

# PAULO BRUNO DE SOUSA SERAFIM

*Brazilian*

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## EDUCATION

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**Master's degree in Computer Science**

March 2016 - April 2018

*Federal University of Ceara (UFC), Fortaleza, Brazil*

**Bachelor's degree in Computer Science**

January 2013 - February 2016

*Federal University of Ceara (UFC), Fortaleza, Brazil*

**Bachelor's degree in Chemical Engineering (incomplete)**

January 2010 - December 2012

*Federal University of Ceara (UFC), Fortaleza, Brazil*

## MASTER'S THESIS

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**Title: Evaluating competition in training of Deep Reinforcement Learning agents in First-Person Shooter games** *(in Portuguese)*

*Comparison of autonomous agents' performance in relation to different training opponents. Multiple agents were trained from image data in a competitive scenario of a First-Person Shooter environment using Deep Q-Networks (DQN). Agents that trained against DQN opponents performed better.*

**Advisor:** Prof. Joaquim Bento Cavalcante-Neto (UFC)

**Co-advisors:** Prof. Creto Vidal (UFC) and Prof. Yuri Nogueira (UFC)

**Outside reader:** Prof. Soraia Musse - Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS)

## RESEARCH EXPERIENCE

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**Inria - Sophia Antipolis Méditerranée**

April 2022 - Present

*Research Engineer*

Optimisation of Neural Networks with implementation using Julia programming language. Worked with a world model using Julia's modelling toolkit.

**CRAb Research Group - Department of Computer Science (UFC)**

*External Collaborator*

March 2018 - Present

Working on analysis of agent's performance under different views of the same scenario by using model interpretability methods. Started researching on character-oriented player modelling behaviour.

*Master's student*

March 2016 - February 2018

Master's work in Deep Reinforcement Learning.

*Volunteer Researcher*

August 2014 - February 2016

Undergraduate research in Neuroevolution, constructing autonomous agents immersed in a resource gathering environment and in a simplified version of a MOBA game.

Undergraduate research on hair animation using mass-spring systems and Neuroevolution for autonomous game agents.

## WORK EXPERIENCE

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### Instituto Atlântico

May 2021 - March 2022

#### Data Scientist

Technical Leader in a team of three Data Scientists on an R&D project for Dell EMC. Worked with anomaly detection using unsupervised learning methods, classification using supervised learning, and development of dashboards to assist tactical and operational decision making.

### Instituto Atlântico

September 2020 - April 2021

#### Computer Vision Engineer

Developer on an R&D Computer Vision project for HP Inc using Deep Learning for human segmentation in photos. Worked on OCR methods applied to printed text documents and developed a synthetic document generator.

### Instituto Atlântico

February 2019 - August 2020

#### Computer Graphics Engineer

Developer on an R&D project for HP Labs in the field of 3D printing. Applied Computer Graphics techniques to build voxelised tree-like support structures.

### GREat - ASTEF

May 2018 - February 2019

#### Software Developer

Developed solutions for fingerprint minutiae extraction and matching focused on high-performance. Started a side research project using Convolutional Neural Networks for fingerprint ROI segmentation.

## TEACHING EXPERIENCE

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### Teaching Internship

February 2017 - July 2017

Graduate Teaching Assistant of the Introduction to Computer Science course under the supervision of Prof. Yuri Nogueira, permanent professor at the Department of Computer Science (UFC).

### Teaching Initiation Program

September 2014 - December 2014

Scholarship (R\$ 1,600.00) funded by the Vice Provost for Undergraduate Studies (Prograd-UFC).

Undergraduate Teaching Assistant of the Elementary Calculus course under the supervision of Prof. Frederico Girão, permanent professor at the Department of Mathematics (UFC).

### Short-duration courses

An Introduction to Reinforcement Learning (18 hours)

February 2020 - April 2020

Internal course at Instituto Atlântico organised by the Group of Cognitive Computing

Introduction to 2D Game Development (4 hours)

August 2015

Organised by the Program of Tutoring Education of the Computer Science Department (UFC)

Elementary Excel (3 hours)

June 2015

Organised by the Program of Tutoring Education of the Economics Department (UFC)

Introduction to C Programming Language (20 hours)

June 2012

Organised by the Junior Enterprise of Chemical Engineering (UFC)

## SUPERVISORY EXPERIENCE

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### Graduate students 2021 - Present

Co-supervisor of a PhD candidate, providing support in the field of Deep Reinforcement Learning.  
Direct supervisor of two Master's students in their works and thesis.

