Gabriel Henrique Lopes Gomes Alves Nunes

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Cotutelle Doctoral candidate in Computer Science at the Federal University of Minas Gerais (UFMG), Brazil, and at Macquarie University, Australia. Master in Computer Science and Bachelor in Physics from UFMG. Recipient of the Google LARA Research Scholarship and the Excellence in Higher Degree Research (Student Award) from the Faculty of Science and Engineering, Macquarie University. Interested in Formal Methods, Quantitative Information Flow, Responsible Computing (e.g. Privacy, Utility, Fairness), Artificial Intelligence, and Neuroscience.
Member of Topete Research Group and INSCRYPT | T-Rex Laboratory.

Education

- **Doctoral Degree in Computer Science** (Researcher Profile) 2023-02 – 2025-12
  School of Computing, Macquarie University, Sydney, New South Wales, Australia
  Recipient of an International Macquarie University Research Excellence (iMQRES) Scholarship.
  Supervised under Cotutelle by Annabelle McIver. (Thesis submitted for evaluation.)
- **Doctoral Degree in Computer Science** 2021-07 – 2025-12
  Graduate Program in Computer Science, UFMG, Belo Horizonte, Minas Gerais, Brazil
  Recipient of a CAPES Scholarship. Supervised under Cotutelle by Mário Alvim.
  - Cotutelle research area: Quantitative Information Flow theory and its application to precisely characterise how different methods of noise introduction affect the trade-off between privacy and utility in microdata and statistical data publications.
  - Keywords: Differential Privacy, Disclosure Control, Caesar, Formal Methods, Git, Java, Jupyter, LaTeX, Linux, Privacy, Privacy Compliance, Python, Scientific Research.
- **Master Degree in Computer Science** 2019-03 – 2021-04
  Graduate Program in Computer Science, UFMG, Belo Horizonte, Minas Gerais, Brazil
  Recipient of a CNPq Scholarship. Supervised by Mário Alvim and by Annabelle McIver.
  - Dissertation defended and approved on April 28, 2021: A formal quantitative study of privacy in the publication of official educational censuses in Brazil (**HDL**: 1843/38085).
  - Dissertation selected for the 35th Thesis and Dissertation Contest (CTD 2022), as part of the 42nd Congress of the Brazilian Computing Society (CSBC 2022) (**DOI**: 10.5753/ctd.2022.223158).
  - Keywords: Alloy, C, C++, Dafny, Differential Privacy, Disclosure Control, Formal Methods, Git, Java, Jupyter, LaTeX, Linux, Privacy, Privacy Compliance, Python, Scientific Research.
- **Bachelor Degree in Physics**, UFMG, Belo Horizonte, Minas Gerais, Brazil 2014-03 – 2018-07
  - Keywords: LabVIEW, LaTeX, MATLAB, Python, SolidWorks, Scientific Research.
- Bachelor Degree in Nanotechnology, Federal University of Rio de Janeiro (UFRJ). Unfinished. 2012-03 – 2013-12
- Bachelor Degree in Medicine, Medical Sciences of Minas Gerais. Unfinished. 2011-02 – 2011-06

Awards

- **Excellence in Higher Degree Research (Student Award)** 2024-12
  Faculty of Science and Engineering, Macquarie University.
  Skills: Scientific Research.
- Outstanding Poster 2024-06
  Future Communications Research Centre, Macquarie University.
  Poster: Quantitative Information Flow for Privacy Analysis (Future Communications Research Centre Workshop).
  Skills: Privacy and Utility Trade-Off, Scientific Research.
- Research Rising Star 2023-10
  School of Computing, Faculty of Science and Engineering, Macquarie University.
  Paper: A Novel Analysis of Utility in Privacy Pipelines, Using Kronecker Products and Quantitative Information Flow.
  Skills: Privacy and Utility Trade-Off, Scientific Research.
- **Google LARA Research Scholarship** 2022-02
  9^{th} Google Latin America Research Awards (LARA).
  A robust and explainable QIF-based framework for assessing big data privacy risks.
  Skills: Disclosure Control, Differential Privacy, Privacy, Privacy Compliance, Scientific Research.

