Erkin Ötleş

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I am a physician-engineer with deep expertise in industrial engineering and computer science. I am dedicated to enhancing health outcomes through the use of data-driven and engineering methodologies. Having recently completed a combined MD-PhD program at the University of Michigan, my research focuses on developing innovative methods to ensure the safety and efficacy of artificial intelligence (AI) tools utilized by physicians, patients, and health systems. This work is inherently translational, addressing challenges encountered during the transition from research to clinical application to inspire and develop new solutions. By integrating principles from industrial engineering, computer science, and medicine—particularly in optimization, decision science, simulation, and machine learning (ML)—I bring a unique perspective to healthcare challenges. My experience in industry applications provides valuable insights into medicine's scientific practice and operations. Beyond research, I am committed to bridging engineering and medicine by mentoring trainees in medicine and engineering, fostering enduring cross-disciplinary collaborations, and facilitating the exchange of ideas between these fields.

Education

2024 - x2027	**Emergency Medicine Resident Physician** University of Wisconsin - Madison
2016 - 2024	**Medical Scientist Training Program Fellow (Dual MD-PhD Training)** University of Michigan - Ann Arbor **Doctor of Medicine** *Distinction in Research Honors* **Doctor of Philosophy** **Industrial Operations Engineering & Artificial Intelligence Lab** Dissertation: Machine Learning for Healthcare: Model Development & Implementation in Longitudinal Settings Advisors: Brian Denton (Industrial & Operations Engineering), Jenna Wiens (Computer Science & Engineering, AI Lab)
2013 - 2016	**Masters of Engineering**, Industrial & Systems Engineering University of Wisconsin - Madison Decisions Science & Operations Research (Concentration: Computer Science)
2007 - 2011	**Bachelors of Science**, Industrial & Systems Engineering University of Wisconsin - Madison Dean's Honor List

Work

2024	**Emergency Medicine Resident Physician**, University of Wisconsin Clinical training in emergency medicine; with rotations in anesthesia, cardiology, pre-hospital/emergency medical services, trauma, ultrasound, and several different emergency departments. Continue to be actively engaged in research with the Patterson Lab and the Data Science for ICU Lab.

2018 - 2024	**Medical Scientist Training Program Fellow**, University of Michigan Developing & studying machine learning methods for clinical problems. Methodologically focused on optimizing performance of human-ML model teams over time. Notable projects: early warning systems for hospital acquired infections & deterioration, personalized models for cancer risk, dynamic outcome prediction utilizing deep learning. Led and maintain the deployment of two ML models in Michigan Medicine's Epic EHR (utilized Epic Cognitive Computing Platform & designed and developed an in-house ML model service platform). These models have been used in the care of over 200,000 patients have been run over 5 million times.
2015 - 2016	**Healthcare Data Science Manager**, MetaStar Pioneered the early formation of the data science division, leading the organization's transition from SAS-based report distribution to self-service reporting through Tableau dashboards and the integration of Python for ML. Championed the adoption of ML and advanced analytics, transforming the organization's approach to data-driven decision-making. Designed and implemented regional and statewide healthcare quality improvement initiatives, leveraging analytics to drive measurable improvements in patient outcomes and operational efficiency.
2011 - 2013	**Solutions Engineer & Tech Coordinator**, Epic Systems Corporation Designed and developed analytics tools for Accountable Care Organizations, playing a key leadership role in the development and implementation of Epic's early large-scale analytics products. Collaborated with customers to design and validate patient tracking and quality measurement methods, ensuring alignment with organizational goals. Led technical support for two major customer implementations, managing and resolving complex installation issues while coordinating cross-functional teams, including internal developers and customer technical and clinical teams. Certified in Ambulatory Clinical Documentation, MyChart, and Clinical Analytics Infrastructure (Cogito), demonstrating expertise in delivering innovative analytics solutions at scale.
2011	**HR Data Science Intern**, Epic Systems Corporation Extracted candidate data from a large email dataset using custom Visual Basic and conducted an in-depth analysis to identify correlations between interview data and employee performance. Developed unique visualizations to distill the most important components of high-dimensional data, enabling clearer insights. Findings were instrumental in refining recruitment strategies and enhancing candidate selection processes.
2011	**Health Systems Engineering Intern**, UW Hospital Spearheaded the design of next-generation inpatient rooms, integrating input from multidisciplinary teams of clinicians, administrators, and vendors. Oversaw the development of data mining tools and processes to evaluate quality of care and patient satisfaction, driving evidence-based improvements in healthcare environments.
2009	**Engineering Co-op,** Boston Scientific (Cardiac Pacing Division) Engineered and optimized production lines for cardiac pacemakers and pacing leads. Designed layouts and led final acceptance testing for over 100 production machines. Developed a software system to accurately measure total production time and assess individual machine performance, facilitating rapid identification and resolution of issues and ensuring all production targets were successfully met.

