

# Learning nonlinear differentiable models for signals and systems: with applications

Título em português: *Aprendendo modelos não-lineares diferenciáveis para sinais e sistemas: com aplicações*

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Universidade Federal de Minas Gerais

Brasil, 2020

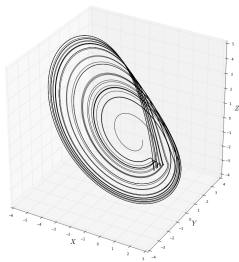
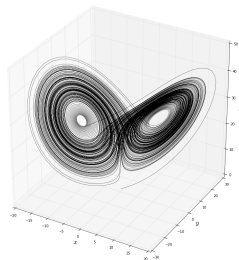
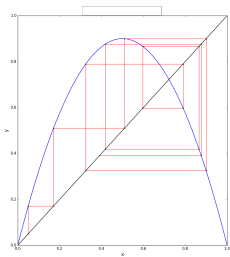
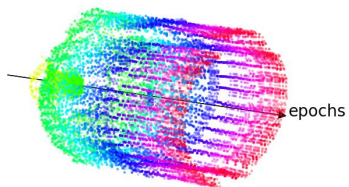
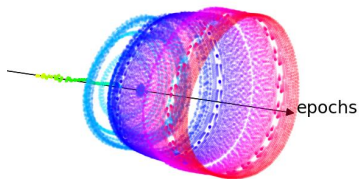
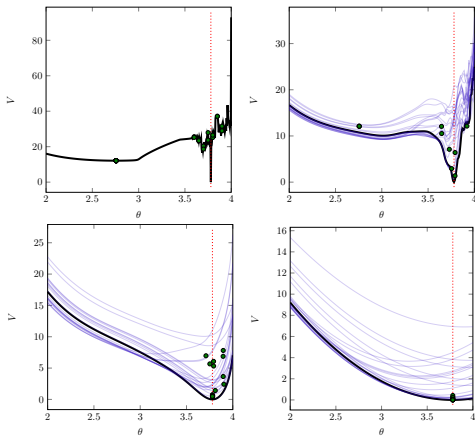


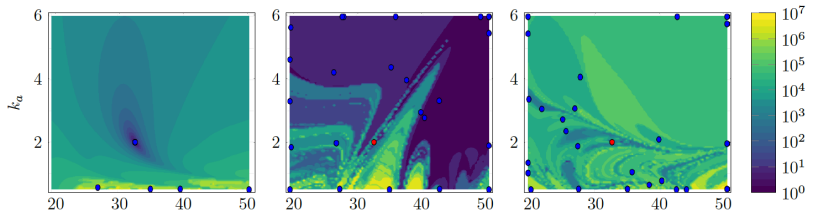
Ilustração de sistemas caóticos.



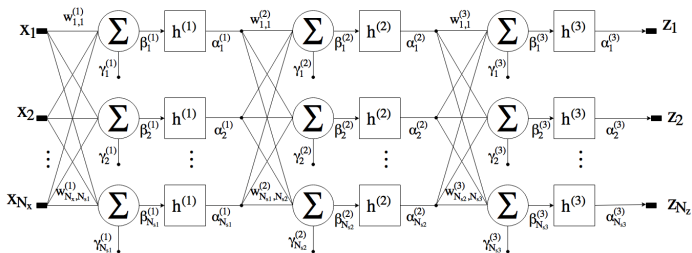
Evolução de duas arquiteturas de rede neural a medida que aprendem a simular um oscilador



Estimando os parâmetros de um simples modelo populacional (mapa logístico).



Estimando os parâmetros de um pêndulo



Esquemático de uma rede neural com 3 camadas.

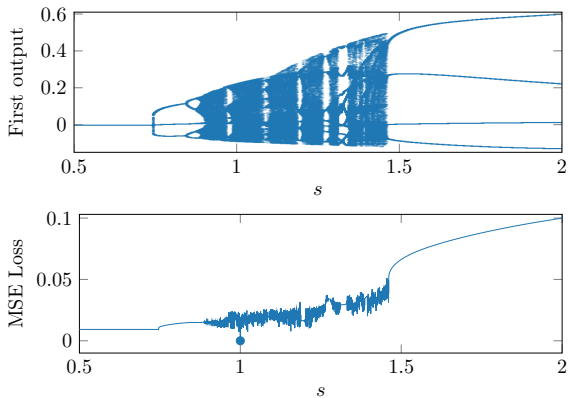


Diagrama de bifurcação e função de custo para uma rede neural  
*Long-Short Term Memory*.

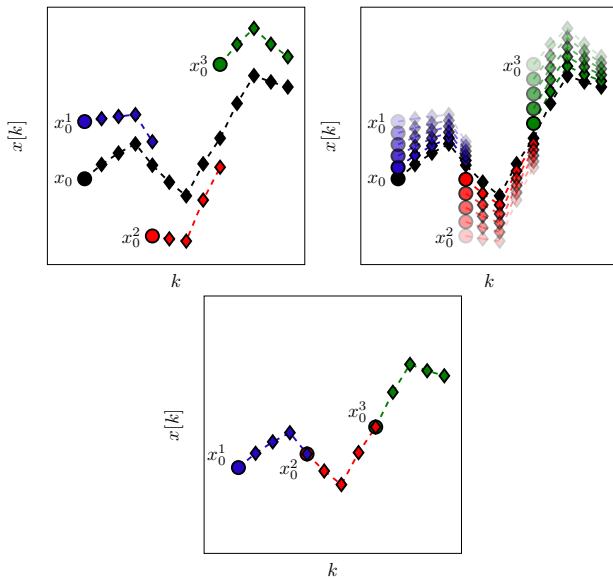
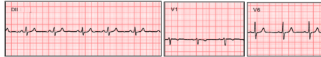


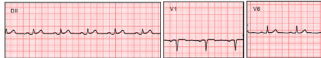
Ilustração do método de múltiplos tiros.



