GABRIEL CAPITELI BERTOCCO

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BRIEF PRESENTATION

I have been a graduate student pursuing a Ph.D. degree in Computer Science at the Institute of Computing (IC), University of Campinas (Unicamp), Brazil, since August 2019. From 2015 to 2018, I was an undergraduate researcher in a project sponsored by Motorola. The focus was on Deep Learning-based face biometrics analysis for age estimation on mobile devices. For this work, in 2017, I won the Inova Innovation Award for the best undergraduate research project being developed at Unicamp. In 2018, I won First Place in the Face Recognition Competition promoted by the IAPR/IEEE International Summer School in Biometrics and Forensics in Italy. In the same year, I developed a method to detect image repurposing by leveraging Deep Learning techniques, which was the goal of my Final Undergraduate Project. I also worked as a researcher at SciPet Solutions on Technological Innovations in the first semester of 2019. I graduated with distinction in 2019 in Computer Engineering, and currently, I am working on my Ph.D. project titled *Mining Persons, Objects and Places from Heterogeneous Source Domains*. This work aims to find coherent groups of identities (people), things (objects), and places that appear in a set of potentially non-overlapping camera views in a fully-unsupervised manner. I am studying and deploying Deep Convolutional Neural Networks (DCNNs)-based algorithms focused on Unsupervised Person Re-Identification, extended to objects and places. The ultimate goal is to design Self-Supervised Learning and Clustering techniques to handle large unlabeled datasets tackling biases in different image semantics (People, Objects, and Places) and modalities (images and texts) in the context of Re-Identification. This investigation recently led to a first-author publication (DOI: 10.1109/TIFS.2021.3107157) in the IEEE Transactions on Information Forensics and Security (TIFS - Impact Factor of 7.178) leveraging Self-Supervised Deep Learning solutions in August 2021. It was also presented in the IEEE Workshop of Information Forensics and Security in December 2021. In 2022, we have designed a newer and more general self-supervised solution for reasoning for complex data in large-scale datasets. I have more than six years of expertise in machine learning, Deep Learning, and Computer Vision with top-tier publications, projects, awards, and one patent. Currently, I am in the third year of my Ph.D., focusing on my research and work opportunities in companies and research centers concerned with generating innovation.

Main research interests: Computer Vision, Deep Learning, and Self-Supervised Learning.

PUBLICATIONS

- William Dias, Fernanda Andaló, Rafael Padilha, **Gabriel Bertocco**, Waldir Almeida, Paula Costa, and Anderson Rocha. Cross-dataset emotion recognition from facial expressions through convolutional neural networks. *Journal of Visual Communication and Image Representation*, 82:103395, 2022
- **Gabriel C. Bertocco**, Fernanda Andaló, and Anderson Rocha. Unsupervised and self-adaptative techniques for cross-domain person re-identification. *IEEE Transactions on Information Forensics and Security*, 16:4419–4434, 2021
- Rafael Padilha, Antônio Theóphilo, Fernanda A. Andaló, Didier A. Vega-Oliveros, João P. Cardenuto, **Gabriel Bertocco**, José Nascimento, Jing Yang, and Anderson Rocha. The Artificial Intelligence and the challenges on the Digital Forensics Science in the XXI century (in Portuguese). *USP Advanced Studies*, 2021
- Rafael Padilha, Caroline Mazini Rodrigues, Fernanda Alcantara Andaló, **Gabriel Bertocco**, Zanoni Dias, and Anderson Rocha. Forensic event analysis: From seemingly unrelated data to understanding. *IEEE Security and Privacy*, 18(6):23–32, 2020

