Çiğdem Ak, Ph.D.

(PRONOUNCED: CHEE-DEM)

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RESEARCH & INTERESTS

My research interests include developing machine learning algorithms that uncover the underlying dynamics of complex systems using my mathematics background and multidisciplinary research experience. I focus on applications at the intersection of theoretical and applied research, particularly in systems biology. During my postdoctoral tenure at Knight Cancer Institute, my main research interest has been developing **scalable, integrative, and interpretable machine learning algorithms**, especially to understand single-cell biology.

EDUCATION

Oregon Health & Science University
Portland, Oregon United States
Postdoctoral Scholar at Cancer Early Detection Advanced Research (CEDAR) Center
Jan. 2020 – Present

Building interpretable machine learning algorithms to understand single-cell biology using multiple kernel learning, topic modeling, and spatial statistics with *Drs. Paul Spellman, and Sadik Esener*

Koç University
İstanbul, Turkey
Ph.D. in Computational Sciences and Engineering
Sep. 2014 – Jul. 2019

Thesis: Spatiotemporal modeling using machine learning with *Drs. Önder Ergönül and Mehmet Gönen*

École Polytechnique
Paris, France
M.Sc. in Mathematics
Sep. 2013 – Sep. 2014

Track: Mathematics for life sciences
Dissertation: Identification of bacterial regulatory networks from experimental data at Inria-Grenoble with *Drs. Eugenio Cinquemani and Hidde de Yong*

École Normale Supérieure de Lyon
Lyon, France
M.Sc. in Mathematics
Sep. 2012 – Sep. 2013

Track: Modeling complex systems

Dissertation: Stability of a linear system structured on age which describes the production of red blood cells at Inria-Lyon with *Drs. Fabien Crauste and Thomas Lepoutre*

Galatasaray University
İstanbul, Turkey
B.Sc. in Mathematics
Sep. 2007 – Jun. 2012
Dissertation: Newtonian mechanics from a Lagrangian point of view with *Dr. Susumu Tanabe*

OTHER RESEARCH EXPERIENCE

Koç University
İstanbul, Turkey
Data Scientist
Jul. 2019 – Jan. 2020
Developed a user-friendly tool for interactive spatiotemporal data visualization and analysis for a European Research Council (ERC) project: Industrialization and Urban Growth from the mid-nineteenth century Ottoman Empire to Contemporary Turkey in a Comparative Perspective, 1850-2000

Koç University
İstanbul, Turkey
Teaching Assistant
Sep. 2019 – Jan. 2019
Assisted the course Engr 421X Introduction to Machine Learning (Fall 2019): Conducted the lab sessions for participants of the Online Data Science Certificate Program and graded homework and exams

Koç University
İstanbul, Turkey
Research and Teaching Assistant
Sep. 2014 – Jul. 2019
Main research topic: Modeling spatiotemporal dynamics of infectious diseases using structured Gaussian processes
Conducted lab sessions/problem-solving sessions and graded homework, quizzes, and exams for various courses in mathematics and engineering departments

Inria Grenoble Rhône-Alpes
Grenoble, France
M2 Research Intern
May 2014 – Aug. 2014
Identification of bacterial regulatory networks from experimental data

Inria Lyon
Lyon, France
M2 Research Intern
Apr. 2013 – Jul. 2013
Stability of a linear system structured on age which describes the production of red blood cells

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PUBLICATIONS

***Corresponding Author**

PEER-REVIEWED

Postdoc papers

Multiplex imaging of localized prostate tumors reveals altered spatial organization of AR-positive cells in the microenvironment
Ak, Ç., Sayar, Z., Thibault, G., Burlingame, E., Eng, J., Chitsazan, A., Adey, A., Boniface, C., Spellman, P., Thomas, G., Kopp, R., Chang, Y. H., Stavrinides, V., Demir, E., and Eksi, S. E. *iScience*, 2024, 110668, ISSN 2589-0042, https://doi.org/10.1016/j.isci.2024.110668.