### Undergraduate students 2015 - 2022

Direct supervisor of three undergraduate students in their Bachelor's thesis.  
Tutor of four undergraduate students during their one-year internships in the CRAB research group.

### Company employees 2018 - 2022

Co-leader of a study group, leading proof-of-concept research in Reinforcement Learning.  
Direct supervisor of three interns during their first months in the company.  
Started and led a research subgroup with five people in Deep Learning applied to fingerprint image problems.

## BOARDS

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### Federal University of Ceara (UFC) June 2019

Outside reader of an undergraduate thesis in the field of Computer Vision.

## AWARDS AND HONOURS

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### Magna Cum Laude 2015

*Federal University of Ceara*

An academic distinction awarded by the Federal University of Ceara for students that conclude the Bachelor's degree with elevated academic performance.

### Best Paper Nominations

XIX Brazilian Symposium on Computer Games and Digital Entertainment (SBGames) 2020

XVI Brazilian Symposium on Computer Games and Digital Entertainment (SBGames) 2017

## FELLOWSHIPS AND GRANTS

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### Master's Fellowship March 2016 - February 2018

*R\$ 36,000.00*

Funded by the Brazilian National Council for Scientific and Technological Development (CNPq).

### Program Young Talents for Science August 2013 - July 2014

*R\$ 4,800.00*

Funded by the Brazilian Coordination for the Improvement of Higher Education Personnel (CAPES).

## PATENTS

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### Generating supports 2019

*WO2021107916A1*

Generation of tree-like supporting structures for 3D printing. Developed when I was working at Instituto Atlântico in a partnership with HP Inc, under the supervision of HP Labs Senior Researcher Jun Zeng.

## STUDENT SOCIETIES

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### **Politeq Jr. (currently called Ciclo Jr.)**

*Junior Enterprise affiliated to the Departments of Chemical and Environmental Engineering at UFC*

President

June 2012 - January 2013

Director of Finance and Administration

February 2012 - June 2012

Trainee

August 2011 - February 2012

### **FEJECE**

*Federation of Junior Enterprises of Ceara*

Board member representing Politeq Jr.

February 2012 - January 2013

## ACADEMIC SERVICE

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### **Reviewer**

2021

Invited reviewer for the 23rd Symposium on Virtual and Augmented Reality (SVR 2021).

### **O CT quer você!**

June 2012

An event idealised by the Centre of Technology (UFC) comprising all engineering courses to help secondary school students. I was a member of the Chemical Engineering organisation committee.

## LECTURES

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### **Technological Advances in 3D Printing**

August 2020

*In Portuguese*

Guest lecturer invited by the University for the International Integration of Afro-Brazilian Lusophony.

### **Deep Reinforcement Learning: Today's AIs that beat humans**

August 2020

Lecturer at CorongaMeet 2.0 Ceara.

### **Autonomous Bots in StarCraft II**

November 2019

*In Portuguese*

Lecturer at the national Developer's Conference 2019 (TDC).

### **How do Robots See?**

October 2019

*An introduction to semantic segmentation in images*

Lecturer at HP Spark Day 2019, organised by HP Inc.

### **Introduction to Artificial Intelligence Applied to Digital Games**

October 2018

*In Portuguese*

Guest lecturer invited by the University Centre UniFanor.

### **Artificial Intelligence Applied to Digital Games**

November 2017

*In Portuguese*

Guest lecturer invited by the University Centre Unichristus.

### **Introduction to Digital Games Development**

June 2017

*In Portuguese*

Guest lecturer invited by the State School of Professional Education Julia Giffoni.

## SELECTED PUBLICATIONS

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- XX Brazilian Symposium on Computer Games and Digital Entertainment** October 2021  
*Assessing the Robustness of Deep Q-Network Agents to Changes on Game Object Textures*  
Paulo B. S. Serafim, Yuri L. B. Nogueira, Creto A. Vidal, Joaquim B. Cavalcante-Neto.
- Book Chapter - Introduction to Virtual and Augmented Reality (in Portuguese)** November 2020  
*Deep Reinforcement Learning em Ambientes Virtuais (Deep Reinforcement Learning in Virtual Environments)*  
Paulo B. S. Serafim, Yuri L. B. Nogueira, Joaquim B. Cavalcante-Neto, Creto A. Vidal.
- 2019 International Joint Conference on Neural Networks** July 2019  
*A Method based on Convolutional Neural Networks for Fingerprint Segmentation*  
Paulo B. S. Serafim, Aldísio G. Medeiros, Paulo A. L. Rego, José G. R. Maia, Fernando A. M. Trinta, Marcio E. F. Maia, José A. F. Macêdo, Aloísio V. Lira Neto.

