

Rene David Reyes Bardales

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WORK EXPERIENCE

Summer Research Intern @ Ecole Polytechnique Federale de Lausanne June - Aug 2022

Supervisor: Prof. Bryan Ford

- Proved security properties of a coercion-resistance e-voting system using the Real/Ideal model
- Adapted existing formal definitions from the literature to our system's more realistic threat model
- Contributed formal security definitions and proofs to a research paper about this system (to be submitted in early 2023)

Graduate Teaching Assistant @ MIT EECS Sep 2021 - Present

Supervisors: Prof. Michael Sipser (Fall '21, '22), Prof. Dor Minzer (Spring '22)

- Led recitations, held office hours and graded for Theory of Computation (18.404/6.840 Fall'21,'22) and Automata, Computability and Complexity (18.400/6.045 Spring'22)

REU Intern @ University of Southern California ISI June - Aug 2021

Supervisors: Dr. Jelena Mirkovic and Dr. Christophe Hauser

- Explored applications of Searchable Encryption schemes to design an end-to-end encrypted email with search functionality
- Presented in a [poster session](#) at an REU Symposium, along with frequent research progress reports.

Undergraduate Researcher @ MIT CSAIL June 2020 - June 2021

Supervisor: Prof. Henry Corrigan-Gibbs (Feb-June 2021)

- Studied and applied novel secret-sharing and multi-party computation techniques to enable efficient privacy-preserving aggregate queries on sensitive data. These techniques included Function Secret-Sharing and Share Conversion.
- Designed system for different types of queries and use cases through frequent interaction with supervisor. Started a proof-of-concept implementation

Supervisor: Prof. Julie Shah (Sep 2020 - Feb 2021)

- Experimented with a novel algorithm to generate saliency maps that are constrained to the data manifold by using GANs.
- Evaluated our on-manifold saliency maps by implementing the proposed algorithm in PyTorch.

Supervisor: Dr. Una-May O'Reilly (June - Aug 2020)

- Conceptualized agent-based models to measure contagion of COVID-19 inside of buildings under different policies. This work was later used in a research paper.
- Contributed to MIT's Covid-19 Health Management System (CHMS) with an agent-based model to predict indoor infections.

Undergraduate Teaching Assistant @ MIT Mathematics Sep 2020 - May 2021

Supervisors: Prof. Michel Goemans (Spring '21), Prof. Ankur Moitra (Fall '20)

- Led recitations, held office hours and graded for Linear Algebra and Optimization (Fall'20) and Discrete Mathematics (Spring'21)

Undergraduate Researcher @ University of Alcalá May - Aug 2019

Supervisor: Ivan Marsa-Maestre

- Conceptualized and modeled air traffic management problems as graph coloring optimization problems and ran experiments
- Co-authored a research paper, with a rigorous explanation of our utility function and experimental set-up.

PROJECTS

SplitFed Learning and Fully Homomorphic Encryption

Sep 2021 - Present

MEng Thesis Project, supervised by Dr. Lalana Kagal

- Exploring accuracy improvements and stronger privacy guarantees for the SplitFed distributed learning protocol using state-of-the-art Differential Privacy and Fully Homomorphic Encryption.
- Will mentor an undergraduate student starting in January 2023, to implement the system using Numpy and the [Concrete FHE library](#). We will then conduct experiments to measure communication and time complexity.

Survey Paper on Kolmogorov Complexity and One-Way Functions

Apr-May 2022

Final Project for Advanced Complexity Theory Course

- Summarized recent work characterizing the existence of One-Way Functions, with the goal of highlighting the importance of this result in a more accessible way.

Cache-Oblivious Data Structures and Oblivious RAM

Apr-May 2021

Final Project for Advanced Data Structures Course

- Proposed methods to make cryptographic data structures more practical by modifying cache-oblivious data structures in a way that hides memory access patterns to obtain ORAM-type guarantees.

EDUCATION

Sep 2021 - June 2023 Master of Engineering in Computer Science at **MIT** (GPA: 5.0/5.0)

Sep 2018 - May 2022 Bachelor of Science in Mathematics, Computer Science at **MIT** (GPA: 4.9/5.0)

PUBLICATIONS

Gimenez-Guzman, Jose Manuel et al. (2020). “Flight Level Assignment Using Graph Coloring”. In: *Applied Sciences* 10.18. ISSN: 2076-3417. DOI: [10.3390/app10186157](https://doi.org/10.3390/app10186157). URL: <https://www.mdpi.com/2076-3417/10/18/6157>.

Gunaratne, Chathika et al. (Apr. 2022). “Evaluating efficacy of indoor non-pharmaceutical interventions against COVID-19 outbreaks with a coupled spatial-SIR agent-based simulation framework”. In: *Scientific Reports* 12.1, p. 6202. ISSN: 2045-2322. DOI: [10.1038/s41598-022-09942-y](https://doi.org/10.1038/s41598-022-09942-y). URL: <https://doi.org/10.1038/s41598-022-09942-y>.

SKILLS

Languages English - Fluent, Spanish - Fluent, French - Intermediate

Programming Python, Rust, Java, JavaScript, C++