CURRICULUM VITAE

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SUMMARY

I am currently a K99/R00-funded Assistant Professor at Columbia University, School of Nursing, Columbia University Medical Center. My program of research is aimed at utilizing cutting-edge technologies to develop novel methodological frameworks and informatics solutions to (1) mitigate the burden of delayed start-of-care and negative outcomes in patients with cognitive impairment (2) improve the quality and safety of healthcare services. These frameworks and solutions are built on novel data science methods (e.g., natural language processing and speech analysis methods) and multiple discrete and heterogenous data points (e.g., patient-clinician verbal communication, free-text clinical notes, and patient self-reported messages). They are also informed by multiple qualitative and quantitative theoretical frameworks. My interdisciplinary education in both health and information sciences and my professional experiences in clinical informatics provide me with the necessary theoretical and methodological skills and leadership capabilities to conduct high quality studies to improve health and mentor the next generation of clinical informaticians.

ACADEMIC APPOINTMENTS, HOSPITAL APPOINTMENTS, AND OTHER WORK EXPERIENCE

Assistant Professor, School of Nursing, Columbia University Medical Center, New York, NY
07/2023 – Present

- SpeechCARE Lab, dedicated to advancing speech-based clinical decision support tools for early detection of cognitive impairment, with a focus on health equity and inclusion

Postdoctoral Research Scientist, School of Nursing, Columbia University Medical Center, New York, NY
05/2020 – 05/2023
Focus: Medical Informatics in Home Healthcare Settings

- Principal Investigator of studies funded by Amazon, Columbia University, and Visiting Nurse Service of New York
- Investigated integration of patient-nurse verbal communication into home healthcare clinical workflows
- Developed ML models combining speech, clinical notes, and EHR data to predict emergency department visits
- Built automated speech processing system to identify Alzheimer's disease using acoustic, linguistic, and emotional markers
- Collaborator on the PREVENT project: developed NLP algorithms for identifying high-risk patients with delayed start-of-care
- Applied contextual word embedding to detect clinical notes indicating nurses' concerns

Postdoctoral Research Fellow, Department of Artificial Intelligence and Informatics and Department of Psychology and Psychiatry, Mayo Clinic, Rochester, MN
04/2018 – 05/2020
Focus: Medical Informatics in Mental and Neurological Disorders

- Developed methodological framework for risk identification in patient registries

- Built NLP pipelines for analyzing over 2 million news articles on public health concerns
- Designed text mining and content analysis system for identifying contributors to patient deterioration
- Led annotation of risk factors for abrupt antidepressant discontinuation and developed non-adherence prediction models
- Collaborated on analysis of U.S. patent documents to characterize disease-related technological innovation trends

Predoctoral Research Fellow, Lister Hill National Center for Biomedical Communications, National Library of Medicine, National Institutes of Health (NIH), Bethesda, MD
05/2016 – 12/2016
Focus: Biomedical and Consumer Health Informatics

- Led development of the PsyTar corpus for evaluating ADR detection algorithms in psychiatric medication use
- Normalized patient ADR expressions using UMLS and SNOMED-CT
- Identified novel ADRs not reported in FDA documentation
- Developed NLP-content analysis framework to detect patients' negative attitudes toward antidepressants

Lecturer, Department of Health Informatics and Administration, University of Wisconsin-Milwaukee, Milwaukee, WI
01/2015 – 01/2018

- Taught graduate courses: Research Design and Methodology
- Taught undergraduate courses: Healthcare Quality Management, Ethics and Laws for Healthcare Professionals, Seminar in Health Professions

Research Assistant, Department of BioHealth Informatics, Indiana University, Indianapolis, IN
09/2012 – 01/2015

- Led study on U.S. hospital patient engagement practices
- Evaluated interface usability of pediatric asthma CDSS with clinical nurses

Principal Investigator, Immunology, Asthma & Allergy Research Institute (IAARI), Tehran University of Medical Sciences, Tehran, IRAN
02/2010 – 08/2012

- Led development of a CDSS for pediatric asthma diagnosis and risk identification
- Created algorithms predicting asthma exacerbation and ED visits
- Conducted feasibility study on CDSS-EHR integration
- Supervised Master's-level researchers in biomedical engineering

Research Faculty, Academic Center for Education, Culture and Research (ACECR), Tarbiat Modares University, Tehran, IRAN
08/2009 – 08/2012

