

# ERIK AMÉZQUITA

Topological Data Analysis (TDA) and shape quantification meet plant biology




## CAREER AND EDUCATION


present  
|  
2023

- **Preparing Future Faculty for Inclusive Excellence Postdoctoral Fellow**  
University of Missouri  Columbia, MO
  - Division of Plant Science & 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
  - Dissertation: Exploring the Mathematical Shape of Plants

2018  
|  
2013

- **Lic. Mathematics (B.S.)**  
Universidad de Guanajuato  Guanajuato, Gto.
  - Advisor: [Antonio Rieser](#) (CONACYT-CIMAT)
  - Defended: May 2018
  - Thesis: Efficient Object Classification using the Euler Characteristic



## PEER-REVIEWED WORK

2024

- **Decoding the coiling patterns of *Cuscuta campestris* with automated image processing**  
M. Bentelspacher, **E.J. Amézquita**, S. Adhikari, J. Barros, S.Y. Park
  - *Plant Cell Reports*. Accepted. Preprint DOI: [10.1101/10.1101/2024.02.29.582789](#)

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](#)



View this CV online at  
[ejamezquita.github.io/cv](#)

## CONTACT

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 [ejamezquita.github.io/](#)  
 [ejamezquita](#)  
**in** [erik-amezquita](#)

## SKILLS

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

**Technologies:** *L<sup>A</sup>T<sub>E</sub>X*,  
RMarkdown, jupyter, vim,  
html/css

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

Made with the R package  
[pagedown](#).

Last updated on 2024-09-14.

- 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](https://doi.org/10.1093/plcell/koac187)
- 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](https://doi.org/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](https://doi.org/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
- 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



## STUDENTS MENTORED

- present  
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2024 ● **Searcy Thomas and Jake Parmentier (Undergraduate)**  
TDA to model spatial cell distributions. Dept. of Mathematics. Univ. of Missouri
- present  
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2024 ● **Ethan Lenhardt (Undergraduate)**  
Mathematical network analysis of academic collaboration. Dept. of Mathematics. Univ. of Missouri.



## TEACHING EXPERIENCE

- 2021 ● **At other institutions**  
TA for [Code In Place](#). Stanford University. Remote. Summer 2021
- 2019 ● **At Michigan State University**  
TA for [CMSE 201](#): Computational Modelling and Data Analysis I. Fall 2019
- 2016  
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2018 ● **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



## INVITED AND RECENT TALKS

- 2024 ● **Characterizing spatial patterns and distributions with Topological Data Analysis (TDA)**  
[NAPPN AI/ML Affinity Group](#). North American Plant Phenotyping Network. Virtual

- 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 ● **Directional statistics to describe the distribution of citrus oil glands**  
[JMM 2023](#). Joint Mathematics Meeting. American Mathematical Society. Boston, MA.
- 2022 ● **The mathematical shape of plants**  
Plant Science Seminar. Division of Plant Science and Technology. University of Missouri, Columbia
- 2022 ● **Using applied topology in plant science**  
[Stochastic Topology seminar](#). Max Planck Institute for Mathematics in the Sciences (MiS). Virtual.
- 2022 ● **TDA to harness plant morphology**  
[Multicellular dynamics seminar](#). Max Planck Institute for Plant Breeding Research (MPIPZ). Virtual
- 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 ● **TDA to bridge mathematics and archaeology**  
[16th School on Probability and Statistics](#). CIMAT. Guanajuato. Gto.
- 2017 ● **Efficient object classification using the Euler characteristic**  
[II Coloquio](#) de Desarrollo Tecnológico al Servicio del Patrimonio Cultural. Guanajuato. Gto.



