ERIK AMÉZQUITA

Topological Data Analysis meets Plant Biology

🎓 CAREER AND EDUCATION

present | 2023

PFFIE Postdoctoral Future Faculty Fellow
University of Missouri   📍 Columbia, MO

- Division of Plant Sciences & Technology (80%)
- Department of Mathematics (20%)

2023 | 2018

PhD, Computational Mathematics, Science & Engineering
Michigan State University   📍 East Lansing, MI

- Advisors: Elizabeth Munch and Dan Chitwood
- Defended: March 2023

2018 | 2013

Lic. Mathematics (B.S.)
Universidad de Guanajuato   📍 Guanajuato, Gto.

- Advisor: Antonio Rieser (CONACYT-CIMAT)
- Defended: May 2018

📖 PEER–REVIEWED WORK

2024

Allometry and volumes in a nutshell: Analyzing walnut morphology using three–dimensional X-ray computed tomography
E.J. Amézquita, M.Y. Quigley, P.J. Brown, E. Munch, D.H. Chitwood

- *The Plant Phenome Journal* 7: e20095. DOI: 10.1002/ppj2.20095

2023

Genomics data analysis via spectral shape and topology
E.J. Amézquita, F. Nasrin, K.M. Storey, M. Yoshizawa

- *PLoS ONE* 18(4): 30284820. DOI: 10.1371/journal.pone.0284820

2023

A critical analysis of plant science literature reveals ongoing inequities
R.A. Marks, E.J. Amézquita, S. Percival, A. Rougon-Cardoso, C. Chibici-Revneanu, S.M. Tebele, J.M. Farrant, R. VanBuren, D.H. Chitwood

- *PNAS* 120(10): e2217564120. DOI: 10.1073/pnas.2217564120

2023

The shape of aroma: measuring and modeling citrus oil gland distribution
E.J. Amézquita, M.Y. Quigley, T. Ophelders, D. Seymour, E. Munch, D. H. Chitwood

- *Plants, People, Planet* 5(5): 698-711. DOI: 10.1002/ppp3.10333

2022

Teaching Tools in Plant Biology. Plants and Python, Coding from Scratch in the Plant Sciences
R. VanBuren, A. Rougon-Cardoso, E.J. Amézquita, E. Coss-Navarrete, A. Espinosa-Jaime, O. Gonzalez-Iturbe, A. Luckie-Duque, E. Mendoza-Galindo, J. Pardo, G. Rodríguez-Guerrero, P. Rosiles-Loeza, M. Vásquez-Cruz, S. Fernandez-Valverde, T. Hernandez-Hernandez, S. Palande, and D.H. Chitwood

- *The Plant Cell* 34(7): e1. DOI: 10.1093/plcell/koac187

CONTACT

🏢 1201 Rollins St
240a LSC
Columbia, MO 65211
✉ eah4d@missouri.edu
🔗 ejamezquita.github.io/
⌨ ejamezquita
in erik-amezquita

SKILLS

Programming: Python, R, C/C++, bash/unix

Technologies: $\LaTeX$, RMarkdown, jupyter, vim, html/css

Languages: Spanish (native), English (fluent), French (elementary)

Made with the R package pagedown.

Last updated on 2024-06-21.

2021

Measuring hidden phenotype: Quantifying the shape of barley seeds using the Euler Characteristic Transform

E.J. Amézquita, M.Y. Quigley, T. Ophelders, J.B. Landis, D. Koenig, E. Munch, D. H. Chitwood

· *in Silico Plants* 4(1): diab033. DOI: 10.1093/insilicoplants/diab033

2020

The shape of things to come: Topological data analysis and biology, from molecules to organisms

E.J. Amézquita, M.Y. Quigley, T. Ophelders, E. Munch, D.H. Chitwood

· *Developmental Dynamics* 249(7): 816-833. DOI: 10.1002/dvdy.175

📖 WORK UNDER REVIEW

2024

Tabula Glycine: The whole–soybean single–cell resolution transcriptome atlas

S.A. Cervantes-Pérez, S. Thibivilliers, S. Amini, J.M. Pelletier, I. Meyer, H. Xu, S. Tennant, P. Ma, C. Sprueil, A.D. Farmer, J.E. Coate, H. Nelissen, Q. Yao, O. Martin, E.J. Amézquita, R.B. Goldberg, J.J. Harada, M. Libault

· *Submitted*

2024

From hand measurements to high throughput phenotyping: understanding maize canopy structure and predicting yield

Z. Ji, E.J. Amézquita, L. Newton, D.H. Chitwood, A.M. Thompson

· *Submitted*

2024

Decoding the coiling patterns of *Cuscuta campestris* with automated image processing

M. Bentelspacher, E.J. Amézquita, S. Adhikari, J. Barros, S.Y. Park

· *Submitted*. Preprint available. DOI: 10.1101/10.1101/2024.02.29.582789

👨‍🏫 TEACHING AND MENTORING EXPERIENCE

2023 | present

At University of Missouri

· Undegraduate Research mentor for Ethan Lenhardt. Mathematical network analysis of academic collaboration. Department of Mathematics. Spring 2024 - present.
· Undegraduate Research mentor for Gibson Tschappler. Topological Data Analysis of spatial data. Division of Plant Science & Technology. Summer 2024 - present.
· Mentor for BIPS. Conducted weekly workshops on good coding practices. Fall 2023.