Experience

- Sessional Teaching Academic 2023-07 – **Present**
  School of Computing, Macquarie University, Sydney, New South Wales, Australia
  Offensive Security (COMP2320/COMP6320), Data Privacy and Information Security (COMP3300), Secure Applications Development (COMP3310), and Formal Methods (COMP4000).
  Skills: Communication, Ethical Hacking, Formal Methods, Java, Privacy, Privacy Compliance, Python, Teaching.
- **Student Researcher** 2022-07 – 2022-11
  Google LLC, New York, New York, United States of America
  Internship supervised by Andrés Muñoz Medina.
  Skills: Apache Beam, Machine Learning, Privacy, Privacy Compliance, Python.

- **Information Security Analyst** 2020-12 – 2021-03
  FUNDEP, UFMG, Belo Horizonte, Minas Gerais, Brazil
  Project PRICE - Privacy in Educational Censuses, directed by Mário Alvim.
  Skills: Privacy, Privacy Compliance, Python, Transparency.
- Visiting Scholar 2019-09 – 2019-11
  School of Computing, Macquarie University, Sydney, New South Wales, Australia
  Internship supervised by Annabelle McIver.
  Skills: Privacy, Privacy Compliance, Python, Transparency.
- **Volunteer IT System Administrator** 2019-03 – **Present**
  INSCRYPT | T-Rex Laboratory, UFMG, Belo Horizonte, Minas Gerais, Brazil
  Skills: Debian, Linux, System Administration, Volunteering.
- Scientific Initiation 2016-03 – 2016-06
  UFMG, Belo Horizonte, Minas Gerais, Brazil
  Research on electronic structures and electrical properties of surfaces using scanning tunnelling microscopy (STM) and photoluminescence spectroscopy. Recipient of a FAPEMIG Scholarship. Supervised by Gustavo Sáfar.
  Skills: Photoluminescence Spectroscopy, Scanning Tunnelling Microscopy, Scientific Research.
- Undergraduate Tutoring & Technological and Industrial Initiation 2014-10 – 2016-01
  Room of Physics Demonstrations, UFMG, Belo Horizonte, Minas Gerais, Brazil
  Development of a high-resolution and low-cost optical spectrometer and of an electrical Paul's Trap. Recipient of a PROGRAD/UFMG & a CNPq Scholarships. Supervised by Elmo Salomão.
  Skills: LabVIEW, SolidWorks, Spectrometer.
- Scientific Initiation 2013-08 – 2014-01
  UFRJ, Rio de Janeiro, Rio de Janeiro, Brazil
  Application of vibrational spectroscopy and theoretical calculations to bio-inorganic metal-amino acid complexes. Recipient of a CNPq Scholarship. Supervised by Joanna Ramos.
  Skills: Chemistry, Spectroscopy.

Skills

- Programming Languages: C, C++, Java, LabVIEW, MATLAB, **Python**, Rust.
- Software Tools: Alloy, Apache Beam, Caesar, Dafny, Debian, Git, Jupyter, LaTeX, Linux, SolidWorks, Vim.
- Technical Skills: Differential Privacy, Disclosure Control, Ethical Hacking, Formal Methods, Privacy, Privacy Compliance, Privacy and Utility Trade-Off, Scientific Research, System Administration, Transparency.
- Soft Skills: Collaboration, Communication, Teaching, Volunteering.

Conference Papers

- The Privacy-Utility Trade-off in the Topics API 2024-10
  2024 ACM SIGSAC Conference on Computer and Communications Security.
  DOI: 10.1145/3658644.3670368. **arXiv**: 2406.15309.
  Co-authors: Mário Alvim, Natasha Fernandes, Annabelle McIver.
  Keywords: Computer Science, Topics API, Third-Party Cookies, Quantitative Information Flow, Privacy, Utility, Privacy-Utility Trade-Off, Differential Privacy.
- A Novel Analysis of Utility in Privacy Pipelines, 2023-11
  Using Kronecker Products and Quantitative Information Flow
  2023 ACM SIGSAC Conference on Computer and Communications Security.
  DOI: 10.1145/3576915.3623081. **arXiv**: 2308.11110.
  Co-authors: Mário Alvim, Natasha Fernandes, Annabelle McIver, Carroll Morgan.
  Keywords: Computer Science, Quantitative Information Flow, Privacy, Utility, Privacy and Utility Trade-off, Differential Privacy.
- Measuring Re-identification Risk 2023-06
  2023 ACM SIGMOD/PODS Conference.
  DOI: 10.1145/3589294. **arXiv**: 2304.07210.
  Co-authors: CJ Carey, Travis Dick, Alessandro Epasto, Adel Javanmard, Josh Karlin, Shankar Kumar, Andres Muñoz Medina, Vahab Mirrokni, Sergei Vassilvitskii, Peilin Zhong.
  Keywords: Computer Science, Re-identification Risk, Privacy, User Representations.
- Flexible and scalable privacy assessment for very large datasets, 2022-07
  with an application to official governmental microdata
  22nd Privacy Enhancing Technologies Symposium (PETS 2022).
  DOI: 10.56553/popets-2022-0114. **arXiv**: 2204.13734.
  Co-authors: Mário Alvim, Natasha Fernandes, Annabelle McIver, Carroll Morgan.
  Keywords: Computer Science, Quantitative Information Flow, Disclosure Control, Microdata, Privacy, Very Large Datasets, Longitudinal Datasets.

