REY AUDIE S. ESCOSIO

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BIOSKETCH

Rey (**he/him**) finished his BS Applied Physics and MS Applied Mathematics from the Institute of Mathematics, University of the Philippines Diliman. Since 2013, he has received two DOST scholarships – the DOST-SEI RA 7687 program, and the DOST-ASTHRDP. A portion of his graduate thesis on gradient-based optimization with acceleration and local search and its applications was awarded a student poster prize at the Society of Mathematical Biology 2020 Annual Meeting.

He is an incoming research fellow of the project titled "*Targeted Control of COVID-19 Post Mass Vaccination*" of the BioSystems and Integrative Sciences Institute of Faculdade de Ciências, Universidade de Lisboa.

Research interests:

infectious disease modelling | **mathematical biology** | **optimization** | **complex systems** | data science | computational neuroscience | science communication | computational social science

EXPERIENCE

University Research Associate, COVID-19 Modelling Project

Natural Sciences Research Institute, University of the Philippines Diliman

Jan 2022 – Dec 2022 Quezon City, Philippines

- Responsible for the model formulation, preprocessing of data, programming, science writing, and other admin duties
- Worked under Dr. Carlene P.C. Pilar-Arceo and the Modelling and Applications Group of the Institute of Mathematics

Science Research Specialist, COVID-19 Modelling Project

Center for Applied Modeling, Data Analytics, and Bioinformatics for Decision Support Systems in Health

Nov 2021 – Dec 2021 Davao City, Philippines

- Focused on parameter estimation for the COVID-19 modelling dynamics of the constituent units of the Davao Region
- Responsible for preprocessing data for parameters, programming and automation of codes, and preparing presentations for the project
- Worked under Dr. May Anne E. Mata

Lecturer, Precalculus Courses

Institute of Mathematics, University of the Philippines Diliman

Sep 2021 – Jan 2022 Quezon City, Philippines

- Taught precalculus to two online classes of early-stage university students

Research Associate, COVID-19 Modelling Project

Modelling and Applications Group, Institute of Mathematics, University of the Philippines Diliman

May 2021 – Nov 2021 Quezon City, Philippines

- Focused on two projects regarding COVID-19 dynamics with objectives on infectious-specific and age-structured vaccination models. Initial preprint accessible here.
- Responsible in handling datasets, researching methods, and preparing codes, presentations, and manuscripts for the projects
- Worked under coinvestigators Dr. Aurelio A. De los Reyes V, Dr. Carlene P.C. Pilar-Arceo, and Dr. Victoria May P. Mendoza

Project Assistant, COVID-19 Modelling Project

Resilience Institute, University of the Philippines

Nov 2020 – May 2021 Quezon City, Philippines

- Mainly works with the Modelling and Applications Group of the Institute of Mathematics, UP Diliman, and other teams from UP Baguio, UP Mindanao, and UP Los Baños
- Assists in mathematical model building for specific interventions applicable to National Capital Region and works further on model fitting, simulations, and projections for scenario analysis
- Worked under co-investigators Dr. Aurelio A. De los Reyes V, Dr. Carlene P.C. Pilar-Arceo, and Dr. Victoria May P. Mendoza

EDUCATION

Postgraduate Studies in Scientific Research Methods and Techniques

Faculdade de Ciências, Universidade de Lisboa

Jun 2023 – Present | Lisbon, Portugal (temporary remote setup)

- Preparing for the Ph.D. Physics program of the university

Project: *Targeted control of COVID-19 post mass vaccination*
- Focused on the research fellowship with the BioSystems and Integrative Sciences Institute under the supervision of Dr. Ganna Rozhnova and Dr. Ana Nunes

Master of Science (Applied Mathematics) (Mathematics in Life and Physical Sciences)

Institute of Mathematics, University of the Philippines Diliman

Aug 2018 – Jan 2021 | Quezon City, Philippines

- Department of Science and Technology-Accelerated Science and Technology Human Resource Development Program - National Science Consortium (DOST-ASTHRDP) Scholarship awardee

Thesis: *A perturbed accelerated gradient descent algorithm using an n-dimensional golden section search method*
- Focused on gradient-based optimization with a local search applied to benchmark functions, matrix decomposition, parameter estimation of mathematical models, signal processing, and single-layer perceptron
- Student researcher under the supervision of Dr. Renier Mendoza (Jan 2019 – present) for my graduate thesis and presented my research in various international and national conferences. Initial preprint accessible here.