- Designed national scientific research portal
- Studied IT-based SMEs and provided policy recommendations to Tehran Chamber of Commerce
- Developed educational software and explored software clustering applications in IRAN

Co-founder, E-Sabz Company, Tehran, IRAN
06/2007 – 08/2009

- Led development and marketing of administration and educational software
- Conducted SWOT analysis and created commercialization plan
- Directed software development and marketing strategies

Research Assistant, Department of Information Technology, Tarbiat Modares University, Tehran, IRAN
09/2005 – 08/2007

- Built rule-based expert system for childhood asthma screening

- Developed agricultural knowledgebase and SQL database for social security insurance management

EDUCATION

PhD in Health Sciences (Clinical Informatics)
University of Wisconsin–Milwaukee, Department of Health Sciences – Milwaukee, WI
Start: 01/2013 – Degree Awarded: 01/2018
Thesis Title: *Utilizing Consumer Health Posts for Pharmacovigilance: Identifying Factors Influencing Patients' Attitudes Toward Antidepressants*
Advisor: Timothy Patrick, PhD (University of Wisconsin–Milwaukee) and Kin Wah Fung, MD (National Center for Biomedical Communications, National Library of Medicine, National Institutes of Health)

MSc in Health Informatics
Indiana University, School of Informatics and Computing, Department of BioHealth Informatics – Indianapolis, IN
Start: 09/2012 – Degree Awarded: 05/2014

MSc in Information Technology
Tarbiat Modares University, Department of Information Technology – Tehran, IRAN
Start: 09/2005 – Degree Awarded: 01/2008

BSc in Business Management
University of Tehran, Department of Business Management – Tehran, IRAN
Start: 09/2001 – Degree Awarded: 08/2004

TRAINING

Research Training in Biomedical Informatics and Entrepreneurship
Discipline: Biomedical Informatics and Translational Innovation
BioMedX Biomedical Informatics Training Program, Columbia University – New York, NY
01/2023 – 06/2023

Postdoctoral Research Training in Clinical Informatics for Home Healthcare
Discipline: Clinical Informatics
School of Nursing, Columbia University Medical Center – New York, NY
05/2020 – 12/2022

Training in Start-Up Businesses for Healthy Aging
Discipline: Translational Aging Science & Innovation
National Institute on Aging Bootcamp to Foster Diversity and Accelerate Innovation – Virtual
08/2022 – 12/2022

Postdoctoral Research Training in Clinical Informatics for Mental Health
Discipline: Medical Informatics and Mental Health
Departments of Artificial Intelligence and Informatics, Psychology and Psychiatry, Mayo Clinic – Rochester, MN
04/2018 – 05/2020

Predoctoral Research Training in Biomedical and Consumer Health Informatics
Discipline: Biomedical and Consumer Health Informatics
Lister Hill National Center for Biomedical Communications, National Library of Medicine, National Institutes of Health – Bethesda, MD
05/2016 – 12/2016

Research Training in Health Sciences
Discipline: Health Sciences
Tehran University of Medical Sciences – Tehran, IRAN
01/2008 – 08/2009