## 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](#).



## SELECT FLASH TALKS (WITH POSTERS)

- 2024 ● **The shape and size of shells, kernels, and cracks, in a nutshell**  
[NAPPN 2024](#). North American Plant Phenotyping Network. West Lafayette, IN
- 2023 ● **Modeling the shape of citrus and their oil gland distribution**  
[NAPPN 2023](#). North American Plant Phenotyping Network. St. Louis, MO
- 2022 ● **Using topology to analyze the shape of plants**  
[IPPS2022](#). International Plant Phenotyping Symposium. Wageningen, The Netherlands
- 2020 ● **Quantifying barley morphology**  
[TDA@NeurIPS](#). Neural Information Processing Systems. Online.
- 2020 ● **Using Euler Characteristic Curves to model barley shape**  
[YRF@SoCG](#). Young Researcher Forum @ CG Week, Symposium on Computational Geometry. Virtual



## SELECT WORKSHOPS AND HACKATHONS ATTENDED

- 2023 ● **Graduate Wellness and Mental Health Ambassador Program.**  
The Graduate School. Michigan State University, East Lansing, MI
- 2022 ● **NatSci Cultural Competency. Workshop Semester Series**  
DEI Office. College of Natural Science. Michigan State University. East Lansing, MI
- 2022 ● **Beyond Abstract Measures: geometry and computation**  
Organized by the [Lorentz Center](#), Leiden, The Netherlands
- 2021 ● **Datathon4Justice**  
[D4J@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
- 2021 ● **MSU Dialogues: Race. Semester I**  
[Office for Institutional Diversity and Inclusion](#). Michigan State University. Virtual
- 2019 ● **Applied Mathematical Modeling with Topological Techniques.**  
[ICERM](#). Institute for Computational and Experimental Research in Mathematics. Providence, RI

## + 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
- 2021 ● **Demeter y Euler van por una cerveza**  
[Seminario Junior de Estudiantes](#). Departamento de Matemáticas. Universidad de Guanajuato. Virtual.
- 2020 ● **Cuantificando la forma de la cebada con ATD**  
Seminario de Matemáticas y Estadística. Instituto Politécnico Nacional. Virtual
- 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

- present  
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2023 ● **Mentor for [BIPS](#): Bioinformatics in Plant Science**  
Division of Plant Science and Technology. University of Missouri  
• Lead weekly workshops on good coding practices. Geared toward plant science undergraduate students.
- 2024 ● **Faculty Search Committee (Data Science Instructor)**  
Division of Plant Science and Technology. University of Missouri

- 2023  
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2021 ● **Mentor for [SGI](#) REU: Summer Geometry Initiative**  
Geometric Data Processing Group. Massachusetts Institute of Technology. Remote  
• General technical support. Organized panels on Mental Health for the 2022 and 2023 editions.
- 2023  
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2022 ● **CMSE Chair Search Committee**  
Department of Computational Mathematics, Science, and Engineering. Michigan State University.
- 2022 ● **Mentor for the [ACRES](#) REU: Advanced Computational Research Experience**  
Institute for Cyber-enabled Research. Michigan State University.  
• Conducted weekly professional development workshops, such as CV and academic poster design.
- 2022  
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2021 ● **President of the CMSE Graduate Student Organization**  
Council of Graduate Students. Michigan State University  
• Lead department-wide events, committees, and inquiries to attend graduate students' needs
- 2017  
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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  
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2015 ● **High School Mathematics Seminar Co-Organizer**  
Escuela de Nivel Medio Superior, Guanajuato. Guanajuato.  
• Organized lectures on college-level math topics, such as combinatorics or group theory.



## SELECT AND RECENT AWARDS

- 2024 ● **Travel Grant (US\$250)**  
[SIAM-CSS24](#) SIAM Central States Section. Kansas City, MO.
- 2024 ● **Travel Grant (US\$650)**  
[SIAM-MDS24](#). Early Career Award. SIAM-Mathematics of Data Science. Atlanta, GA
- 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](#) (2nd place)**  
College of Engineering. Michigan State University. Most outstanding graduate research.
- 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
- 2018 ● **Francisco Aranda Ordaz Award (3rd place)**  
Asociación Mexicana de Estadística. Best undergrad statistics thesis produced in Mexico.
- 2018 ● **Raymond P. and Marie M. Ginther Graduate Fellowship**  
Awarded by CMSE to outstanding incoming graduate students.
- 2018  
|  
2013 ● **CIMAT Academic Excellence Scholarship**  
Merit-based scholarship for math undergraduates.
- 2017 ● **Best Undergraduate Mathematics, Physics and Earth Sciences Research Project (3rd place).**  
4to Congreso Interinstitucional de Jóvenes Investigadores.
- 2017 ● **Best Undergraduate Engineering Research Project (1st place)**  
5to Encuentro de Jóvenes Investigadores. Universidad de Guanajuato.