Automated segmentation of tumor innervating neuronal fibers
Ait-Ahmad, K., **Ak, Ç.**, Thibault G., Chang, Y. H., Eksi, S. E. *Heliyon*, 2024, e41209, https://doi.org/10.1016/j.heliyon.2024.e41209.

Estrogen regulates divergent transcriptional and epigenetic cell states in breast cancer
Ors, A., Chitsazan A. D., Doe, A. R., Mulqueen R. M., **Ak, Ç.**, Wen Y., Haverlack, M., Handu, M., Naldiga, S., Saldivar, J. C., and Mohammed H. *Nucleic Acids Research*, 2022, Volume 50, Issue 20, Pages 11492–11508, https://doi.org/10.1093/nar/gkac908.

Fast and interpretable genomic data analysis using multiple approximate kernel learning
Bektaş, A. B., **Ak, Ç.**, Gönen, M. *Bioinformatics*, 2022, vol. 38, Issue Supplement 1, Pages i77–i83, https://doi.org/10.1093/bioinformatics/btac241.

Spatial prediction of COVID-19 pandemic dynamics in the United States
Ak, Ç.*, Chitsazan, A., Gönen, M., Grossberg, A., Etzioni, R. *ISPRS International Journal of Geo-Information*, 2022, 11(9), 470, https://doi.org/10.3390/ijgi11090470.

PhD papers

A prospective prediction tool for understanding Crimean–Congo haemorrhagic fever dynamics in Turkey
Ak, Ç., Ergönül, Ö., Gönen, M. Clinical Microbiology and Infection, 26(1):123.e1-123.e7. 2020, https://doi.org/10.1016/j.cmi.2019.05.006.

Structured Gaussian processes with twin multiple kernel learning
Ak, Ç., Ergönül, Ö., Gönen, M. *Proceedings of The 10th Asian Conference on Machine Learning*, PMLR 95:65-80. 2018, https://proceedings.mlr.press/v95/ak18a/ak18a.pdf.

Spatiotemporal prediction of infectious diseases using structured Gaussian processes with application to Crimean–Congo hemorrhagic fever
Ak, Ç., Ergönül, Ö., Şencan, İ., Torunoğlu, M. A., Gönen, M. *PLoS Neglected Tropical Diseases*, vol. 12, no. 8, p. e0006737. 2018, https://doi.org/10.1371/journal.pntd.0006737.

IN PREPARATION

scMKL: Knowledge-based machine learning to enhance the interpretability of single-cell multi-omics analysis
Kupp, S., Vangordon, I., Gonen, M., Esener, S., Eksi, S. E.,. **Ak, Ç.*** Currently in revision at *Communications Biology*. Bioarxiv link.

EpiConfig: Multimodal topic modeling for single-cell multiomics
Ak, Ç., Szczepanski, N., Doe, A., Chitsazan, A., Yardımcı, G. G. Conference proceedings *https://meetings.cshl.edu/posters/single23/single2023_AbstractBook.pdf*. Manuscript currently in preparation. To be submitted January 2025. Bioarxiv link.

Investigating the spatial interactions of neural and immune cells in localized prostate cancer via new spatial analysis tools
Ak, Ç. Ait-Ahmad, K., Kupp, S., Wang, M., Thibault G., Chang, Y. H., Eksi, S. E. Manuscript currently in preparation. To be submitted February 2025.

Functional PTEN mutations in progestin-resistant de novo endometrial intraepithelial neoplasia
Mohebnasab, M., **Ak, Ç.**, Williams, T., Corless, C., Morgan, T. *Archives of Pathology & Laboratory Medicine*, 145 (9): e2–e194. 2021. Currently adding more data for publication.

Upregulated NRXN1 expression mediates neuronal phenotypic plasticity in prostate cancer through mitochondrial shuttling at cellular adhesion sites
Grieco, J. P., Sener, G., Theison, H., Riesterer, J. L., Kuykendall, M. J., Makkawi, R., Davies, A. E., McGann, J., **Ak, Ç.**, Eksi, S. E. Currently in revision at *Nature Communications*. 2024.

