 online courses about deep learning offered in Coursera: “*Neural Networks and Deep Learning*”, “*Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization*”, “*Structuring Machine Learning Projects*”, “*Convolutional Neural Networks*”, “*Sequence Models*”.

## LANGUAGE CERTIFICATES

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### Certificate in Advanced English (Council of Europe Level C1)

Cambridge English Language Assessment, 2014

## OTHER LINKS

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Lattes CV (0898576944135254)

[lattes.cnpq.br/0898576944135254](http://lattes.cnpq.br/0898576944135254)

ORCID (0000-0003-3632-8529)

[orcid.org/0000-0003-3632-8529](http://orcid.org/0000-0003-3632-8529)

SCOPUS (57191699148)

[www.scopus.com/authid/detail.uri?authorId=57191699148](http://www.scopus.com/authid/detail.uri?authorId=57191699148)

Google Scholar (Antonio H. Ribeiro)

[scholar.google.com.br/citations?user=5t\\_sZdMAAAAJ](http://scholar.google.com.br/citations?user=5t_sZdMAAAAJ)

Web of Science ResearcherID (AAE-1948-2019)

[publons.com/researcher/1170361](http://publons.com/researcher/1170361)

## PUBLICATIONS

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### Work in Progress

E. M. Lima, A. H. Ribeiro, G. M. Paixão, M. H. Ribeiro, M. M. P. Filho, P. R. Gomes, D. M. Oliveira, E. C. Sabino, B. B. Duncan, L. Giatti, S. M. Barreto, W. Meira, T. B. Schön, and A. L. P. Ribeiro, “Deep neural network estimated electrocardiographic-age as a mortality predictor,” *medRxiv*, Feb. 2021. DOI: 10.1101/2021.02.19.21251232.

### In Press

J. N. Hendriks, F. K. Gustafsson, A. H. Ribeiro, A. G. Wills, and T. B. Schön, “Deep Energy-Based NARX Models,” *To appear in the Proceedings of the 19th IFAC Symposium on System Identification (SYSID)*, 2021. arXiv: 2012.04136.

A. H. Ribeiro, J. N. Hendriks, A. G. Wills, and T. B. Schön, “Beyond Occam’s Razor in System Identification: Double-Descent when Modeling Dynamics,” in *To Appear in the Proceedings of the 19th IFAC Symposium on System Identification (SYSID)*, 2021. arXiv: 2012.06341.

A. H. Ribeiro and T. B. Schön, “How convolutional neural networks deal with aliasing,” in *Accepted at the IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2021.

### Journal Papers

W. Meira Jr, A. L. P. Ribeiro, D. M. Oliveira, and A. H. Ribeiro, “Contextualized Interpretable Machine Learning for Medical Diagnosis,” *Communications of the ACM*, 2020. DOI: 10.1145/3416965.

G. M. M. Paixão, L. G. S. Silva, P. R. Gomes, E. M. Lima, M. P. F. Ferreira, D. M. Oliveira, M. H. Ribeiro, A. H. Ribeiro, J. S. Nascimento, J. A. Canazart, L. B. Ribeiro, E. J. Benjamin, P. W. Macfarlane, M. S. Marcolino, and A. L. Ribeiro, “Evaluation of Mortality in Atrial Fibrillation: Clinical Outcomes in Digital Electrocardiography (CODE) Study,” *Global Heart*, vol. 15, no. 1, p. 48, Jul. 2020, ISSN: 2211-8179. DOI: 10.5334/gh.772.

A. H. Ribeiro, M. H. Ribeiro, G. M. M. Paixão, D. M. Oliveira, P. R. Gomes, J. A. Canazart, M. P. S. Ferreira, C. R. Andersson, P. W. Macfarlane, W. Meira Jr., T. B. Schön, and A. L. P. Ribeiro, “Automatic diagnosis of the 12-lead ECG using a deep neural network,” *Nature Communications*, vol. 11, no. 1, p. 1760, 2020. DOI: 10/drkd. arXiv: 1904.01949.