2007, 2008, 2010	**Engineering Intern**, Electronic Theatre Controls
	Streamlined the design process for custom theater systems through digitalization, improving efficiency and accuracy. Designed an innovative test stand for new rigging products, ensuring robust performance evaluation. Provided mentorship to junior engineers, guiding the redesign of factory workstations to enhance productivity and ergonomics.

Development Projects (GitHub)

2023 - Present	**describe** - iOS application for ambient physician note creation
2023 - Present	**BiomedWaveforms** - Open source project to visualize EKGs & other waveforms
2023 - Present	**Scraib** - An open source AI, on-device, LLM-based scribe for use by physicians
2023 - Present	**Toki** - iOS application for timing conference talks
2022 - Present	**eotles.com** - Custom personal portfolio website
2019 - 2020	**T-Square** - Longitudinal data transformer for RNNs (Python & TensorFlow)
2018 - 2020	**Wave** - Apple Watch app to assess hydration status using orthostatic heart rate measurements. (currently in beta testing)
2017	**M is for Medicine** - iMessage sticker pack (Appstore link)

Manuscripts (Google Scholar)

x2025	Racial Disparities in Efficacy & Toxicity of Immune Check Point Inhibitors. Lancet Oncology (Accepted).
2024	Miller SR, Schipper M, Fritsche LG, Jiang R, Strohbehn G, Ötleş E, …, Green MD, Bryant AK. 2024. **Pan-Cancer Survival Impact of Immune Checkpoint Inhibitors in a National Healthcare System.** Cancer Medicine.
2024	Ötleş E, Ceylanoglu KS, Demirci H. 2023. **Bilateral Choroidal Detachments Associated with Perinuclear Anti-Neutrophil Cytoplasmic Antibodies (P-ANCA) -Associated Vasculitis.** Ocular Immunology and Inflammation.
2023	Krumm AE, Ötleş E, Marcotte KM et al. **Strategies for evaluating predictive models: examples and implications based on a natural language processing model used to assess operative performance feedback.** Journal of the Association for Surgical Education.
2023	Ötleş E, Denton BT, Wiens J. 2023. **Updating Clinical Risk Stratification Models Using Rank-Based Compatibility: Approaches for Evaluating and Optimizing Clinician-Model Team Performance**. Machine Learning for Healthcare Conference. PMLR.
2023	Gates R, Marcotte KM, Moreci R, George BC, Kim G, Kraft K, Soltani T, Ötleş E, Krumm AE. 2023. **Association of Gender and Operative Feedback Quality in Surgical Residents.** Journal of Surgical Education.
2023	Ötleş E, Balczewski EA, Keidan M, Oh J, Patel A, Young VB, Rao K, Wiens J. 2023. **Clostridioides difficile infection surveillance in intensive care units and oncology wards using machine learning**. Infection Control & Hospital Epidemiology.

2022 Ötleş E, James CA, Lomis KD, and Woolliscroft JO, 2022. **Teaching artificial intelligence as a fundamental toolset of medicine**. <u>Cell Reports Medicine</u>.

2022 Marcotte KM, Ötleş E, Thelen AE, Gates R, George BC, and Krumm AE, 2022. **Using natural language processing to determine factors associated with high-quality feedback**. <u>Global Surgical Education - Journal of the Association for Surgical Education</u>.

2022 Ötleş E, Seymour J, Wang H, Denton BT. **Dynamic prediction of work status for workers with occupational injuries: assessing the value of longitudinal observations.** <u>Journal of the American Medical Informatics Association</u>.