- A formal quantitative study of privacy in the publication of official educational censuses in Brazil 2022-07
  Proceedings of the XXXV Thesis and Dissertation Contest (CTD 2022).
  DOI: 10.5753/ctd.2022.223158.
  Co-authors: Mário Alvim, Annabelle McIver.
  Keywords: Computer Science, Quantitative Information Flow, Disclosure Control, Microdata, Privacy, Utility, Differential Privacy.
- On Privacy and Accuracy in Data Releases 2020-08
  31^{st} International Conference on Concurrency Theory (CONCUR 2020).
  DOI: 10.4230/LIPIcs.CONCUR.2020.1.
  Co-authors: Mário Alvim, Natasha Fernandes, Annabelle McIver.
  Keywords: Computer Science, Privacy and Utility Trade-off, Quantitative Information Flow, Inference Attacks, Differential Privacy.

Software

- Topics API Analysis 2024-06
  Zenodo. **DOI**: 10.5281/zenodo.11032230.
  Keywords: Software, Topics API, Third-Party Cookies, Quantitative Information Flow, Privacy, Utility, Web Standards, Interest-Based Advertising.
- INEP (syntactic) Anonymization 2022-04
  Zenodo. **DOI**: 10.5281/zenodo.6533683.
  Keywords: INEP, Microdata, ARX, Java.
- Bayes Vulnerability for Microdata (BVM) library 2021-04
  Zenodo. **DOI**: 10.5281/zenodo.6533703.
  Keywords: Software, Privacy, Utility, Formal Methods, Quantitative Information Flow, Very Large Datasets, Longitudinal Datasets.

Datasets

- AOL Dataset for Browsing History and Topics of Interest 2024-06
  Zenodo. **DOI**: 10.5281/zenodo.11029571.
  Keywords: Dataset, Topics API, Third-Party Cookies, Privacy, Utility, Privacy and Utility Trade-off, Web Standards, Interest-Based Advertising.
- INEP Enrollment Codes 2021-04
  Zenodo. **DOI**: 10.5281/zenodo.6533674.
  Keywords: INEP, Microdata, CSV.

Workshop Papers

- A new Framework for Measuring Re-Identification Risk 2023-12
  Workshop on Regulatable Machine Learning at the 37th Conference on Neural Information Processing Systems (RegML @ NeurIPS 2023).
  Co-authors: CJ Carey, Travis Dick, Alessandro Epasto, Adel Javanmard, Josh Karlin, Shankar Kumar, Andres Muñoz Medina, Vahab Mirrokni, Sergei Vassilvitskii, Peilin Zhong.
  Keywords: Computer Science, Re-identification Risk, Privacy, User Representations.
- A Quantitative Information Flow Analysis of the Topics API 2023-11
  Proceedings of the 22nd Workshop on Privacy in the Electronic Society (WPES 2023).
  DOI: 10.1145/3603216.3624959.
  Co-authors: Mário Alvim, Natasha Fernandes, Annabelle McIver.
  Keywords: Computer Science, Topics API, Third-Party Cookies, Quantitative Information Flow, Privacy, Utility.
- A novel analysis of utility in privacy pipelines, 2023-09
  using Kronecker products and quantitative information flow
  Theory and Practice of Differential Privacy (TPDP) 2023.
  Co-authors: Mário Alvim, Natasha Fernandes, Annabelle McIver, Carroll Morgan.
  Keywords: Computer Science, Quantitative Information Flow, Privacy, Utility, Privacy and Utility Trade-off, Differential Privacy.
- Measuring Re-identification Risk 2023-05
  2023 Security for the Web Workshop.
  Co-authors: CJ Carey, Travis Dick, Alessandro Epasto, Adel Javanmard, Josh Karlin, Shankar Kumar, Andres Muñoz Medina, Vahab Mirrokni, Sergei Vassilvitskii, Peilin Zhong.
  Keywords: Computer Science, Re-identification Risk, Privacy, User Representations.