MEDIA COVERAGE

Multiplex Imaging of Localized Prostate Tumors Reveals Altered Spatial Organization of AR-Positive Cells in the Microenvironment - Beyond the Abstract
https://www.urotoday.com/recent-abstracts/urologic-oncology/prostate-cancer/155143-multiplex-imaging-of-localized-prostate-tumors-reveals-altered-spatial-organization-of-ar-positive-cells-in-the-microenvironment-beyond-the-abstract.html

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SELECTED CONFERENCE PRESENTATIONS AND PROCEEDINGS

2025 **Poster.** Multimodal Topic Modelling, AACR Annual Meeting, Chicago, USA

2024 **Talk.** Spatial Analysis of Androgen Receptor's Role in Prostate Cancer Across Multiple Scales, 3rd Annual Spatial Biology Summit, Stanford, USA

2014 **Talk & Poster.** Enhancing interpretability of single-cell multi-omics analysis, Epigenetics Symposium, Portland, USA

2023 **Poster.** EpiConfig: Multimodal topic modelling for single-cell multiomics, Machine Learning in Computational Biology, Seattle, USA

2023 **Talk & Poster.** EpiConfig: Multimodal topic modelling for single-cell multiomics, CSHL Single Cell Analyses meeting, New York City, USA

2023 **Poster.** EpiConfig: Multimodal topic modelling for single-cell multiomics, Pacific Symposium on Biocomputing (PSB), Hawaii, USA

2022 **Poster.** EpiConfig: Multimodal topic modelling for single-cell multiomics, The Early Detection of Cancer Conference, Portland, USA

2022 **Talk & Poster.** Fast and interpretable genomic data analysis using multiple approximate kernel learning, 30th Conference on Intelligent Systems for Molecular Biology (ISMB), Madison, USA

2022 **Talk.** Multimodal topic modelling for single-cell multiomics, Symposium on Approaches in Single-cell Analysis, Portland, USA

2019 **Talk.** Devising graphical user interfaces to examine structural change and population dynamics, ENCHOS III, Third Meeting of the European Network for the Comparative History of Population Geography and Occupational Structure (1500-1900), Istanbul, Turkey

2018 **Talk & Poster.** Structured Gaussian processes with twin multiple kernel learning, 10th Asian Conference on Machine Learning (ACML 2018), Beijing, China

2018 **Poster.** Modeling spatiotemporal dynamics of infectious diseases using structured Gaussian processes, 17th European Conference on Computational Biology (ECCB 2018), Athens, Greece

2017 **Talk.** Spatiotemporal prediction of infected cases by using structured Gaussian process with application to Crimean–Congo haemorrhagic fever, 61st ISI World Statistics Congress, Marrakesh, Morocco

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INVITED TALKS

2024 **Spatial Heterogeneity and Sample Size Effects in Prostate Cancer Progression**, Quantitative & Systems Biology seminar series, Knight Cancer Institute, Oregon Health and Science University

2022 **Fast and interpretable genomic data analysis using multiple approximate kernel learning**, Lifespan Academic Medical Center, Brown University

2022 **Multimodal topic modelling for single-cell multiomics**, Symposium on Approaches in Single-cell Analysis, Knight Cancer Institute, Oregon Health and Science University

2022 **EpiConfig: multimodal topic modeling for single-cell multiomics**, Computational Biology Research Retreat, Knight Cancer Institute, Oregon Health and Science University

2022 **EpiConfig: multimodal topic modeling for single-cell multiomics**, Single Cell Technology Work Group, Oregon Health and Science University

2020 **Spatiotemporal modeling using machine learning**, Mathematics Department, Galatasaray University

2019 **Spatiotemporal modeling using machine learning**, Tarentum AI, Istanbul Technical University

2017 **Mathematical modelling of infectious diseases**, Spread of Epidemic Diseases Summer School, Feza Gürsey Research Center, Bogazici University

2014 **Identification of metabolic network models in E. coli**, Freie Universität Berlin, Department of Mathematics and Computer Science