2022 Kamran F, Tang S, Ötleş E, McEvoy DS, Saleh SN, Gong J, Li BY, Dutta S, Liu X, …, Donnelly JP, Shenoy E, Ayanian J, Nallamothu K, Sjoding MW, Wiens J. **Early Identification of Hospitalized Patients with COVID-19 at Risk of Clinical Deterioration: A Model Development and Multi-Site External Validation Study**. <u>bmj</u>.

2022 Ötleş E, Denton B, Qu B, Murali A, Merdan S, Auffenberg G, Hiller S, Lane BR, George AK, Singh K. **Development and Validation of Models to Predict Pathologic Outcomes of Radical Prostatectomy in Regional and National Cohorts.** <u>The Journal of Urology</u>.

2021 Ötleş E, Oh J, Li B, Bochinski M, Joo H, Ortwine J, Shenoy E, Washer L, Young VB, Rao K, Wiens J. **Mind the Performance Gap: Examining Dataset Shift During Prospective Validation.** <u>Machine Learning for Healthcare Conference. PMLR.</u>

2021 Wong A, Ötleş E, Donnelly JP, Krumm A, McCullough J, DeTroyer-Cooley O, Pestrue J, Phillips M, Konye J, Penoza C, Ghous M, Singh K 2021. **External Validation of a Widely Implemented Proprietary Sepsis Prediction Model in Hospitalized Patients**. <u>JAMA Internal Medicine.</u>

2021 Solano QP, Hayward L, Chopra Z, Quanstrom K, Kendrick D, Abbott KL, Kunzmann M, Ahle S, Schuller M, Ötleş E, George BC. **Natural Language Processing and Assessment of Resident Feedback Quality.** <u>J Surg Educ.</u>

2021 Abbott KL, George BC, Sandhu G, Harbaugh CM, Gauger PG, Ötleş E, Matusko N, Vu JV. **Natural Language Processing to Estimate Clinical Competency Committee Ratings**. <u>Journal of Surgical Education.</u>

2021 Ötleş E, Kendrick D, Solano QP, Schuller M, Ahle SL, Eskender MH, Carnes E, George BC. **Using Natural Language Processing to Automatically Assess Feedback Quality: Findings From Three Surgical Residencies**. <u>Academic Medicine.</u>

2021 Singh K, Valley TS, Tang S, Li BY, Kamran F, Sjoding MW, Wiens J, Ötleş E, Donnelly JP, Wei MY, … Singh K. **Validating a Widely Implemented Deterioration Index Model Among Hospitalized COVID-19 Patients**. <u>Annals of the American Thoracic Society.</u> (medRxiv)

2020 Beasley JW, Holden RJ, Ötleş E, Green LA, Steege LM, Wetterneck TB. **It's time to bring human factors to primary care policy and practice**. <u>Applied Ergonomics.</u>

2017	Gorski JK, Batt RJ, Ötleş E, Shah MN, Hamedani AG, Patterson BW. **The impact of emergency department census on the decision to admit**. <u>Academic Emergency Medicine.</u>

2016	Patterson BW, Batt RJ, Wilbanks MD, Ötleş E, Westergaard MC, Shah MN. **Cherry picking patients: examining the interval between patient rooming and resident self-assignment**. <u>Academic Emergency Medicine.</u>

Patents

2024	Denton BT, Ötleş E. **Artificial intelligence based approach for dynamic prediction of injured patient health-state.** Application filed 2021.

Under Review

2024	Primary Care Physician Perceptions and Requirements of Digital Scribes: Results from a Pilot Survey. NEJM AI.

Abstracts

2024	Model-Controller and Evaluation Framework for Precision Alerting of Clinical Risk *MLHC 2024*
2024	**<u>Evaluating the Efficacy of a Large Language Model in Screening Ophthalmology Articles for Systematic Reviews</u>** *ARVO 2024 Annual Meeting / Investigative Ophthalmology & Visual Science June*
2024	**<u>Performance of Topcon Optical Coherence Tomography Quality Score Across Demographic Groups and Compared to Physician Quality Assessment</u>** *ARVO 2024 Annual Meeting / Investigative Ophthalmology & Visual Science*
2023	Primary Care Physician Perceptions and Requirements of Digital Scribes *AMIA 2023 Annual Meeting*
2023	Updating Clinical Risk Stratification Models Using Rank-based Compatibility *INFORMS Healthcare*
2023	Observer-Level Performance Should Be Measured When Evaluating Machine Learning Models for Healthcare *SAIL*
2023	External Validation of a Natural Language Processing Model Used to Assess the Quality of Operative Performance Feedback *Association for Surgical Education Annual Meeting*
2023	No more notes? Perceptions of digital scribe technology among family medicine physicians *American Physician Scientist Association*

