

# RAFAEL PADILHA

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## RESEARCH INTERESTS

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My primary research interests lie in the intersection between Machine Learning and Computer Vision. Most of my experience has been on applied problems in Digital Forensics, Scene Understanding, Biometrics, and Medical Imaging. I am especially concerned about Fairness, Bias and Interpretability (xAI) on machine learning algorithms and datasets.

## EDUCATION

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### Ph.D. in Computer Science

August 2017 - July 2022 (*expected*)

University of Campinas (Brazil)

*Thesis:* Learning visual clues of the passage of time

*Research Topic:* Digital Forensics, Event Understanding

*Advisors:* Anderson Rocha, Fernanda Andaló

### M.Sc. in Computer Science

January 2015 - July 2017

University of Campinas (Brazil)

*Thesis:* Two-tiered face verification with low-memory footprint for mobile devices

*Research Topic:* Facial Biometrics

*Advisors:* Jacques Wainer, Fernanda Andaló

### Exchange Computer Science Student

August 2012 - July 2013

École Supérieure d'Ingénieurs - ENSICAEN (France)

### B.Eng. in Computer Engineering

January 2009 - December 2014

University of Campinas (Brazil)

## RESEARCH EXPERIENCE

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### University of Campinas (Brazil)

August 2017 - ongoing

#### Ph.D. research - *Learning visual clues of the passage of time*

My thesis involves understanding which are the most significant visual clues of the passage of time, how they relate as time progresses, and how to use them to mine temporal knowledge from one or more images with similar semantic context. The outcomes of my research are useful for organizing and understanding data from forensic events.

### University of Kentucky (USA)

December 2019 - November 2020

#### Ph.D. Research Internship at the *Multimodal Vision Research Laboratory*

Internship advised by Prof. Nathan Jacobs as part of my Ph.D. studies. Designed a deep learning-based approach to verify if the alleged time-of-capture of a photograph is consistent with its visual appearance and location.

### University of Campinas (Brazil)

August 2020 - ongoing

Research collaboration with *Mining of Complex Data* extension course

Advised by Prof. Zanoni Dias, collaborating and advising students from the extension course in medical image analysis problems, such as COVID-19 diagnostic through X-ray and CT images, and bias assessment on retinal OCT scans.

### University of Campinas (Brazil)

January 2015 - July 2017

#### M.Sc. research - *Two-tiered face verification with low-memory footprint for mobile devices*

With the popularization of smartphones, automatic facial image analysis has boomed in interest both in academia and industry, fostering a wide range of new applications. In my M.Sc. research, I have studied and proposed machine learning methods for several fronts, from face verification to face presentation attack detection, considering the limitations of low-powered devices (e.g., smartphones, wearables).

### University of Campinas (Brazil)

January 2010 - August 2012

*Undergraduate Researcher*

Advised by Prof. Jacques Wainer, working on the detection of Diabetic Retinopathy, retinal image quality assessment, and referral recommendation with hand-crafted features and machine learning algorithms.

## TEACHING EXPERIENCE

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### University of Campinas (Brazil)

Lecturer for *Algorithms and Computer Programming* undergraduate course

July 2021 - December 2021

Teaching Assistant for *Machine Learning* extension course

April 2018 - December 2021

Teaching Assistant for *Algorithms and Computer Programming* undergraduate course

2012, 2016, 2017

## WORK EXPERIENCE

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### Saffe Payments

May 2016 - October 2016

*Software Developer*

Implementing an iOS mobile payment application that employed deep-learning based facial recognition algorithms to make transactions more secure. Evaluated and integrated a facial spoofing detector to the main application.