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CEDAR PROJECT HIGHLIGHTS

TEAM LEAD

Jul. 2022 – Dec. 2024	PI: **Ak Ç.** Building interpretable computational frameworks for understanding single-cell (multi)omics, Full 2022-1492.
May 2021 – Dec. 2024	PI(s): **Ak Ç,** Yardimci G. EpiConfig: Multimodal topic modeling for single-cell multiomics, Full 2021-1317 and 2021-1530.
Jun. 2020 – Jun. 2021	PI(s): **Ak Ç,** Grossberg A. COVID-19 Prediction Hub of Oregon, U.S. County COVID-19 Prediction, Exploratory 7820520.
Jun. 2020-Dec. 2020	PI: **Ak Ç.** Building pathway/gene set based predictive algorithms for single cell modeling, Exploratory 7900620.

TEAM MEMBER

Jan. 2024-Jul. 2025	PI: Chang YH. Making multiplex tissue imaging broadly accessible in the clinic: detection and stratification of early prostate cancer lesions, Full 2023-1796.
Feb. 2023-Jan. 2025	PI: Eksi E. Investigating the spatial interactions of neural and immune cells in localized prostate cancer via new image analysis tools (DTRON), Full 2022-1629.
Aug. 2022-Aug. 2024	PI: Eksi E. Establishing models and tools for targeting cancer-neuron crosstalk, Full 2022-1494.
Jan. 2020-Apr. 2022	PI: Yunga ST. Platelet multi-omics for cancer detection, Full 6741119.
Dec. 2019-Apr. 2022	PI: Morgan T. Personalized Genetic Medicine to Prevent Transition to Uterine Cancer, Full 6260819.

SCHOLARSHIPS

2014 – 2019 Koç University Ph.D. Full tuition scholarship, Istanbul, Turkey

2013 – 2014 Master Excellence Scholarship from Fondation Mathématique Jacques Hadamard, Paris, France

2012 – 2013 The Ampère Scholarships of Excellence of the École Normale Supérieure de Lyon, Lyon, France

2007 – 2012 University Scholarship of Ministry of National Education of Turkey, Istanbul, Turkey

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AWARDS & HONORS

2019 Young Scientists Award, first rank prize of the Prof. Enver Tali Çetin Young Scientists Award, Istanbul, Turkey

2018 Long Talk, one of the 27 long talks out of 64 papers at the 10th Asian Conference on Machine Learning, Beijing, China

2018 Conference Travel Award, awarded to only 5 students presenting at the 10th Asian Conference on Machine Learning, Beijing, China

2012 Dean's High Honor List, Galatasaray University, Istanbul, Turkey

2011 Travel Award, awarded for undergraduate accomplishments from Galatasaray University, Istanbul, Turkey

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LEADERSHIP & SERVICE

2020 – present **Organizer**, CompBio Weekly Journal Club, at CEDAR OHSU, Portland, USA

2019 **Organization** team and **Lecturer**, Machine Learning Summer School, Koç University, Istanbul, Turkey

2017 **Lecturer**, Spread of Epidemic Diseases Summer School, Feza Gürsey Research Center, Istanbul, Turkey

2017 **Organizer**, Invited paper session at the 61st ISI World Statistics Congress, Marrakesh, Morocco

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SCIENTIFIC TRAINING

2020 15th Machine Learning in Computational Biology Conference (MLCB), virtual

2020 Mahine Learning for Health Workshop, OHSU - PSU, virtual

2020 International Alliance for Cancer Early Detection (ACED) Summer School, virtual

2015 7th International Summer School of Spatial Epidemiology, Climate and Health: Concepts and Modeling, Bielefeld University, Bielefeld, Germany

2014	6th International Summer Course on Research Methodology and Ethics in Health Sciences, Koç University, Istanbul, Turkey
2013	Biological invasions and evolutionary biology, stochastic and deterministic models, Université Claude Bernard Lyon 1, Lyon, France
2013	Multiscale modeling in the life sciences summer school, ENS de Lyon, Lyon, France
2011	Nesin mathematics village summer school, Izmir, Turkey
2011	4th European Women in Mathematics Summer School, Lorentz Center, Leiden, Netherlands