2021	**Comparative Assessment of a Machine Learning Model and Rectal Swab Surveillance to Predict Hospital Onset Clostridioides difficile** *IDWeek*
2020	**A NLP Approach for Assessment of Surgical Trainee Feedback Quality**, Association for Surgical Education Annual Meeting
2019	**Return to Work After Injury: A Sequential Prediction & Prescription Problem**, *Machine Learning for Healthcare*
2021	Dynamic Machine Learning for Medical Practice *INFORMS*
2020	High-confidence machine learning: A clinical decision-making case study *INFORMS*
2019	*Dynamic Machine Learning For Occupational Injuries* INFORMS
2017	**Immune Genomic Expression Correlates with Discharge Location & Poor Outcomes in Trauma Patients**, *Academic Surgical Congress*
2016	**Cues for PE Diagnosis in the Emergency Department: A Socio-technical Systems Approach for Clinical Decision Support**, *JAMIA*

Work in Progress

x2025	Operationalizing Machine Learning in Clinical Settings: The Utility of NNT Curves in the Context of Limited Healthcare Resources
x2025	A Human Factors Approach to Designing for Human-AI Teaming
x2025	An Introduction to the Fundamentals Artificial Intelligence in Medicine (Textbook & Course Materials)
x2024	Digital Scribes: Enabling Clinical Artificial Intelligence & NLP

Books & Chapters

2016	**Human Factors**, *WHO Technical Series on Safer Primary Care*

White Papers & Other Work

2011 - Ongoing	YouTube Channel: Simulation Tools (175,000 views)
2017	A Community Pharmacy Initiative to Decrease Hospital Readmissions by Increasing Patient Adherence and Competency of Therapy, *MetaStar*
2012	Improving the Quality and Efficiency of Primary Care through Industrial and Systems Engineering - A White Paper, *I-PrACTISE*

Peer Review

2022	AMIA Annual Symposium
2021-2022	Gut
2022	JAMIA
2020 - 2024	Machine Learning for Healthcare Conference

Selected Press

2024	STAT News: Yale tested 6 early-warning algorithms used by health systems. Epic's AI tool didn't fare well
2023	NPR: Will A.I. Take Your Job — or Make It Better?
2022	STAT News: How medical schools are missing the mark on artificial intelligence
2021	Forbes: Trust The AI? You Decide
2021	The Washington Post: Sepsis prediction tool used by hospitals misses many cases, study says. Firm that developed the tool disputes those findings.
2021	The Verge: A hospital algorithm designed to predict a deadly condition misses most cases
2021	WIRED: An Algorithm That Predicts Deadly Infections Is Often Flawed
2021	STAT News: A popular algorithm to predict sepsis misses most cases and sends frequent false alarms, study finds

Invited Presentations

2024	Introduction to Artificial Intelligence for Medicine *Invited talk at Oakland University William Beaumont School of Medicine Med Ed Week.*
2024	Artificial Intelligence in Clinical Care *Invited talk Stanford Emergency Medicine Faculty Development Series.*
2023	Machine Learning for Healthcare: Stories From Across The Healthcare ML Lifecycle *Invited talk at Worcester Polytechnic Institute Business School's Inaugural Business Week.*
2023	AI in Health Professions Education Workshop *National Academy of Medicine*
2023	Innovations in Machine Learning and Artificial Intelligence for Application in Education *University of Michigan Medical School Research Innovation Group (RISE)*
2021	What Clinicians Need to Know when Using AI *University of Michigan Medical School Precision Health Webinar*

| 2021 | Engineering Machine Learning for Medicine |
| | *Georgia Tech, ISyE 8803 - Virtual.* |

| 2021 | Engineering Machine Learning for Medicine: Developing, Deploying, and Evaluating Dynamic Prediction Models |
| | *CHEPS Seminar Fall 2021 - Ann Arbor, MI.* |

| 2019 | Looking to the Future: Digital Scribes. |
| | *American Academy of Family Physicians Commission on Quality & Practice - Kansas City, MO.* |