## PUBLICATIONS

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### Journal articles

- [R. Padilha](#), F.A. Andaló, B. Lavi, L.A.M. Pereira, A. Rocha, “Temporally Sorting Images from Real-World Events”, *Pattern Recognition Letters*, 2021. Impact factor: 3.756. [doi:10.1016/j.patrec.2021.04.027](https://doi.org/10.1016/j.patrec.2021.04.027)
- [R. Padilha](#), A. Theóphilo, F.A. Andaló, D.A. Vega-Oliveros, J.P. Cardenuto, G. Bertocco, J. Nascimento, J. Yang, A. Rocha, “Artificial Intelligence and the challenges of Digital Forensics on 21st century”. *Estudos Avançados da Universidade de São Paulo*, 2021. (In Portuguese). [doi:10.1590/s0103-4014.2021.35101.009](https://doi.org/10.1590/s0103-4014.2021.35101.009)
- [R. Padilha](#), C.M. Rodrigues, F.A. Andaló, G. Bertocco, Z. Dias, A. Rocha, “Forensic Event Analysis: From Seemingly Unrelated Data to Understanding”, *IEEE Security & Privacy*, 2020. Impact factor: 3.573. [doi:10.1109/MSEC.2020.3000446](https://doi.org/10.1109/MSEC.2020.3000446).
- [R. Padilha](#), F.A. Andaló, G. Bertocco, W.R. Almeida, W. Dias, T. Resek, R. da S. Torres, J. Wainer, A. Rocha, “Two-tiered face verification with low-memory footprint for mobile devices”, *IET Biometrics*, 2020. Impact factor: 2.588. [doi:10.1049/iet-bmt.2020.0031](https://doi.org/10.1049/iet-bmt.2020.0031)
- W.R. Almeida, F.A. Andaló, [R. Padilha](#), G. Bertocco, W. Dias, J. Wainer, R. da S. Torres, A. Rocha, “Detecting face presentation attacks in mobile devices with a patch-based CNN and a sensor-aware loss functions”. *PLOS One*, 2020. Impact factor: 3.040. [doi:10.1371/journal.pone.0238058](https://doi.org/10.1371/journal.pone.0238058)
- W. Dias, F.A. Andaló, [R. Padilha](#), G. Bertocco, W.R. Almeida, P. Costa, A. Rocha, “Cross-dataset emotion recognition from facial expressions through convolutional neural networks”. *Journal of Visual Communication and Image Representation*. [doi:10.1016/j.jvcir.2021.103395](https://doi.org/10.1016/j.jvcir.2021.103395). Impact Factor: 2.678.

### Book Chapters

- [R. Padilha](#), F.A. Andaló, L.A.M. Pereira, A. Rocha, “Unraveling the Notre Dame Cathedral fire in space and time: an X-coherence approach”, *Crime Science and Digital Forensics: A Holistic View*, CRC Press, 2021. [doi:10.1201/9780429322877-2](https://doi.org/10.1201/9780429322877-2)

### Patents

- F.A. Andaló, [R. Padilha](#), W.R. Almeida, G. Bertocco, J. Wainer, R. da S. Torres, A. Rocha, “Multiple-tiered facial recognition”, US 15/918 462, 2020. Patent granted, filed by Motorola.

### Workshop Papers

- [R. Padilha](#), F.A. Andaló, R. da S. Torres, A. Rocha, J. Wainer, “Two-tiered facial verification for mobile devices”, In *Workshop of Theses and Dissertations, Conference on Graphics, Patterns and Images (WTD/SIBGRAPI)*, 2018.

## Refereed Conference Papers

- A. Theophilo, R. Padilha, F.A. Andaló, A. Rocha, “Explainable Artificial Intelligence for Authorship Attribution on Social Media”. To appear in *International Conference on Acoustics, Speech and Signal Processing (ICASSP 2022)*.
- D. Ferber, F. Vieira, J. Dalben, M. Ferraz, N. Sato, G. Oliveira, R. Padilha, Z. Dias, “Deep Learning-based COVID-19 diagnostics of low-quality CT images”, In *Brazilian Symposium on Bioinformatics (BSB)*, 2021. doi:10.1007/978-3-030-91814-9\_7
- G. Oliveira, R. Padilha, A. Dorte, L. Cereda, L. Miyazaki, M. Lopes, Z. Dias, “COVID-19 X-ray Image Diagnostic with Deep Neural Networks”, In *Brazilian Symposium on Bioinformatics (BSB)*, 2020. doi:10.1007/978-3-030-65775-8
- R. Padilha, F.A. Andaló, A. Rocha, “Improving the chronological sorting of images through occlusion: A study on the Notre-Dame cathedral fire”, In *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2020. doi:10.1109/ICASSP40776.2020.9054120
- Z. Boulkenafet,..., F.A. Andaló, R. Padilha, G. Bertocco, W. Dias, J. Wainer, R. da S. Torres, A. Rocha, et al., “A Competition on Generalized Software-based Face Presentation Attack Detection in Mobile Scenarios”. In *International Joint Conference on Biometrics (IJCB)*, 2017. doi:10.1109/btas.2017.8272758
- H.F. Jelinek, R. Pires, R. Padilha, S. Goldenstein, J. Wainer, A. Rocha, “Quality control and multi-lesion detection in automated retinopathy classification using a visual words dictionary”. In *International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2013.
- H.F. Jelinek, R. Pires, R. Padilha, S. Goldenstein, J. Wainer, T. Bossomaier, A. Rocha, “Data fusion for multi-lesion diabetic retinopathy detection”. In *IEEE International Symposium on Computer-Based Medical Systems (CBMS)*, 2012. doi:10.1109/CBMS.2012.6266342