Bachelor of Science in Applied Physics (Instrumentation Physics)

National Institute of Physics, University of the Philippines Diliman

Jun 2013 – Jun 2018 | Quezon City, Philippines

- Department of Science and Technology-Science Education Institute (DOST-SEI) RA 7687 Scholarship awardee

Thesis: *Response of single and connected Hodgkin-Huxley neurons to a sinusoidal input*
- Worked on varying stimuli to coupled differential equations describing neural response analyzed dynamically and statistically in different cases
- Student researcher in Complexity Science Group under the supervision of Dr. Johnrob Bantang (Oct 2015 – May 2018)
- Presented in three Samahang Pisika ng Pilipinas (SPP) Physics Conferences (2016 – 2018) accessible on my Google Scholar profile.

Secondary Education

Peñaranda National High School

Jun 2009 – Mar 2013 | Nueva Ecija, Philippines

- Salutatorian of the Special Science Curriculum and a consistent honors student since grade school

RESEARCH

Preprints

1. **Escosio, R. A. S.**, et al., (2022). A Model-Based Strategy on COVID-19 Vaccine Roll-out in the Philippines. Available at medRxiv.
2. **Escosio, R. A. S.**, & Mendoza, R. G., (2022). A Modified Accelerated Gradient Descent Using an N-Dimensional Golden Section Search for Escaping Saddle Points. Available at SSRN.

Conference proceedings

1. **Escosio, R. A. S.**, & Mendoza, R. G., (2022). A Modified Accelerated Gradient Descent Using an N-Dimensional Golden Section Search for Escaping Saddle Points. Proceedings of the 8th International Conference on Control and Optimization with Industrial Applications (oral presentation).
2. **Escosio, R. A. S.**, & Bantang, J. Y. (2018). Stability, periodicity, and mode-locking behaviors in a Hodgkin-Huxley neuron. Proceedings of the Samahang Pisika ng Pilipinas (poster presentation)
3. **Escosio, R. A. S.**, & Bantang, J. Y. (2017). Recurrence plot analysis of a Hodgkin-Huxley neuron dynamics. Proceedings of the Samahang Pisika ng Pilipinas (oral presentation)
4. **Escosio, R. A. S.**, & Bantang, J. Y. (2016). Frequency response analysis of a Hodgkin-Huxley neuron in a generalized current density stimulus. Proceedings of the Samahang Pisika ng Pilipinas (oral presentation)

Other publications

1. Liwag, J. T., Fidelino, J. S., **Escosio, R. A. S.**, Ocampo, A. B., & Santos-Ocampo, N. (2023). Practice Spotlight: Queer Scientists PH: Visibility Towards Community Building and Empowerment. Queering Science Communication. Bristol University Press. 124-126.

International conference presentations

1. **Escosio, R. A. S.**, Cawiding, O. R., Vergara, T. H. M., et al., *The What-Ifs of Early COVID-19 Transmission in the Constituent Units of the National Capital Region, Philippines.* Society of Mathematical Biology 2022 Annual Meeting (SMB 2022), hybrid meeting, September 19-23, 2022. (online poster presentation)
2. **Escosio, R. A. S.**, and Mendoza, R. G., *A Modified Accelerated Gradient Descent Using an n-Dimensional Golden Section Search for Escaping Saddle Points.* The 8th International Conference on Control and Optimization with Industrial Applications, virtual attendance, August 24-26, 2022. (oral presentation)
3. Añonuevo, L. E., **Escosio, R. A. S.**, et al., *Modeling the COVID Dynamics in Davao City, Philippines Under Different Variants-of-Concern.* Society of Mathematical Biology Mathematical Epidemiology and Immunology Subgroups Mid-Year Mini Virtual Conference, virtual meeting, February 27-28, 2022. (oral presentation, presented by Añonuevo)
4. **Escosio, R. A. S.**, de los Reyes, A. A. V, Mendoza, V. M. P, & Pilar-Arceo, C. P. C. *Modelling COVID-19 Dynamics with Different Community Quarantine Protocols in National Capital Region, Philippines.* Society of Mathematical Biology 2021 Annual Meeting (eSMB 2021), virtual meeting, June 13-17, 2021. (poster presentation)
5. **Escosio, R. A. S.**, & Mendoza, R. G., *Parameter Estimation of the Fitzhugh-Nagumo Model via a Perturbed Accelerated Gradient Descent Algorithm with an n-Dimensional Golden Section Search Method.* Society of Mathematical Biology 2020 Annual Meeting (eSMB 2020), virtual meeting, August 17-20, 2020. (poster presentation)
   - Won the subgroup student poster prize against submissions from around the world
   - Initially accepted for the 12th European Conference on Mathematical and Theoretical Biology (ECMTB 2020) but redirected to eSMB 2020