- Rafael Padilha, Fernanda A Andaló, **Gabriel Bertocco**, Waldir R Almeida, William Dias, Thiago Resek, Ricardo da S Torres, Jacques Wainer, and Anderson Rocha. Two-tiered face verification with low-memory footprint for mobile devices. *IET Biometrics*, 9(5):205–215, 2020
- Waldir R Almeida, Fernanda A Andaló, Rafael Padilha, **Gabriel Bertocco**, William Dias, Ricardo da S Torres, Jacques Wainer, and Anderson Rocha. Detecting face presentation attacks in mobile devices with a patch-based cnn and a sensor-aware loss function. *PloS one*, 15(9):e0238058, 2020
- Marcos Cirne, Fernanda Andaló, Rafael Dias, Thiago Resek, **Gabriel Bertocco**, Ricardo da S Torres, and Anderson Rocha. Deep face verification for spherical images. In *2019 IEEE International Conference on Image Processing (ICIP)*, pages 3292–3296. IEEE, 2019
- **Gabriel Bertocco**, Fernanda Andaló, Ricardo Torres, Jacques Wainer, and Anderson Rocha. Automatic age range estimation on mobile devices. In *XV Congress of Scientific Initiation at UNICAMP*, 2017
- Zinelabdine Boulkenafet, ..., W.R. Almeida, 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 *2017 IEEE International Joint Conference on Biometrics (IJCB)*, pages 688–696. IEEE, 2017

IN REVIEW

- **Gabriel Bertocco**, Antônio Theóphilo, Fernanda Andaló, Anderson Rocha. Reasoning for Complex Data through Ensemble-based Self-Supervised Learning, 2022

PRESENTATIONS

- **Gabriel C. Bertocco**, Fernanda Andaló, and Anderson Rocha. Unsupervised and self-adaptative techniques for cross-domain person re-identification. 13^{th} *IEEE International Workshop on Information Forensics and Security.* Montpellier, France, 2021

PATENTS

• Andalo, F.; Padilha, R.; Almeida, W. R.; **Gabriel Bertocco**; Wainer, J.; Torres, R.; ROCHA, A. *Multiple-tiered facial recognition.* United States, 2018

AWARDS

• **First Place in the Face Verification Competition**. IAPR/IEEE International Summer School on Biometrics and Forensics, Alghero, Italy, 2018.
• **INOVA Award**. Title: Automatic age range estimation on mobile devices. Advisor: Prof. Dr. Anderson Rocha. Co-advisor: Dr. Fernanda Andaló. INOVA/UNICAMP, 2017.
• **Fourth place in the Competition on generalized face presentation attack detection in mobile authentication scenarios**. International Joint Conference on Biometrics (IJCB), 2017.
• **Honorable mention in the Olympic of physics of State of São Paulo (Brazil)**. Award given to the twenty best students of the high school of the state of São Paulo, Brazil, with greatest grade in the applied theorical and pratical tests. 2013.
• **Gold Medal (First Place) in the Olympic of mathematics promoted by the Pontificia Universidade Catolica de Campinas (PUCCamp - Brazil)**. High School Award given to the group that had the best grade in the test applied by PUCCamp. This winner group was composed by Caio Barbosa, Karen Campos and I. 2013.

PROJECTS

• (2019 - Ongoing): *Mining Persons, Objects, and Places from Heterogeneous Source Domains.* **Advisor:** Prof. Dr. Anderson Rocha. *Funding Agency:* The São Paulo Research Foundation (FAPESP). Ph.D. project I have focused on at the University of Campinas, Brazil. The ultimate goal is to design large-scale self-supervised learning solutions to filter and group persons, objects, and places, tackling biases in a fully-unsupervised manner. We envision designing solutions that we can also extend for applications in further Artificial Intelligence research fields. The initial results of this work were published on TIFS in August of 2021, surpassing all prior art performances.
• (2019) *CrowdPet: Automatic identification of animals in images.* **Coordinators**: Dra. Fernanda Andaló and Dr. Fabio Rogério Piva. **Funding Agency**: **SciPet/SAE**. (Scientific Initiation). I worked in deep learning-based solutions to identify stray dogs and cats and filter out unknown classes leveraging and studying Open-Set solutions and Explainable Artificial Intelligence (XAI) techniques. Research outcomes are now available, in the form of mobile applications, to some prefectures in Brazil.
• (2018) *Event Repurposing Detection Based on Image Analysis.* **Coordinator**: Prof. Dr. Anderson Rocha. (Final Undergraduate Project). In this project, I proposed Deep Learning and Open-set based solutions to predict if a given image belongs or not to the context of an event of interest. In this way, we would be able to detect potential misinformation regarding image data.
• (2018) *BioLive-360: open-set face recognition in 360° images for a smart personal assistant application.* **Coordinator**: Prof. Dr. Anderson Rocha. **Funding Agency**: **Motorola Mobility**. (Scientific Initiation). This project is a continuation of the previous one, where I kept the exploration of age estimation on mobile devices, with the support of specialists working with 360° images.
• (2015 - 2017) *BioLive: Multi-feature and Open-Set Authentication Techniques for Mobile Devices.* **Coordinator**: Prof. Dr. Anderson Rocha. **Funding Agency**: **Motorola Mobility**. (Scientific Initiation). In this project, I explored Deep Learning-based solutions to estimate the age range of a given photo of a person taken by a mobile device. This work won the best undergraduate project at the University of Campinas in 2017.