Leading projects at the intersection of mathematics, computer science, and plant biology

2022 | 2019

At Michigan State University

· Mentor for the ACRES REU. Conducted weekly professional development workshops. Summer 2022.
· TA for CMSE 201: Intro to Computational Modelling and Data Analysis. Fall 2019

Audience was mainly undergraduate students with no prior coding experience

2023 | 2021

At other institutions

· Mentor for SGI 2023. Summer Geometry Initiative REU. Massachusetts Institute of Technology.
· Mentor for SGI 2022. Summer Geometry Initiative REU. Massachusetts Institute of Technology.
· Mentor for SGI 2021. Summer Geometry Institute REU. Massachusetts Institute of Technology.
· TA fo Code In Place. Stanford University.

Conducted virtually

2018 | 2016

At CIMAT/Universidad de Guanajuato
· TA for Precalculus and analytic geometry. Spring 2018
· TA for Topology I (Intro to point-set topology). Fall 2017
· TA for 14th Calculus Problem-solving Workshop. Summer 2017
· TA for Introduction to C++ and data structures (Online). Summer 2017
· TA for Introduction to probability. Fall 2016

Some courses involved leading tutorials on C++ or R

🎤 INVITED AND RECENT TALKS

2024

The early dodder gets the host
MW-ASPB 2024. ASPB Midwest Section. West Lafayette, IN

2023

The wal(nut)zing nutcracker: linking morphological and commercial traits in walnuts
IPG Plant Talks. University of Missouri. Columbia, MO

2023

Mapper and the topological shape of genomic analysis
MU-GNU International Symposium in Plant Biotechnology. Bond LSC. Columbia, MO.

2023

A primer on Topological Data Analysis
Geometry and Topology Seminar. Department of Mathematics. University of Missouri. Columbia, MO

2023

Exploring the mathematical shape of plants
CS Colloquium. Department of Computer Science. Saint Louis University. St. Louis, MO

2023

When topology meets plant morphology
USTARS 2023. Underrepresented Students in Topology and Algebra Research Symposium, Seattle

2023

The mathematical shape of plants
Plant Sciences Seminar. Department of Botany and Plant Sciences. University of California, Riverside

2023

Measuring the shape of plants and nuts using topological data analysis
JMM 2023. Joint Mathematics Meeting. American Mathematical Society. Boston, MA.

2022

Using the Euler characteristic to quantify the shape of barley seeds
OU Topology and Data Science Seminar. Department of Math. University of Oklahoma. Virtual

2022

Bridging applied topology and plant biology
JMM 2022. Joint Mathematics Meeting. American Mathematical Society

2022

Measuring the shape of plants with the Euler Characteristic Transform
UFTDA 2022. University of Florida Topological Data Analysis Conference. Gainesville, FL

2021

Analyzing maize leaf angles and modeling leaf curvature
2021 NAPPN. North American Plant Phenotyping Network. Virtual

2018

Efficient object classification using the Euler characteristic
II Coloquio de Desarrollo Tecnológico al Servicio del Patrimonio Cultural. Guanajuato. Gto.

🔧 SELECTED WORKSHOPS LEAD

2022

The shape of things: Measuring the shape of plants with Topological Data Analysis
2022 NAPPN. North American Plant Phenotyping Network. Athens, GA. Check material.

2021   **Using the Euler characteristic to quantify the shape in biology**
2021 AATRN Tutorial-a-thon. Applied Algebraic Topology Research Network. Watch video.

2021   **Measuring the shape of plants with Topological Data Analysis**
2021 NAPPN. North American Plant Phenotyping Network. Check material.

SELECTED POSTERS PRESENTED

2024   **Genomics data analysis via spectral shape and topology**
EFCCRD 2024. University of Missouri. Columbia, MO

2024   **The early dodder gets the host**
IPG Symposium. University of Missouri. Columbia, MO

2023   **The shape and size of shells, kernels, and cracks, in a nutshell**
CAFNR Research Symposium. University of Missouri. Columbia, MO

2022   **Using topology to analyze the shape of plants**
IPPS2022. International Plant Phenotyping Symposium. Wageningen, The Netherlands

2022   **Modeling the shape of citrus and their oil gland distribution**
OSU PSS. The Ohio State University Plant Sciences Symposium. Virtual

2017   **Archaeological object classification using the Euler characteristic**
Barrett Memorial Lectures. Math Department. University of Tennessee. Knoxville, TN

SELECTED WORKSHOPS AND HACKATHONS ATTENDED

2022   **Beyond Abstract Measures: geometry and computation**
Organized by the Lorentz Center, Leiden, The Netherlands

2021   **Datathon4Justice**
D4J. Organized by QSIDE. Institute for Quantitative Study of Inclusion, Diversity, and Equity. Virtual