## ADDITIONAL PUBLICATIONS

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- XX Brazilian Symposium on Computer Games and Digital Entertainment** October 2021  
*Gym Hero: A Research Environment for Reinforcement Learning Agents in Rhythm Games*  
Rômulo F. Férrer Filho, Yuri L. B. Nogueira, Creto A. Vidal, Joaquim B. Cavalcante-Neto, Paulo B. S. Serafim.
- 28th International Conference on Systems, Signals and Image Processing** June 2021  
*Robust Fingerprint Singular Point Detection using a Single-Stage CNN for Object Detection*  
Lucas S. Fernandes, João P. B. Andrade, Leonardo F. Costa, Paulo B. S. Serafim, Paulo A. L. Rego, José G. R. Maia.
- XIX Brazilian Symposium on Computer Games and Digital Entertainment** November 2020  
*Investigating Deep Q-Network Agent Sensibility to Texture Changes on FPS Games*  
Paulo B. S. Serafim, Yuri L. B. Nogueira, Creto A. Vidal, Joaquim B. Cavalcante-Neto, Rômulo F. Férrer Filho.
- XXII Symposium on Virtual and Augmented Reality** November 2020  
*Autonomous Foraging with SARSA-based Deep Reinforcement Learning*  
Anderson O. Mesquita, Yuri L. B. Nogueira, Creto A. Vidal, Joaquim B. Cavalcante-Neto, Paulo B. S. Serafim.
- XIX Brazilian Symposium on Computer Games and Digital Entertainment** November 2020  
*Simplifying Attribute Balancing in Electronic Role-Playing Games (in Portuguese)*  
Alexandre M. M. Santos, Paulo B. S. Serafim, Artur O. R. Franco, Rafael A. F. Carmo, José G. R. Maia.
- 2020 International Joint Conference on Neural Networks** July 2020  
*A Novel Approach for Automatic Enhancement of Fingerprint Images via Deep Transfer Learning*  
Aldísio G. Medeiros, João P. B. Andrade, Paulo B. S. Serafim, Alexandre M. M. Santos, José G. R. Maia, Fernando A. M. Trinta, José A. F. Macêdo, Pedro P. R. Filho, Paulo A. L. Rego.
- XVIII Brazilian Symposium on Computer Games and Digital Entertainment** October 2019  
*A Minimal Training Strategy to Play Flappy Bird Indefinitely with NEAT*  
Matheus G. Cordeiro, Paulo B. S. Serafim, Yuri L. B. Nogueira, Creto A. Vidal, Joaquim B. Cavalcante-Neto.
- XVII Brazilian Symposium on Computer Games and Digital Entertainment** October 2018  
*Evaluating Competition in Training of Deep Reinforcement Learning Agents in First-Person Shooter Games*  
Paulo B. S. Serafim, Yuri L. B. Nogueira, Creto A. Vidal, Joaquim B. Cavalcante-Neto.

## XVI Brazilian Symposium on Computer Games and Digital Entertainment

November 2017

*On the Development of an Autonomous Agent for a 3D First-Person Shooter Game Using Deep Reinforcement Learning*

Paulo B. S. Serafim, Yuri L. B. Nogueira, Creto A. Vidal, Joaquim B. Cavalcante-Neto.

## 19th Symposium on Virtual and Augmented Reality

November 2017

*Towards Playing a 3D First-Person Shooter Game Using a Classification Deep Neural Network Architecture*

Paulo B. S. Serafim, Yuri L. B. Nogueira, Creto A. Vidal, Joaquim B. Cavalcante-Neto.

## LANGUAGES

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<b>Portuguese</b>	Native
<b>English</b>	Full professional proficiency
<b>French</b>	Limited professional proficiency

## REFERENCES

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**Dr. Emanuele Natale, CNRS Researcher**

*Research Supervisor*

**Affiliation:** CNRS, Université Côte d'Azur, Inria, I3S

**E-mail:** emanuele.natale@inria.fr

**Phone:** +33 4 92 38 76 31

**Dr. Joaquim Bento Cavalcante-Neto, Permanent Professor at UFC**

*Master's and Bachelor's Advisor*

**Affiliation:** Department of Computer Science, Federal University of Ceara (UFC)

**E-mail:** joaquimb@dc.ufc.br

**Phone:** +55 85 9 99 97 12 97