HONORS & AWARDS

- "Best of the Best" Project Recognition, Columbia Center for AI Technology (CAIT), 2025
  Selected as one of the “best of the best” projects funded over the past five years by CAIT, in recognition of long-term impact and innovation in speech- and language-based prediction of hospitalization and emergency department visits in home healthcare.
- Winner, National Institute on Aging (NIA) PREPARE Challenge – Pioneering Research for Early Prediction of Alzheimer's and Related Dementias, 2025. Selected among 70 national teams for receiving the Explainability Bonus Prize and Model Development Award for interpretable speech processing algorithm in dementia detection.
- Finalist, Biomedical Engineering Technology Accelerator (BioMedX), 2023; Selected among 30 teams for Columbia’s translational accelerator supporting AI-based biomedical research.
- Best Poster Award, Bridge2AI-Voice Consortium, Washington DC, 2023; Recognized for outstanding presentation on speech-based cognitive impairment detection; selected from ~50 national poster presentations.
- Finalist, National Institute on Aging (NIA) Healthy Aging Start-Up Challenge, 2022; Chosen as 1 of the top 10 teams from over 200 applicants for innovations supporting healthy aging.
- Columbia Center of AI Technology Research Award (with Amazon), New York, NY, 2021; Awarded internal funding to support development of AI-based speech processing for early dementia detection.
- Journal Club Manager, American Medical Informatics Association (JAMIA), 2019–2020; Selected from 40 national applicants to lead scholarly engagement for JAMIA’s national journal club.
- Research Award, FDA Centers of Excellence in Regulatory Science and Innovation (CERSIs), Mayo Clinic, 2018; Recognized for informatics research addressing medication adherence; selected from over 30 applicants.
- Best Dissertation Award, Department of Health Sciences, University of Wisconsin–Milwaukee, 2018; Recognized as top dissertation among 10 PhD candidates; nominated for AMIA Dissertation Award.
- Intramural Research Training Award (IRTA), National Library of Medicine / NIH, 2016; NIH-funded award supporting early-stage researchers in biomedical and consumer health informatics.
- Chancellor’s Graduate Student Award (CGSA), University of Wisconsin–Milwaukee, 2015–2017; Selected from ~100 applicants per term for academic excellence and research contributions.
- Certificate of Excellence in Online and Blended Teaching, University of Wisconsin–Milwaukee, 2016; Awarded in recognition of excellence in hybrid and online teaching methods.
- Travel Award, HIMSS Conference & Exhibition, Orlando, FL, 2013; Supported participation in a leading international conference in health informatics.
- Scholarship Award, MSc in Health Informatics, Indiana University–Purdue University Indianapolis, 2012–2014; Merit-based scholarship awarded to support graduate training in health informatics.
- Patent Award, Iran Intellectual Property Center, 2012; Granted for development of a clinical decision support system for pediatric asthma screening.
- Best Article Award, International Journal of Information Technology, Iran, 2011; Selected as best article among 30 presented at national conference on applied health informatics.

- Research Award, Immunology & Asthma & Allergy Research Institute (IAARI), Tehran University of Medical Sciences, 2010; Awarded for interdisciplinary research on pediatric asthma and clinical decision support.
- Thesis Award, IAARI, Tehran University of Medical Sciences, 2008; Recognized for excellence in thesis work focused on intelligent diagnosis systems for pediatric asthma.
- National Exceptional Talent Recognition, IRAN Ministry of Science & National Elites Foundation, 2005; National recognition for academic excellence and research potential among top-performing students.
- 4th Rank, National IT Entrance Exam, Iran, 2005; Achieved 4th place out of 16,000 participants in competitive national entrance exam for IT programs.
- 1st Rank, BSc in Management, University of Tehran, 2005; Graduated first in class among 60 students in the Department of Business Management.

ADMINISTRATIVE LEADERSHIP AND ACADEMIC SERVICE

Grant Review Panels

- Grant Reviewer, NIH Study Section ZAG1 ZIJ-5 (M2) B: NIA SBIR Biobehavioral and Social Processes, July 2025
- Grant Reviewer, NIH Study Section HSR3: Healthcare Informatics, May 2025
- Grant Reviewer, NIH Special Emphasis Panel – AI/ML Tools for Visualizing Behavioral and Social Science Research (Solicitation #: PHS2023-1), April 2025
- Grant Reviewer, VA, Healthcare Informatics & Access to Care, August 2025
- Grant Reviewer, VA, Healthcare Informatics & Access to Care, March 2025

Academic Service

- Member, Governance Task Force, American Medical Informatics Association (AMIA), 2021
- Senior Program Committee Member, AMIA Annual Symposium, 2019–Present
- Senior Program Committee Member, AMIA Informatics Summit, 2020–2021
- Senior Program Committee Member, International Symposium on Mathematical and Computational Oncology, 2019, 2020
- Senior Program Committee Member, 22nd International Conference on Artificial Intelligence in Medicine, 2024
- Dissertation Committee Reviewer, 22nd International Conference on Artificial Intelligence in Medicine, 2024

Editorial Board

- Student Editorial Board of Journal of American Medical Informatics Association (JAMIA), 2019-2021
- Special Issue on Mental, Neurological, and Substance Use Disorders, Frontiers in Artificial Intelligence (AI), 2021- current

Reviewer

- npj Mental Health Research
- Journal of American Medical Informatics Association (JAMIA)
- Journal of Medical Internet Research (JMIR)
- Applied Clinical Informatics
- Journal of Biomedical Informatics (JBI)