Academic Publications

- A formal quantitative study of privacy in the publication of official educational censuses in Brazil 2021-04
  Universidade Federal de Minas Gerais.
  HDL: 1843/38085.
  Keywords: Computer Science, Quantitative Information Flow, Disclosure Control, Microdata, Differential Privacy, Privacy, Utility.

- An Introduction to Raman Spectroscopy 2017-11
  Didactic or instructional material. Supervised by Leandro Malard.
  Keywords: Physics, Raman Spectroscopy.
- A Geometric Introduction to Lie Groups 2016-11
  III National Scientific Initiation and Master Program (PICME) Symposium.
  Co-authors: André Nascimento, Cássio Feitosa, Cleber Barreto, Diego Carriel. Supervised by Romero Solha.
  Keywords: Mathematics, Lie Groups.
- Coupling optical techniques with scanning tunneling microscopy to investigate organic films 2016-09
  XV Brazilian Materials Research Society (SBPMat) Meeting.
  Co-authors: Otávio Alonso, Rogerio Magalhães-Paniago, Angelo Malachias, Gustavo Sáfar.
  Keywords: Physics, Scanning Tunneling Microscopy, Photoluminescence Spectroscopy.

Projects

- PRICE – Privacy in Educational Censuses 2020 – 2021
  PRICE | INSCRYPT Information Security Analyst
  The new Brazilian privacy legislation legally holds entities as responsible for the quality, confidentiality, and privacy of data they keep about individuals. INEP, the National Institute of Educational Studies and Research of the Ministry of Education, publishes very detailed educational data annually. The PRICE project was a study commissioned by INEP on how to transform the data to be published in a way that the privacy of students is not violated, while maintaining its utility for statistical research.
  Technical Work:
  - Report 01: Report on the international panorama and the INEP context regarding methods of handling privacy control in statistical disclosure.
  - Report 02: Report on the risks to privacy arising from the current form of disclosure of microdata from INEP Educational Censuses.
  - Report 03: Technical report on treatment methods applicable to the dissemination microdata of INEP's Educational Censuses.
  - Report 04: Technological solution and its documentation.
  - Report 05: Final technical report of the pilot project.
  - Report 06: Technical Implementation Report.
  - Report 07: Assisted Operation Report.
  - Report 08: Project closure report.

  Decentralized Execution Term (TED) INEP-UFMG 8750. Coordinator: Mário Alvim.
  Skills: Computer Science, Privacy, Transparency, Python.
- Workshop on database anonymization techniques 2018-11-30
  Educational Statistics Directorate (DEED/INEP)
  Regional Planning and Development Center (CEDEPLAR/UFMG)
  The workshop aims to present INEP professionals with the state of the art of data anonymization techniques with the most recurrent use, their advantages and disadvantages, in order to support organizational decisions regarding the adoption of one or more techniques, considering the technical capacity of the teams , infrastructure, operation and any existing legal limitations. Coordinator: Mário Alvim.
  Skills: Computer Science, Privacy, Transparency.
- Lumus Max Optical Spectrometer 2014 – 2015
  Lumus Max (in Portuguese) | Room of Physics Demonstrations (in Portuguese)
  Development of a high-resolution and low-cost optical spectrometer. Some parts of the hardware were designed using Dassault Systèmes' SolidWorks and the software was implemented using National Instruments' LabVIEW visual programming language. Coordinator: Elmo Salomão.
  Skills: Physics, Spectrometer, LabVIEW, SolidWorks.
- Electrical Paul's Trap 2014
  Electrical Paul's Trap (in Portuguese) | Room of Physics Demonstrations (in Portuguese)
  Development of an electrical Paul's Trap (quadrupole ion trap). Coordinator: Elmo Salomão.
  Skills: Physics.

Languages

	Understanding		Speaking		Writing
	Listening	Reading	Spoken Interaction	Spoken Production	
Portuguese	C2	C2	C2	C2	C2
English	C2	C2	C1	C1	C2
Spanish	B1	B1	B1	B1	B1

Common European Framework of Reference for Languages

Exam	Listening	Reading	Writing	Speaking	Overall	Level	Date
TOEFL iBT	30	28	26	24	108	-	2020-07
IELTS Academic	8.0	8.0	6.5	6.5	7.5	C1	2015-11

Referees

Referees can be provided upon request.