PROFESSIONAL DEVELOPMENT

2024	Productive Conflict and You Workshop	OHSU, USA
2024	Early Career Faculty Advancement Program (ECAP)	OHSU, USA
2023	Training Future Faculty (TFF)	OHSU, USA
2023	Vollum Science Writing Class	OHSU, USA
2022	Bystander Intervention Training: Stepping-In for Respect	OHSU, USA
2020	Center for the Improvement of Mentored Experiences in Research (CIMER) Mentoring Up Training	OHSU, USA

TEACHING

Fall 2019	Introduction to Machine Learning, Engr 421X/421/521 Dasc 421/521	Koç University
Spring 2019	Introduction to Machine Learning, Comp 421X	Koç University
Fall 2018	Introduction to Machine Learning, Comp 421X Comp/Indr 421/521 Elec443/543	Koç University
Spring 2018	Introduction to Machine Learning, Comp 421X	Koç University
Fall 2017	Introduction to Machine Learning, Indr/Comp 421/521	Koç University
Spring 2016	Statistics for Engineers, Engr 201	Koç University
Fall 2016	Statistics for Engineers, Engr 201	Koç University
Spring 2016	Linear Algebra, Math 107	Koç University

Fall 2015	Differential Equations, Math 204	Koç University
Summer 2015	Differential Equations, Math 204	Koç University
Summer 2015	Statistics, Math 201	Koç University
Spring 2015	Statistics, Math 201	Koç University
Fall 2014	Calculus, Math 106	Koç University
Spring 2012	Abstract Algebra, Math 216	Koç University

MENTORING

I mentored three graduate students during their master's internship and advised through their master's thesis.Two of them are writing papers with me and work in projects I lead. (*: (co)-mentors)

2021-2022 **Alyx E. Gray**
University of Oregon, Bioinformatics and Genomics Master, 9-month research internship
Master Thesis: Benchmarking Integrative Consensus Clustering with Paired Proteomic and Clinical Data Modalities (Alyx Gray, Sean Speese, Thuy Ngo, Theresa Lusardi*, Samuel Tassi Yunga*, Cigdem Ak*)
Current Position: Research Associate - Bioinformatics Data Analyst at University of Colorado, Anschutz Medical Campus

2023-2024 **Samuel D. Kupp**
University of Oregon, Bioinformatics and Genomics Master, 9-month research internship
Master Thesis: Identification of Significant Gene Sets for Cancer Cohort Discrimination using Kernel-Based Machine Learning (Sam Kupp, Cigdem Ak*)
Current Position: Computational Biologist 1 at CEDAR, Knight Cancer Institute

2024-2025 **Ian Vangordon Jr.**
University of Oregon, Bioinformatics and Genomics Master, 9-month research internship
Master Thesis: Cell type annotation of multimodal single-cell data with scMKL (Ian Vangordon, Sam Kupp, Cigdem Ak*)
Current Position: Computational Biologist Intern at CEDAR, Knight Cancer Institute

OUTREACH

Peer Reviewer: BioMedInformatics, Genes, Heliyon, International Journal of Infectious Diseases, Proceedings of Machine Learning Research Workshop and Conference Proceedings (PMLR), Scientific Reports

Talk: Presented my doctorate research to high school and undergraduate students at Galatasaray University Mathematics Department Alumni Event, 2019

Speaker: Discussed graduate programs abroad and scholarship opportunities at Galatasaray University Mathematics Department Alumni Event, 2020

Volunteer Student Tutor: Educational Volunteers Foundation of Turkey, Istanbul, Turkey, 2008-2010
Taught 9- to 11-year-olds on weekends at Math, Science, and Me Research Workshop. This program aimed to help children develop their scientific thinking skills to think scientifically, solve problems, and develop positive attitudes towards science.

LANGUAGES

Programming: R, Python, MATLAB, LaTeX; familiar with C
Written & Spoken: English (fluent), French (fluent), Turkish (native)