- AMIA Annual Symposium
- AMIA Joint Summits on Translational Science
- Frontiers in AI
- Journal of Medical Systems
- PLOS ONE
- American Public health Association (APHA)
- Journal of Pulmonary & Respiratory Medicine

Department and Conference Services

- Project Coordinator, Department of Health Informatics Administration, University of Wisconsin–Milwaukee, 2015–2016
- Program Assistant, HIMSS Conference, Orlando, FL, 2013
- Program Assistant, Indy Big Data Conference, Indianapolis, 2014
- Volunteer, International Graduate Welcome Program, Office of International Affairs, Indiana University, 2013–2014

FELLOWSHIP AND GRANT SUPPORT

Active Research Support

2024-2025 **SpeechCARE: Explainable Multimodal Speech Analysis for Early Detection of Cognitive Impairment**
National Institute on Aging (NIA) – PREPARE Challenge Phase 2 and Phase 3 Awards
$30,000
Role: PI

This project was part of the Pioneering Research for Early Prediction of Alzheimer's Disease & Related Dementias (PREPARE) Challenge, a multi-phase initiative launched by the National Institute on Aging in 2023. Our team participated in Phase 2, focusing on developing explainable and inclusive machine learning models to predict early cognitive decline. We received two awards: one for our explainability framework and another for model development, totaling $30,000. Our solution, SpeechCARE, is a transformer-based, multimodal pipeline designed to detect cognitive impairment from speech. It integrates pretrained multilingual acoustic and linguistic models through a novel Mixture-of-Experts-inspired fusion architecture that dynamically weights modality-specific features across diverse tasks (e.g., story recall, sentence reading). The pipeline includes automated transcription, LLM-assisted speech task identification, and a SHAP- and LLM-based explainability module that highlights phonetic, syntactic, and semantic markers associated with mild cognitive impairment. SpeechCARE demonstrated strong performance (AUC = 0.88; F1 = 0.72 overall; AUC = 0.90 for MCI detection), with minimal demographic bias and scalability for underrepresented populations.

2024-2025 **Tackling Disparity with Sound: Audio-Recorded Patient-Clinician Communication for Early Detection of Mild Cognitive Impairment in Black Older Adults**
Center for Interdisciplinary Research on Alzheimer's Disease Disparities (CIRAD) – $50,000
Role: PI

This initiative extends our ongoing research which initially focused on gathering a dataset of audio-recorded verbal interactions between Black patients and nurses at VNS Health. In pursuit of this aim, we plan to expand our sample by incorporating additional recordings of Black patient-social worker verbal communication. Furthermore, we will conduct a systematic analysis of the phonological, syntactical, and lexical characteristics of Black verbal communication. This analysis will serve to refine the acoustic and linguistic models of Amazon Transcribe, enhancing its performance in automatic transcription of home

care patient-clinician verbal communications and improving ADscreen's robustness, performance, and scalability in detecting MCI-ED among patients through their routine interactions with clinicians.

2022-2027 **Development of a Screening Algorithm for Timely Identification of Patients with Mild Cognitive Impairment and Early Dementia in Home Healthcare**
(1K99/R00AG076808-01A1)
National Institute on Aging (NIA) - $979,922
Role: PI

The goal of this study is to model the routine verbal communication between patients and nurses in home healthcare setting to identify patients at risk of cognitive impairment, specifically mild cognitive impairment (MCI) and early dementia (ED). The specific aims are: Aim 1) To model MCI-ED patients' verbal communications with clinicians using an automated speech analysis system. Aim 2) To utilize existing natural language processing algorithms to automatically identify MCI-ED related information. Aim 3) To develop a n screening algorithm to identify home healthcare patients with MCI-ED.

Past Support

2023-2024 **A speech-processing Algorithm for Automatic Screening of African American Patients with Mild Cognitive Impairment and Early Dementia in Home Healthcare Setting (**P30-AG-073105-01)
A2 Pilot Award, Sponsored by National Institute on Aging – $246,000
Role: PI

Due to sociocultural factors, African American patients seek medical attention at advanced stages of cognitive impairment, viewing initial symptoms as a normal part of aging. Regarding speech recognition, African Americans' specific dialect affects spoken language's acoustic and linguistic components. We hypothesize that building a Mild Cognitive Impairment-Early Dementia algorithm on a sample of African American patient-nurse verbal communication during routine HHC encounters can improve the algorithm's sensitivity, raising the HHC nurses' attention to the African American patients' cognitive impairment for further neurological examination. Specifically, we aimed to develop an MCI-ED screening algorithm using linguistic and acoustic features extracted from African American patients' verbal communications and EHR data.