2021   **Immersive Visualization Institute**
IVI2021. Abrams Planetarium, MSU Libraries, and MSU Museum. East Lansing. MI

OUTREACH

2023   **If life gives you lemons, analyze the shape of their aroma**
Science on Tap. International Tap House. Columbia, MO

2023   **Un matemático y un botánico van por una limonada**
¡Science on Wheels en Español! SACNAS Mizzou. Columbia, MO

2023   **Mental Health in Mathematics and Computer Science**
Panel organizer and moderator. SGI23. Massachussets Institute of Technology. Virtual

2022   **Webinar de Solicitudes al Doctorado en Estados Unidos**
Panelist. Organized by the Coloquio de Exestudiantes CIMAT/DEMAT. Virtual

2022   **Mental Health in Mathematics and Computer Science**
Panel organizer and moderator. SGI22. Massachussets Institute of Technology. Virtual

2021 A topologist and a plant biologist go for a newly shaped beer
Hispanics in STEM celebration. WaMPS. Michigan State University. East Lansing, MI

2020 Using topology to quantify the shape of barley
Summer Math Academy. Math Department. University of Toronto. Virtual

2020 Wrangling and Presenting Data with Pandas and Seaborn in Python
Social Science Data Analytics Initiative. Michigan State University. Virtual

2020 Narrating our data with RMarkdown
Social Science Data Analytics Initiative. Michigan State University. Virtual

2018 La maldición de la dimensión y aprendizaje de máquina
Ciencia es Cultura. Dirección de Extensión Cultural. UGto. San Luis, Gto.

2017 Un matemático y un psicólogo se hallan en Hanoi
Ciencia es Cultura. Dirección de Extensión Cultural. UGto. Guanajuato, Gto.

2016 Infinitos grandes e infinitos pequeños
Ciencia es Cultura. Dirección de Extensión Cultural. UGto. San Miguel Allende, Gto.

👥 SELECT SERVICE

2022 | 2021 President of the CMSE Graduate Student Organization
CMSE and the Council of Graduate Students
· Lead department-wide events, committees, and inquiries to attend graduate students' needs

2017 | 2016 Student Representative
College of Natural and Exact Sciences Council. Universidad de Guanajuato.
· Logged each session minutes, such as budget or policy, and shared them with the math students.

2016 | 2015 High School Mathematics Seminar Co-Organizer
Escuela de Nivel Medio Superior, Guanajuato. Guanajuato.
· Delivered lectures on math topics usually not covered at high school levels, such as combinatorics or group theory.

2013 | 2012 Tutor of the Guatemalan Math Olympiad Team
Math Olympiad National Team. Guatemala.
· Successfully lobbied the Guatemalan Department of Education to obtain funding for 3 students to participate in the 15th Central American and Caribbean Math Olympiad.

🏅 AWARDS

2024 Travel Grant (US$350)
MW-ASPB 2024. ASPB Midwest Section. West Lafayette, IN

2024 Best Flash Talk. 1st place out of 52 talks
2024 NAPPN. North American Plant Phenotyping Network. West Lafayette, IN

2023 Distinguished Graduate Student. Travel Grant (US$700)
USTARS 2023. Underrepresented Students in Topology and Algebra Research Symposium.

2022 ● **Best Poster Award. 3rd place out of 173 posters.**
IPPS2022. International Plant Phenotyping Symposium. Wageningen, The Netherlands

2022 ● **Travel Grant (EUR 2000)**
IPPS2022. International Plant Phenotyping Symposium. Wageningen, The Netherlands

2022 ● **Fitch H. Beach Award**
College of Engineering. Michigan State University
· 2nd place. Most outstanding graduate research within the College of Engineering.

2022 ● **Travel Grant (US$800)**
2022 NAPPN. North American Plant Phenotyping Network. Athens, GA

2019 ● **Travel Grant (US$800)**
Applied Mathematical Modeling with Topological Techniques. ICERM. Providence, RI

2019 ● **IMPACTS Fellowship**
Awarded jointly by Michigan State University and the NRT-NSF program (NSF DGE-1828149).

2018 ● **Sotero Prieto Medal**
Sociedad Mexicana de Matemáticas
· Best undergrad math thesis produced in Mexico during the 2017-18 academic year.

2018 ● **Francisco Aranda Ordaz Award**
Asociación Mexicana de Estadística
· 3rd place. Best undergrad statistics theses produced in Mexico during the 2016-18 academic years.

2018 ● **Raymond P. and Marie M. Ginther Graduate Fellowship**
Awarded by CMSE to outstanding incoming graduate students.

2018
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2013 ● **CIMAT Academic Excellence Scholarship**
Merit-based scholarship for math undergraduates.

2017 ● **Best Undergraduate Mathematics, Physics and Earth Sciences Innovation Research Project.**
4to Congreso Interinstitucional de Jóvenes Investigadores. 3rd Place. Nationwide event.

2017 ● **Best Undergraduate Engineering Research Project**
5to Encuentro de Jóvenes Investigadores. 1st Place. Statewide event