Local conference presentations

1. Tongol, C. A. L., **Escosio, R. A. S.**, & Cawiding, O. R., *Mathematical Modeling of COVID-19 Dynamics with Information-Dependent Vaccination in the Philippines.* 2022 MSP Annual Convention, virtual meeting, May 21, 28 & June 4, 2022. (oral presentation, presented by Tongol)
2. **Escosio, R. A. S.**, et al., *Multi-City Mathematical Modeling of the Early Months of COVID-19 Transmission and Mitigation in Metro Manila, Philippines.* 2022 MSP Annual Convention, virtual meeting, May 21, 28 & June 4, 2022. (oral presentation)
3. Cawiding, O. R., **Escosio, R. A. S.**, et al., *Optimal Control Applied to Age-Dependent Vaccine Prioritization in the National Capital Region of the Philippines.* 2022 MSP Annual Convention, virtual meeting, May 21, 28 & June 4, 2022. (oral presentation, presented by Cawiding)
4. **Escosio, R. A. S.**, *The What-Ifs of Early COVID-19 Transmission in the Constituent Units of the National Capital Region, Philippines.* 3rd Graduate Student Research Conference, College of Science, University of the Philippines Diliman, virtual meeting, May 23, 2022. (poster presentation)
   - Won the poster prize under the Health category against other graduate students of the college.
5. **Escosio, R. A. S.**, & Mendoza, R. G., *Implementing an n-Dimensional Golden Section Search as a Modified Local Search for an Accelerated Gradient Descent.* 2021 MSP Annual Convention, virtual meeting, May 15, 22, 29, 2021. (oral presentation)
6. **Escosio, R. A. S.**, & Mendoza, R. G., *A Perturbed Accelerated Gradient Descent Algorithm using an n-Dimensional Golden Section Search Method.* 2020 ASTHRDP Graduate Scholars Conference, virtual meeting, November 26-27, 2020. (poster presentation)
7. **Escosio, R. A. S.**, & Mendoza, R. G., *Parameter Estimation of Fitzhugh-Nagumo Model using an Accelerated Gradient Descent Algorithm with a Local n-Dimensional Golden Section Search Method.* 38th Samahang Pisika ng Pilipinas (SPP) Physics Conference and Annual Meeting, virtual meeting, October 19-23, 2020. (contributed talk)
8. **Escosio, R. A. S.**, & Munar, V. P., *Compartmental Modeling of Voter Turnout in a Three Party Election with Voter Inhomogeneity.* 38th Samahang Pisika ng Pilipinas (SPP) Physics Conference and Annual Meeting, virtual meeting, October 19-23, 2020. (contributed talk)
9. **Escosio, R. A. S.**, & Mendoza, R. G., *Gradient-Based Optimization with a Local n-Dimensional Golden Section Search.* National Academy of Science and Technology (NAST) 42nd Annual Scientific Meeting, virtual meeting, July 8-10, 2020. (poster presentation)

In-person participation

1. Unifying the Epidemiological and Evolutionary Dynamics of Pathogens Program, Nordic Institute for Theoretical Physics, May 29-June 23, 2023 (attended first two weeks).
2. Spring College on the Physics of Complex Systems, International Center for Theoretical Physics, Trieste, Italy, February 20-March 17, 2023
3. SEAMS School 2022 on Modern Trends in Signal and Data Processing, University of the Philippines Diliman, December 5-13, 2022.
4. 3rd International Workshop on Mathematical Biology (IWOMB 2020), University of the Philippines Los Baños, January 6-8, 2020.

5. ICTP Asian Network School and Workshop on Condensed Matter and Complex Systems 2019, University of the Philippines Diliman, November 4-8, 2019.
6. 16th International Conference on Molecular Systems Biology (ICMSB 2019), De La Salle University, October 28-31, 2019.
7. 2nd International Workshop on Mathematical Biology (IWOMB 2019), Bohol Bee Farm, January 6-10, 2019.