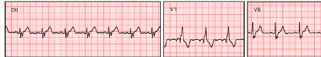
No abnormalities



1st degree AV block (1dAVb)



Right bundle branch block (RBBB)



Left bundle branch block (LBBB)



Sinus bradycardia (SB)



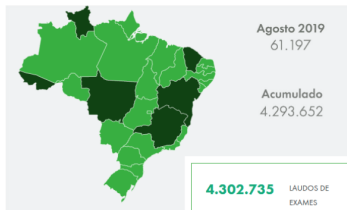
Atrial fibrillation (AF)



Sinus tachycardia (ST)



ECGs com as anormalidades estudadas.



**4.302.735** LAUDOS DE EXAMES

**131.748** TELECONSULTORIAS ATENDIDAS

**R\$ 252M** DE ECONOMIA GERADA PELA REDUÇÃO DE ENCAMINHAMENTOS

**968** MUNICÍPIOS ATENDIDOS

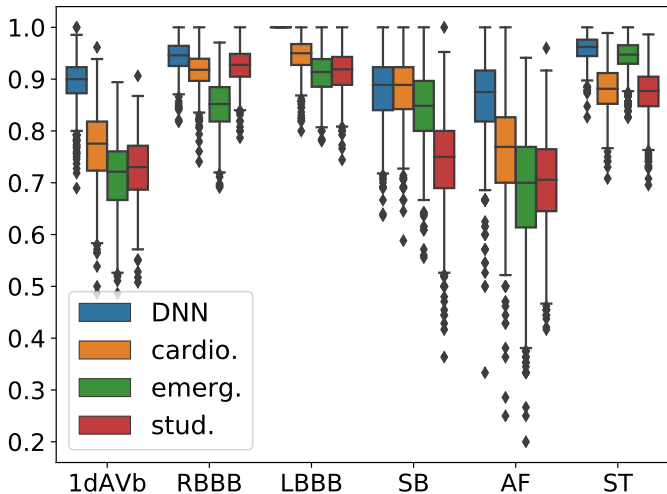
## RESULTADOS TELE-ELETCARDIOGRAFIA

Acumulado  
06/2006 - 08/2019 **4.293.652**

Agosto 2019 **61.197**



Regiões atendidas e números da Rede de Telessade de Minas Gerais.



Comparando a performance da rede neural com residentes e estudantes de medicina.

# Publicações científicas descritas na minha tese

## Principais publicações:

**Beyond exploding and vanishing gradients: analysing RNN training using attractors and smoothness**, Antônio H. Ribeiro, Koen Tiels, Luis A. Aguirre and Thomas B. Schön. Proceedings of the 23rd International Conference on Artificial Intelligence and Statistics (AISTATS), 2020.

**Automatic Diagnosis of the 12-Lead ECG using a Deep Neural Network**, Antônio H. Ribeiro, Manoel Horta Ribeiro, Gabriela M.M. Paixão, Derick M. Oliveira, Paulo R. Gomes, Jéssica A. Canazart, Milton P. S. Ferreira, Carl R. Andersson, Peter W. Macfarlane, Wagner Meira Jr., Thomas B. Schön, Antonio Luiz P. Ribeiro. Nature Communications, 2020. v. 11(1) n. 1760. doi: 10.1038/s41467-020-15432-4

**On the Smoothness of Nonlinear System Identification**, Antônio H. Ribeiro, Koen Tiels, Jack Umenberger, Thomas B. Schön, Luis A. Aguirre. Automatica, 2020.v 121, n. 109158. doi: 10.1016/j.automatica.2020.109158.

**Deep Convolutional Networks in System Identification**, Carl Andersson\*, Antonio H. Ribeiro\*, Koen Tiels, Niklas Wahlström and Thomas B. Schön (\* Equal contribution). Proceedings of the 58th IEEE Conference on Decision and Control (CDC), 2019. pp. 3670–3676. doi: 10.1109/CDC40024.2019.9030219

**“Parallel Training Considered Harmful?” : Comparing Series-Parallel and Parallel Feedforward Network Training**, Antônio H. Ribeiro, Luis A. Aguirre. Neurocomputing, 2018. v. 316 (17) pp. 222-231. doi: 10.1016/j.neucom.2018.07.071

**Shooting Methods for Parameter Estimation of Output Error Models**, Antonio H. Ribeiro, L.A. Aguirre. Proceedings of the IFAC World Congress, 2017. IFAC-PapersOnLine v. 50 (1), pp. 13998-14003. doi: 10.1016/j.ifacol.2017.08.2421

## Publicações secundárias:

**SciPy 1.0–Fundamental Algorithms for Scientific Computing in Python**, Nature Methods, 2020. v. 17 (3) pp. 261-272. doi: 10.1038/s41592-019-0686-2

**Evaluation of mortality in bundle branch block patients from an electronic cohort: Clinical Outcomes in Digital Electrocardiography (CODE) study**, Journal of Electrocardiology, 2019. v. 57 pp. S56-S60. doi: 10.1016/j.jelectrocard.2019.09.004

**Tele-electrocardiography and Bigdata: The CODE (Clinical Outcomes in Digital Electrocardiography) Study**, Journal of Electrocardiology, 2019. v. 57 pp. S75-S78. doi: 10.1016/j.jelectrocard.2019.09.008

**Lasso Regularization Paths for NARMAX Models via Coordinate Descent**, Proceedings of the American Control Conference, 2018. pp. 5268-5273. doi: 10.23919/ACC.2018.8430924