2020-2024 **Homecare-CONCERN: Building risk models for preventable hospitalizations and emergency department visits in homecare** (R01HS027742) (PI: Maxim Topaz)
Agency for Health Research and Quality - $1,500,000
Role: collaborator (contribution: Using advanced natural language processing systems to analyze home healthcare clinical notes)

This study brings together an interdisciplinary team of experts in homecare, data science, nursing and risk model development to explore whether cutting-edge data science approaches can improve timely identification of patients at risk in homecare. Specific aims are to: 1. Further develop and validate a preventable hospitalization or ED visit risk prediction model (Homecare-CONCERN). 2. Prepare Homecare-CONCERN for clinical trial via pilot testing. 3. Inform the future implementation of Homecare-CONCERN clinical decision support tool in the homecare setting.

2020-2022 **Using Artificial Intelligence to Identify Homecare Patient's Risk of Hospitalization and Emergency Department Visits: Speech-Analysis Feasibility Study**
Amazon Sponsored Research Proposal, Columbia Center of AI Technology (CAIT)- $150,000
Columbia Nursing Pilot Grant - $14,000
Eugenie and Joseph Doyle Research Fund (Visiting Nurse Service of New York)- $10,000
combined funding: $174,000
Role: Contact-PI, Multiple-PI: Maxim Topaz, Zoran Kostic

This work explores the feasibility of improving homecare patient risk prediction by using a critical but underexplored data stream: verbal communication between nurses and patients. This study applies advanced artificial intelligence methods to explore whether audio recorded nurse-patient communication during routine homecare visits can inform identification of patients at risk for hospitalization or ED visits. Aims: 1) Assess the feasibility of a nurse-patient encounter audio recording during homecare encounters; 2) Evaluate the accuracy of two automated speech recognition methods (commercial software versus open source software); and 3) Explore whether features of audio recorded nurse-patient encounters can be used to predict (via machine learning) patient hospitalizations or ED visits.

2020-2022 **Using Natural Language Processing to Improve Identification and Prediction of Alzheimer's Disease and Related Dementias** (R21AG065753) (PIs: Maxim Topaz, Miriam Ryvicker)
National Institute on Aging - $260,000
Role: Investigator (contribution: Development of a risk identification model for early identification of home healthcare patients with Alzheimer's disease and related dementias)

Nurses' documentation of patient diagnoses, symptoms and interventions for home care patients with Alzheimer's Disease and related dementias: A natural language processing study Alzheimer's disease and related dementias (ADRD) affect about 5 million people in the U.S. Home health care nurses provide care for many people with ADRD and document what they observe about their patients' needs in the form of free-text notes. This study will use a method known as 'natural language processing' to gain new knowledge from nurses' notes and identify ways to better support people with ADRD and their caregivers.

2019-2022 **Improving Patient Prioritization During Hospital-homecare Transition: A Mixed Methods Study of a Clinical Decision Support Tool** (R01NR018831) (PI: Maxim Topaz)
National Institute of Nursing Research - $2,000,000
Role: Investigator (Contribution: Built a natural language processing algorithm to identify reasons for delayed start-of-care nursing visits in home healthcare)

The proposed study assembles a strong interdisciplinary team of experts in health informatics, nursing, homecare, and sociotechnical disciplines to evaluate an innovative tool called "Priority for the First Nursing Visit Tool" (PREVENT) in a pre-post intervention efficacy study. Specifically, the study aims are: *Aim 1)* Evaluate the effectiveness of the PREVENT tool on process and patient outcomes. Using survival analysis and logistic regression with propensity score matching we will test the following hypotheses: Compared to not using the tool in the pre-intervention phase, when homecare clinicians use the PREVENT tool, high risk patients in the intervention phase will: a) receive more timely first homecare visits and b) have decreased incidence of rehospitalization and have decreased emergency department use within 60 days. *Aim 2)* Examine aspects of PREVENT's reach, adoption, and implementation. Aim 2 will be assessed using mixed methods including homecare admission staff interviews, think-aloud observations, and analysis of staffing and other relevant data.