Presentations

| 2024 | Model-Controller and Evaluation Framework for Precision Alerting of Clinical Risk |
| | *Machine Learning for Healthcare Conference 2024 - Toronto, Canada.* |

| 2023 | Introducing Updating Clinical Risk Stratification Models Using Rank-based Compatibility: Evaluating & Optimizing Clinician-Model Team Performance |
| | *Machine Learning for Healthcare Conference 2023 - New York, New York.* |

| 2023 | Updating Clinical Risk Stratification Models Using Rank-based Compatibility |
| | *INFORMS Healthcare 2023 - Toronto, Canada.* |

| 2023 | Introduction to AI |
| | *Collaborative for Human Factors, Cognitive Load, and Well-being* |

| 2021 | Medical Decision Making with Machine Learning: Model Development, Validation, and Updating |
| | *INFORMS 2021 - Virtual.* |

| 2021 | High-confidence machine learning: A clinical decision-making case study |
| | *INFORMS 2021 - Virtual.* |

| 2021 | Comparative Assessment of a Machine Learning Model and Rectal Swab Surveillance to Predict Hospital Onset *Clostridioides difficile* |
| | *IDWeek - Virtual.* |

| 2021 | Characterizing the Performance Gap. |
| | *Machine Learning for Healthcare Conference - Virtual.* |

| 2021 | Considerations When Updating Models Used in Clinical Settings. |
| | *INFORMS Healthcare Conference - Virtual.* |

| 2020 | Dynamic Machine Learning for Medical Practice. |
| | *INFORMS Annual Conference - Virtual.* |

| 2020 | Prediction & Prevention: Powering Precision Health. |
| | *University of Michigan Precision Health Symposium - Virtual.* |

| 2020 | Dynamic Prediction of Patient Outcomes. |
| | *University of Michigan Medical Scientist Training Program - Virtual.* |

2020	<u>Friday Night AI: AI & COVID-19</u>. *Ann Arbor District Library - Virtual.*
2020	"You Did Great, Now Do Better" - NLP for Operative Feedback Quality. *University of Michigan - Department of Surgery Grand Rounds (Scrubs Surgery Olympics)*
2020	A NLP Approach for Assessment of Surgical Trainee Feedback Quality. *Association for Surgical Education*
2020	A NLP Approach for Assessment of Surgical Trainee Feedback Quality. *University of Michigan - Department of Surgery Moses Gunn Research Day*
2019	Dynamic Prediction of Patient Outcomes: A Deep Learning Approach. *INFORMS Annual Conference - Seattle, WA.*
2019	Dynamic Prediction of Patient Outcomes. *CHEPS Symposium - Ann Arbor, MI.*
2019	Return to Work After Injury: Sequential Prediction & Decision. *Machine Learning for Healthcare - Ann Arbor, MI.*
2019	Occupational Injury: Dynamic Prediction. *University of Michigan Medical Scientist Training Program - Roscommon, MI.*
2018	Shamu: Bringing Your Health Plan to Life. *Gupta Health Hackathon - Ann Arbor, MI.*
2017	Augmenting Cancer Surveillance with Machine Learning. *CHEPS Symposium - Ann Arbor, MI.*
2017	Machine Learning in Primary Care. *I-PrACTISE Annual Meeting - Madison, WI.*
2016	<u>Primary Care & Predictive Analytics</u>. *I-PraCTISE Colloquia - Madison, WI.*
2015	Forecasting Emergency Department Admissions. *INFORMS Healthcare Conference - Nashville, TN.*
2015	FlexSim Emergency Room Simulation Competition. *Society for Health Systems Annual Conference - Orlando, FL.*
2014	Industrial Engineering in Primary Care. *NAPCRG Annual Meeting - New York, City NY.*
2014	2013 I-PraCTISE Conference Review. *I-PraCTISE Annual Meeting - Madison, WI.*

Policy

2016	<u>Integration of Drug Price Information into Electronic Medical Records</u>. *AMA.*

Grants

2018 - 2019	Innovation Fellowship, <u>Developing AI assistants for Physicians</u>. *AAFP*.