TEACHING ASSISTANT

In the following courses, I was the teaching assistant of my advisor Prof. Dr. Anderson Rocha, where we taught machine learning and deep learning concepts with theoretical and practical explorations.

- Complex Data Mining Course at University of Campinas. **Supervision:** Prof. Dr. Anderson Rocha. First Semester of 2022.
- Complex Data Mining Course at University of Campinas. **Supervision:** Prof. Dr. Anderson Rocha. First and Second Semester of 2021.
- Complex Data Mining Course at University of Campinas. **Supervision:** Prof. Dr. Anderson Rocha. First and Second Semester of 2020.
- Data Science Course for Motorola Mobility Brazil. **Supervision:** Prof. Dr. Anderson Rocha. Second Semester of 2020.
- Complex Data Mining Course for Bradesco Bank. **Supervision:** Prof. Dr. Anderson Rocha. Second Semester of 2020 and First Semester of 2022.
- Data Science Course for Ericsson Brazil. **Supervision:** Prof. Dr. Anderson Rocha. First Semester of 2020.

ACADEMIC DISCIPLINES

At the beginning of this Ph.D. project (2019 - 2020), I attended six disciplines, with four of them related directly to machine learning and Deep Learning (MO443, MO444, MO446, and MO651).

These are all disciplines required by the Institute of Computing at the University of Campinas (IC/UNICAMP), in which I obtained the maximum academic grade in all of them. Besides, I also have the maximum

Course Name	Code	Final Grade
Introduction to Computer Vision	MO446	A
Introduction to Digital Image Processing	MO443	A
Machine Learning and Pattern Recognition	MO444	A
Graph Theory	MO405	A
Mobile Robotics	MO651	A
Teleprocessing and Computer Networks	MO611	A

Performance Coefficient, being four on a scale from 0 to 4. Currently, I am in the third year of my Ph.D., focusing on my research and work opportunities in companies and research centers concerned with generating innovation.

COURSES IN CONFERENCES

• **IAPR/IEEE International Summer School for Advanced Studies on Biometrics for Secure Authentication: ASSURING TRUSTWORTHINESS OF BIOMETRICS.** Alghero, Italy. 2018.
• **NVIDIA Hands-On Labs em Deep Learning.** Course given by NVIDIA at UNICAMP. Campinas, São Paulo, Brazil. 2018.
• **Tutorial: Face Analysis in the Wild**. 30^{th} Conference on Graphics, Patterns and Images (SIBGRAPI). Niterói, Rio de Janeiro, Brazil. 2017.

EDUCATION

Ph.D. Pursuing Ph.D. degree in Computer Science at University of Campinas (UNICAMP), 2019 - Today.

College Undergraduate level in Computer Engineering at University of Campinas (UNICAMP), 2014 - 2019.

COMPUTER SKILLS

Advanced Knowledge Python, Pytorch, Tensorflow, Keras and C
Intermediate Knowledge R, Java, Java for Android, Caffe
Basic Knowledge Android Studio Plataform, C++, Cuda C, Python Cuda

LANGUAGES

Native Portuguese
Professional Proficiency English