## Abstracts and Short Papers

- G. Oliveira, L. David, R. Padilha, A.P. da Silva, F. de Paula, L. Infante, L. Jorge, P. Xavier, Z. Dias, ‘Bias Assessment in Medical Imaging Analysis: a Case Study on Retinal OCT Image Classification’, In *International Conference on Agents and Artificial Intelligence (ICAART)*, 2022. To appear.
- R. Padilha, F.A. Andaló, A. Rocha, “Learning Visual Clues of the Passage of Time”, In *International Conference on Multimedia and Electronic Safety in Forensic Sciences (ICMedia)*, 2019.

## Submitted Work

- R. Padilha, T. Salem, S. Workman, F.A. Andaló, A. Rocha, N. Jacobs, “Content-Based Detection of Temporal Metadata Manipulation”. Submitted to *Transactions on Information Forensics and Security*. Impact Factor: 7.178.

## Datasets

- R. Padilha, F.A. Andaló, B. Lavi, L.A.M. Pereira, A. Rocha. “Notre-Dame Cathedral Fire Dataset”. [10.6084/m9.figshare.11787333](https://figshare.com/figure-dataset/11787333)
- W.R. Almeida, F.A. Andaló, R. Padilha, G. Bertocco, W. Dias, J. Wainer, R. da S. Torres, A. Rocha. “RECOD Mobile Presentation-Attack Dataset (RECOD-MPAD)”. [10.5281/zenodo.3749308](https://zenodo.org/record/3749308)
- R. Padilha, F.A. Andaló, G. Bertocco, W.R. Almeida, W. Dias, T. Resek, R. da S. Torres, J. Wainer, A. Rocha. “RECOD Selfie Dataset (RCD-Selfie)”. [10.6084/m9.figshare.5427142](https://figshare.com/figure-dataset/5427142)

## HONOURS & AWARDS

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- **Best paper award** for the work “*COVID-19 X-ray Image Diagnostic with Deep Neural Networks*” in the Brazilian Symposium on Bioinformatics (BSB 2020).
- **Alumni Scholarship** from the Institute of Computing, University of Campinas, 2019-2020.
- **Research Internship Scholarship** (BEPE) from the São Paulo Research Foundation (FAPESP), 2019-2020.
- **Ph.D. Scholarship** from the São Paulo Research Foundation (FAPESP), 2018-2022.
- **Ph.D. Scholarship** from Coordination for the Improvement of Higher Education Personnel (CAPES), 2017-2018.
- **4<sup>th</sup> place in the competition** on generalized face presentation attack detection in mobile authentication scenarios, International Joint Conference on Biometrics (IJCB), 2017.
- **M.Sc. Scholarship** from Motorola Mobility, 2015-2017.
- National Counsel of Technological and Scientific Development (CNPq) **Undergraduate Research Scholarship**, 2010-2012.

## TALKS & PRESENTATIONS

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- Understanding the Passage of Time: from ‘Back to the Future’ to Forensic Events** *May, 2020*  
*Seminars on Computer Science, Institute of Computing, University of Campinas (Brazil)*
- Learning visual clues of the passage of time** *May, 2019*  
*InterForencics, ICMedia, São Paulo (Brazil)*
- Two-tiered facial verification for mobile devices** *May, 2019*  
*16<sup>th</sup> International Summer School of Biometrics, Alghero (Italy)*

## ACADEMIC SERVICE

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### Conference papers revision

- CVPR, ICCV, BMVC, WACV, IWBF *2021*
- ICML, ICPR, BMVC, WACV *2020*

### Journal articles revision

- Springer**  
Eurasip Journal on Image and Video Processing, Multidimensional Systems and Signal Processing
- Wiley**  
Electronics Letters

### Examining committee

- Comparative study of deep learning architectures for detection of manipulated images** *2019*  
*Undergraduate thesis of **Thales Pomari**, advised by prof. **Tiago Carvalho** (IFSP, Campinas, Brazil)*

## REFERENCES

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- Prof. Dr. Anderson Rocha**  
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Ph.D. advisor, Institute of Computing, University of Campinas, Campinas, SP, Brazil.
- Fernanda A. Andaló, Ph.D.**  
*fernanda@andalo.net.br*  
Ph.D. co-advisor, LEGO, Denmark.
- Prof. Dr. Nathan Jacobs**  
*jacobs@cs.uky.edu*  
Ph.D. research internship advisor, Department of Computer Science, University of Kentucky, Lexington, KY, USA.