# Wellison Santos

## **Contact Information**

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Summary

I am a researcher with +8 years of experience with adaptive systems. My work focuses on improving QoS in cloud-native apps. I used formal methods to auto-scaling SOA apps throughout my graduation using LTLChecker and CADP. In my MS.c., I developed a proactive system for auto-scaling microservices that uses machine learning models to forecast CPU, called ML-Adapt. ML-Adapt decreased application response time by 20% compared to HPA in best-case scenarios. In my Ph.D., I'm researching ways to improve ML-Adapt. First, I demonstrated that the Multiple Predictor System (MPS) improves microservices time-series forecasts by 35-75% in best results and works equal to or better than the previous approach in 81.5% of experiments. I also have hands-on experience in DevOps, managing secure cloud infrastructure (AWS), containerization (Docker), and CI/CD pipelines. I implement security best practices, including IDP configuration for access management, VPN setup, IAM policies, and automated compliance checks to protect system integrity while enhancing operational efficiency.

## Education

- 2020–2024 **Ph.D. in Computer Science:** Universidade Federal de Pernambuco<sup>1</sup>, Recife/Brazil *Thesis: Proactive adaptation of Microservice-based applications*
- 2018–2020 **MS.c. in Computer Science:** Universidade Federal de Pernambuco, Recife/Brazil *Dissertation: Adaptation of microservices-based applications using machine learning*
- 2013-2017 **BS.c. in Computer Science:** Universidade do Estado do Rio Grande do Norte<sup>2</sup>, Santa Cruz/Brazil

Final paper: A solution for runtime verification of service compositions

## Experience

2025–Now Professor: I am an instructor for the DevOps course in the Software Engineering postgraduate program at MIT and have taught LPIC-1 courses in Network Engineering. Additionally, I am a Professor of Network Architecture<sup>3</sup>, teaching at the undergraduate, master's, and PhD levels.
Transferable skills: Higher Education Teaching, Research and Development (R&D), Higher Education Research, Advisor.

Location: Cesar School and Instituto Infnet

<sup>&</sup>lt;sup>1</sup>The computer science program ranks among the top seven most esteemed programs in Brazil.

<sup>&</sup>lt;sup>2</sup>I graduated with academic honours and was acknowledged as **the top student in the program**.

<sup>&</sup>lt;sup>3</sup>I was elected in 2025.1 as the top professor of the cybersecurity course by a vote of the students.

2025–Now **Research Assistant:** I focus on enhancing cybersecurity solutions through research in distributed systems and artificial intelligence. Topics include but are not limited to attack detection and prevention analysis, threat mining, forensic analysis, incident response, and correlations of anomalous behaviours in networks and systems.

> **Transferable skills:** Research Support, Research, Publishing, Teaching, Subject Recruitment. **Location:** CISSA (Integrated Center for Security in Advanced Systems)

2024–2025 **DevOps Engineer:** I assist various teams with secure and automated infrastructure management, concentrating on robust cloud environments, particularly in AWS, while implementing strong cybersecurity practices. I am skilled in containerization using Docker, VPN setup, IAM management, and IDS monitoring to ensure system integrity. I utilize CI/CD tools such as Jenkins and GitHub Actions for efficient and secure deployments, and I leverage Python for automation and compliance checks.

**Transferable skills:** VPN, IDP, IAM, AWS, Docker, CI/CD, Jenkins, GitHub Actions, Python, Automation, Problem-solving.

Location: Instituto SENAI de Inovação para Tecnologias da Informação e Comunicação.

2023–2024 **VIRS Student at Systopia Lab:** The current project aims to design and develop a new solution for bottleneck detection in microservices, considering their inherent dynamism in production environments.

**Transferable skills:** Root Cause and Anomaly Detection, Microservices, Graph Neural Networks **Location:** The University of British Columbia, Canada.

2018-2024 **Ph.D. and MS.c. fellow:** During my MS.c., I created ML-Adapt, a proactive system that uses machine learning to forecast CPU for auto-scaling microservices. ML-Adapt notably reduced application response time by 20% compared to HPA in best-case scenarios. However, its effectiveness relied heavily on forecast accuracy. My Ph.D. research focuses on enhancing this forecast component. I introduced the Multiple Predictors System (MPS) approach, demonstrating its superior accuracy (35-75% improvement in the best results) in 81.5% of experiments compared to the previous approach.

**Transferable skills:** Machine Learning, Self-adaptive Systems, Microservices, Kubernetes, Auto-scaling, Time Series Forecasting, Java, Kubernetes, Python.

Location: Universidade Federal de Pernambuco, Brazil.

2016-2018 **Undergraduate Research Projects:** I produced two innovative solutions in two areas. In the first one, I created augmented reality digital games to enhance motor coordination in children, encouraging active movement through interactive puzzles located in their environment. In the second one, I addressed implementing and monitoring service compositions in dynamic business environments. I emphasised runtime monitoring to ensure expected behaviour by verifying adherence to behavioural properties (e.g., ensuring activity B follows activity A) using formal techniques like LTLMiner and CADP.

**Transferable skills:** SOA, SOA Orchestration, Formal Description, Self-Adaptive Systems, Systems Modelling, Augmented Reality, Android, Unity.

Location: Universidade do Estado do Rio Grande do Norte, Brazil.

#### Grants

- 2023-2024 **Sandwich Doctorate Fellowship** Grant by the Brazilian CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, in Portuguese)
- 2018-2024 **MS.c. and Ph.D. Fellowship** Grant by the Brazilian FACEPE (Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco, in Portuguese)

2014-2017 **Teacher Assistant Fellowship for Calculation for Computing, Physics and Numerical Calculation** – Grant by the UERN college (Universidade do Estado do Rio Grande do Norte, in Portuguese)

#### Publications

Wellison R. M. Santos, Adalberto R. Sampaio, Nelson S. Rosa, George D. C. Cavalcanti (2025). Univariate vs multivariate prediction for containerised applications auto-scaling: a comparative study. Proceedings of the 40th ACM/SIGAPP Symposium on Applied Computing. doi:https://doi.org/10.1145/3672608.3707770

Flávio Neves, Rafael Souza, Wesley Lima, Wellison Raul, Michel Bonfim, Vinicius Garcia (2024). Smart Anonymity: a mechanism for recommending data anonymization algorithms based on data profiles for IoT environments. The Journal of Supercomputing. doi:https://doi.org/10.1007/s11227-024-06209-3

Santos, W.; Sampaio Jr, A.; Rosa, N.; Cavalcanti, G. Microservices Performance Forecast Using Dynamic Multiple Predictor Systems. EAAI (2024). doi:https://doi.org/10.1016/j.engappai.2023.107649

Santos, W.; Sampaio Jr.; Rosa, N.; Cavalcanti, G. Predictive models for adapting microservice-based applications: a comparative analysis. JPDC. (Major Revision)

Santos, W.; Xavier, M.; da Cunha, D. C.; Júnior, J. C. M.; Adauto, D.; Ferraz, C. Trendsbot: Checking the veracity of telegram messages using data streams<sup>3</sup>. SRBC (2019). doi:https://doi.org/10.5753/sbrc\_estendido.2019.7771

<sup>&</sup>lt;sup>4</sup>The paper received an **honourable mention** award.