A. H. Ribeiro, K. Tiels, J. Umenberger, T. B. Schön, and L. A. Aguirre, “On the smoothness of nonlinear system identification,” *Automatica*, vol. 121, p. 109158, Nov. 2020. DOI: 10.1016/j.automatica.2020.109158. arXiv: 1905.00820.

P. Virtanen, R. Gommers, T. E. Oliphant, M. Haberland, T. Reddy, D. Cournapeau, E. Burovski, P. Peterson, W. Weckesser, J. Bright, S. J. van der Walt, M. Brett, J. Wilson, K. J. Millman, N. Mayorov, A. R. J. Nelson, E. Jones, R. Kern, E. Larson, C. J. Carey, Í. Polat, Y. Feng, E. W. Moore, J. VanderPlas, D. Laxalde, J. Perktold, R. Cimrman, I. Henriksen, E. A. Quintero, C. R. Harris, A. M. Archibald, A. H. Ribeiro, F. Pedregosa, P. van Mulbregt, and S. 1. Contributors, “SciPy 1.0—Fundamental Algorithms for Scientific Computing in Python,” *Nature Methods*, vol. 17, no. 3, pp. 261–272, 2020. DOI: 10/ggj45f. arXiv: 1907.10121.

G. M. M. Paixão, E. M. Lima, P. R. Gomes, M. P. Ferreira, D. M. Oliveira, M. H. Ribeiro, A. H. Ribeiro, J. Nascimento, J. A. Canazart, G. Cardoso, L. B. Ribeiro, and A. L. P. Ribeiro, “Evaluation of mortality in bundle branch block patients from an electronic cohort: Clinical Outcomes in Digital Electrocardiography (CODE) study,” *Journal of Electrocardiology*, Sep. 2019, ISSN: 0022-0736. DOI: 10/dcgk.

A. H. Ribeiro and L. A. Aguirre, ““Parallel Training Considered Harmful?”: Comparing series-parallel and parallel feedforward network training,” *Neurocomputing*, vol. 316, pp. 222–231, Nov. 2018, ISSN: 0925-2312. DOI: 10/gfhwk.

### International Conference Papers

D. M. Oliveira, A. H. Ribeiro, J. A. O. Pedrosa, G. M. Paixão, A. L. P. Ribeiro, and W. Meira Jr, “Explaining end-to-end ECG automated diagnosis using contextual features,” in *Machine Learning and Knowledge Discovery in Databases. European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD)*, ser. Lecture Notes in Computer Science, vol. 12461, Ghent, Belgium: Springer, Sep. 2020, pp. 204–219. DOI: 10.1007/978-3-030-67670-4\_13.

A. H. Ribeiro, K. Tiels, L. A. Aguirre, and T. B. Schön, “Beyond exploding and vanishing gradients: Attractors and smoothness in the analysis of recurrent neural network training,” in *Proceedings of the 23rd International Conference on Artificial Intelligence and Statistics (AISTATS)*, PMLR, vol. 108, 2020, pp. 2370–2380. arXiv: 1906.08482.

C. Andersson, A. H. Ribeiro, K. Tiels, N. Wahlström, and T. B. Schön, “Deep Convolutional Networks in System Identification,” *Proceedings of the 58th IEEE Conference on Decision and Control (CDC)*, pp. 3670–3676, Sep. 2019. DOI: 10.1109/CDC40024.2019.9030219. arXiv: 1909.01730.

A. H. Ribeiro and L. A. Aguirre, “Lasso Regularization Paths for NARMAX Models via Coordinate Descent,” in *2018 Annual American Control Conference (ACC)*, Jun. 2018, pp. 5268–5273, ISBN: 2378-5861. DOI: 10/gf7ssz.

A. H. Ribeiro and L. A. Aguirre, “Shooting Methods for Parameter Estimation of Output Error Models,” *Proceedings of the 20th IFAC World Congress. IFAC-PapersOnLine*, vol. 50, no. 1, pp. 13 998–14 003, Jul. 2017, ISSN: 2405-8963. DOI: 10/gfjwmp.