Awards & Honors

2024	University of Michigan Medical School Dean's Distinction in Research Honors
2023	Making a Difference at Michigan Medicine Award
2021	Kass Award (excellence in research in infectious diseases) - IDWeek
2020	University of Michigan Surgery Olympics Mentor (1st place)
2020	MSTP Program Activities Committee
2017	University of Michigan Surgery Olympics (1st place)
2017	Michigan SlingHealth's Innovation Demo Day Competition (1st Place)
2013	SHS FlexSim Emergency Room Simulation Competition (1st Place)
2011 - Present	Alpha Pi Mu (Industrial Engineering Honor Society)
2011 - Present	Tau Beta Pi (Engineering Honor Society)
2007 - 2011	Dean's Honor List
2007 - 2011	Colbeck Scholarship
2007 - 2011	Thomas Engineering Scholarship
2007 - 2011	WV Distinguished Scholarship

Teaching

2015	**Lecturer**, Industrial & Systems Engineering University of Wisconsin - Madison Health Systems Engineering (ISyE 417) Was the primary lecturer for a Healthy Systems Engineering course aimed at senior-level industrial engineering students. Extensively refined lectures and developed new assignments for active classroom-based learning. Introduced new health system based-project.
2014	**Teaching Assistant**, Industrial & Systems Engineering University of Wisconsin - Madison Health Systems Engineering (ISyE 417) Provided continuity between four different course instructors. Additionally, I aided the instructors with a total course redesign, I recorded lectures and redesigned activities to support "active learning". <u>My lecture videos have >175k views.</u>
2013	**Teaching Assistant**, Industrial & Systems Engineering Simulation Modeling Lab (ISyE 321) Redeveloped the entire laboratory course focused on discrete event simulation; this involved designing new preparatory videos and activities. These changes significantly improved student understanding and satisfaction.

Leadership

2020 - 2022	**Program Advisory Committee**, University of Michigan MSTP
2020 - 2021	**External Relations Chair**, INFORMS University of Michigan Student Chapter
2016 - 2017	**President,** Medical Innovation Group UMMS
2015 - 2016	**Communications Chair,** INFORMS UW - Madison
2012 - Present	**National Advisory Council**, I-PrACTISE

2009 - 2011	**Industry Chair**, Engineering Expo 2011
2010 - 2011	**External Relations Officer**, Institute of Industrial Engineers
2010 - 2011	**College of Engineering Rep.**, Associated Students of Madison
2010 - 2011	**Engineering Student Council Rep.**, Polygon
2009 - 2010	**Fundraising Chair**, Institute of Industrial Engineers

Service

2023 - Present	**University of Michigan Medical School AI Working Group**
2023	**OneFact Open Source AI Foundation Advisor**
2022 - Present	**Collaborative Human Factors Cognitive Load and Wellbeing in Healthcare**
2021	**University of Michigan MSTP Scientific Retreat Co-Chair**
2019 - 2022	**University of Michigan MSTP Journal Editor**
2019	**IOE Coding Club**
2015 - 2016	**Health IT Thread Designer**, UW - Madison, SMPH Curriculum Redesign
2015 - 2016	**EMS Volunteer**, Cross Plains EMS
2011	**Organizing Volunteer**, Wisconsin Science Olympiad
2009 - 2010	**STEM Mentoring**, Young Scientists of America
2009 - 2010	**Emergency Department Volunteer**, United Hospital

Industry Connections

2023	**AI Practice Advisor**, HTD Health
2023	**AI Advisor**, Fourier Health
2022	**Chief Medical AI Officer**, Peers Health

Mentorship

2022 - 2023	**Emily Balczewski** - MD-PhD Candidate
2020 - 2021	**Max Klaben** - IOE Undergrad
2020 - 2021	**Isabelle Miner** - IOE Undergrad

Professional Memberships

American Medical Association, INFORMS, I-PrACTISE, IISE

Skills

Docker, Java, Keras, Matlab, MUMPS (Caché), Python, PyTorch, R, SQL, Swift, TensorFlow, Unix