Online participation

1. ICTP-ICTS Winter School on Quantitative Systems Biology (QSB 2022), virtual meeting, December 5-16, 2022.
2. Data Science Summer School 2022, Hertie School Data Science Lab, virtual meeting, July 20-August 5, 2022.
3. Workshop in Mathematical and Computational Biology 2022, virtual meeting, June 9-10, 2022.
4. UJ Infectious Disease Modelling through Mathematics and Machine Learning (IDML) Postgraduate Student Workshop, virtual meeting, January 17-21, 2022.
5. ICTP-ICTS Winter School on Quantitative Systems Biology (QSB 2021), virtual meeting, December 6-17, 2021.
6. 7th International Conference on Mathematical Neuroscience (ICMNS 2021), virtual meeting, June 28-July 1, 2021.
7. 4th International Workshop on Mathematical Biology (IWOMB 2021), virtual meeting, June 9-11, 2021.
8. MSRI: Topological Insights in Neuroscience, virtual meeting, May 4-11, 2021.
9. 12th Conference on Dynamical Systems Applied to Biology and Natural Sciences (DSABNS 2021), virtual meeting, February 2-5, 2021.
10. Princeton Center for the Physics of Biological Function (CPBF) Online Summer School 2020, weekly virtual meeting, June 15-August 3, 2020.

SKILLS

Programming languages and version control
Proficient in Python and Matlab and similar platforms such as Octave; familiar with R, C++, and SQL; familiar with the GitHub environment

Typesetting and other software
Effective in using LaTeX for documents, presentations, and so on (including this CV); proficient in MS Office and similar softwares and in Adobe Photoshop and other graphics editing software

Languages
English and Filipino – proficient in both oral and written communication

Interpersonal skills
Held leadership positions from my organizations and affiliations; thinks critically and creatively; communicates effectively; works efficiently with teams; fun to be with

INVOLVEMENTS

Mathematical Society of the Philippines

– Renewed as member (Oct 2020 – present)

Samahang Pisika ng Pilipinas

– Sworn in as an associate member (Oct 2020 – present)

Queer Scientists PH

– Involved from conception specifically for the internal affairs and volunteers' engagement and participation
– Collaborated with other various volunteers from different sectors for the publicity and activities of the organization

UP DOST Scholars' Association

– Served as *President* (Jun 2016 – May 2017) handling monthly general assemblies, assuring successful national and local events, and leading the organization overall
– Served as *Vice President for External Affairs* (Apr 2014 – May 2015) handling marketing strategies, org recognition, alumni relations, organizational and campus relations, partnerships and sponsorship, and meetings and alliances
– Affiliated with the Philippine Alliance of DOST Scholars and held position as Vice President (Mar 2015 – Mar 2016)
– Spearheaded the DOST Scholars' Summit 2015 (Mar 2015) when I was only 17 years old with more than 200 participants all around Metro Manila and Laguna; event wins the Best Career Event of the UP College of Science Council of Organization Leaders (CS COOL)
– Led the programs committee of the yearly National DOST Scholars' Summit 2018 (Apr 2018) handling 400 participants from around the Philippines, contacting speakers, delegating tasks, and managing a smooth program
– Spearheaded the anniversary dinner of the organization (Nov 2017) that reached out to alumni from even way back 1970's
– In charge of the first-ever Coalesce of the National DOST Scholars' Summit 2016 (Apr 2016)

- Worked as a marketing co-head for the DOST Scholars' Summit 2014 (Mar 2014) when I was only 16 years old

UP Organization of Novo Ecijanos

- Served as *Vice President for Marketing and Finance* (Jun 2019 – May 2020) and the term coincides with the start of the pandemic wherein donations are immediately garnered for in-need Nueva Ecija residents
- Yearly taught high school students in topics of math and physics for the annual College Admission Tests Review Sessions for four years (Jul 2017 – Jul 2020)
- Co-headed the research team of the Tagisan ng Talino at Talento (Feb 2018) creating questions and topics for various sub-events such as quiz bees, performances, and other contests
- Collaborated to head the publicity team of the Tagisan ng Talino at Talento 2016 (Feb 2016) and worked on publicity materials and other creative means for event exposure

Volunteering and Assistantship in UP

- Student assistant for the UP Office of Student Activities (Feb 2018 – May 2018) working hand-in-hand with the staff with their daily tasks
- Worked with the organizing team of the International Conference on Mathematical and Computational Modeling of Biological Systems (Nov 2016) assisting on logistics
- Part of the UP Diliman Online Dorm Application Team (2015 – 2017) at the front receiving applications for three years
- Student volunteer for the technical team of the student elections of UP Diliman (2015 – 2019) for five years and UP Los Baños (2015 – 2016) for two years assisting on technicals and voting systems and creating final results presentations