A. H. Ribeiro and L. A. Aguirre, “Selecting transients automatically for the identification of models for an oil well,” *Proceedings of the 2nd IFAC Workshop on Automatic Control in Offshore Oil and Gas Production. IFAC-PapersOnLine*, vol. 48, no. 6, pp. 154–158, 2015. DOI: 10/gfjwq8.

### **Workshop papers, conference abstracts and extended abstracts**

J. N. Hendriks, F. K. Gustafsson, A. H. Ribeiro, A. G. Wills, and T. B. Schön, “Deep Energy-Based NARX Models,” *Workshop on Nonlinear System Identification*, 2021.

A. H. Ribeiro, J. N. Hendriks, A. G. Wills, and T. B. Schön, “Beyond Occam’s Razor in System Identification: Double-Descent when Modeling Dynamics,” in *Workshop on Nonlinear System Identification*, 2021.

A. H. Ribeiro and T. B. Schön, “Overparametrized Regression Under L2 Adversarial Attacks,” in *Workshop on the Theory of Overparameterized Machine Learning (TOPML)*, Apr. 2021.

D. M. Oliveira, A. H. Ribeiro, J. A. O. Pedrosa, G. M. M. Paixao, A. L. Ribeiro, and W. M. Jr, “Explaining black-box automated electrocardiogram classification to cardiologists,” in *2020 Computing in Cardiology (CinC)*, vol. 47, 2020. DOI: 10.22489/CinC.2020.452.

G. M. Paixão, A. H. Ribeiro, E. Lima, B. Seewald, M. H. Ribeiro, D. Oliveira, P. Gomes, N. Castro, W. Meira, T. Schön, and A. L. Ribeiro, “ECG-AGE FROM ARTIFICIAL INTELLIGENCE: A NEW PREDICTOR FOR MORTALITY? THE CODE (CLINICAL OUTCOMES IN DIGITAL ELECTROCARDIOGRAPHY) STUDY,” *Journal of the American College of Cardiology*, vol. 75, no. 11 Supplement 1, p. 3672, 2020, ISSN: 0735-1097. DOI: 10.1016/S0735-1097(20)34299-6.

A. H. Ribeiro, D. Gedon, D. M. Teixeira, M. H. Ribeiro, A. L. P. Ribeiro, T. B. Schon, and W. M. Jr, “Automatic 12-lead ECG classification using a convolutional network ensemble,” in *2020 Computing in Cardiology (CinC)*, 2020. DOI: 10.22489/CinC.2020.130.

A. H. Ribeiro, C. Andersson, K. Tiels, N. Wahlstrom, and T. B. Schon, “Deep Convolutional Networks are Useful in System Identification,” *Workshop on Nonlinear System Identification*, 2019.

G. Paixao, L. G. S. e Silva, P. R. Gomes, M. Ferreira, D. Oliveira, M. H. Ribeiro, A. H. Ribeiro, J. Nascimento, G. Cardoso, R. Araujo, B. Santos, J. Canazart, L. Ribeiro, and A. L. Ribeiro, “Clinical Outcomes in Digital Electrocardiography: Evaluation of Mortality in Atrial Fibrillation (Code Study),” *Circulation. Abstracts from American Heart Association’s.*, vol. 138, no. Suppl\_1, A16594–A16594, Nov. 2018.

A. H. Ribeiro, M. H. Ribeiro, G. Paixão, D. Oliveira, P. R. Gomes, J. A. Canazart, M. Pifano, W. Meira Jr., T. B. Schön, and A. L. Ribeiro, “Automatic Diagnosis of Short-Duration 12-Lead ECG using a Deep Convolutional Network,” *Machine Learning for Health (ML4H) Workshop at NeurIPS*, 2018. arXiv: 1811.12194.

### **National Conference Papers**

A. H. Ribeiro and L. A. Aguirre, “Relações Estáticas de Modelos NARX MISO e sua Representação de Hammerstein,” in *XX Congresso Brasileiro de Automática*, 2014.