2019-2020 **Proactive: A Risk Identification Model for Timely Identification of Patients for Outpatient Care Coordination of Depression**
Department of Psychiatry and Psychology, Mayo Clinic
Role: Multiple-PI, Contact PI: Mark Williams

The presence of depression as a comorbidity increases the rate of Emergency Department (ED) visits by up to 61%, with depression severity linked to frequent ED visits. The collaborate care model (CoCM) of care management targets adults with major depression (MDD) in primary care where there may be the opportunity to prevent ED visits. However, little is known on how to predict which MDD patients should be prioritized. This study aimed to: Develop and validate an explainable machine learning based- risk identification model for the proactive identification of patients with depression at high risk of frequent ED visits to allow prioritization for CoCM in primary care.

2018 **Utilizing Patient-Generated Data to Identify Significant Factors Associated with Non-adherence to Psychiatric Medication: A Text Mining Approach**

FDA Centers of Excellence in Regulatory Science and Innovation (CERSIs), $2,500
Role: PI

The goal of this study was to utilize text mining methods and machine learning algorithms to identify contributing factors of drug non-adherence (drug discontinuation) associated with psychiatric medications using patients' self-reported experiences with medications posted in online healthcare communities.

2017-2022 **Mayo Clinic Center for clinical and Translational Science (CCaTS)**
(3UL1TR002377-02S2) (PI: Sundeep Khosla)
National Center for Advancing Translational Sciences (NCATS)- $12,490,175
Role: Postdoctoral research fellow (contribution: Built natural language processing pipelines for analysis of patients' reported narrative data and News Media reports)

Clinical and Translational Science (CTS) has been a fundamental and highly valued element of Mayo Clinic since its founding, and Mayo Clinic's mission "to provide the best care to every patient every day through integrated clinical practice, education, and research." The specific aims of this funding are: Aim 1. Train and maintain an outstanding multidisciplinary CTS workforce, including the entire spectrum of individuals involved in CTS; Aim 2. Eliminate barriers to the work of translation by streamlining methods and processes, including improved and innovative informatics tools, completing the transformation of Mayo's clinical trial process, and accelerating the implementation of trial results and other discoveries to improve patient care; Aim 3. Engage and incorporate a range of diverse stakeholders as active participants in CCaTS, both in leadership roles and in specific research projects, to improve the process of translation and the delivery of health care, promoting community engagement in research among our Mayo workforce and engaging our local and national communities using both traditional and innovative approaches; and Aim 4. Expand, strengthen, and streamline our regional and national collaborations in all aspects of CTS and education, connecting with our regional and national partners, as well as with the CTSA Consortium, to achieve the ultimate goal of NCATS to improve patient care and human health.

2016-2017 **Development of a Natural Language Processing Pipeline for Identifying Drug-related Information from Patient Self-Reported Messages in Online Healthcare Forums**
Lister Hill National Center for Biomedical Communications, National Library of Medicine- $33,600
Role: PI

The first aim of this study was to develop the PsyTAR (Psychiatric Treatment Adverse Reactions) corpus, an annotated corpus using patients' narrative data for psychiatric medications, particularly SSRIs (Selective Serotonin Reuptake Inhibitor) and SNRIs (Serotonin Norepinephrine Reuptake Inhibitor) medications. This corpus consists of three main components: sentence classification, entity identification, and entity normalization (mapping the identified entities to medical terminologies). The second aim focused on utilizing the PsyTAR corpus to develop a risk identification algorithm for the early identification of patients with depression at risk of antidepressant nonadherence.

2015-2017 **The Chancellor's Graduate Student Award (CGSA)**
University of Wisconsin Milwaukee -$38,000
Role: PhD student in Clinical Informatics

This award helped me develop a natural language processing pipeline for analyzing self-reported messages in online healthcare forums for patients with depression. Specifically, I created (1) an application programming interface (API) for the automatic collection of patient narrative reports from social media, (2) a framework for annotating desired entities/concepts in the narrative reports, and (3) trained natural language techniques to automate extraction of medical concepts.

2013-2016 **Improving Access to Care of Underserved Patients in Indiana State (**PI: Brad Doebbeling)
Patient-Centered Outcomes Research Institute - $2,000,000

Role: Research assistant (contribution: Analyzing the audio-recorded patient interviews using qualitative methods)

The goal of this study was to explore facilitators and barriers of underserved patients' access to healthcare services and to develop informatics interventions to improve their access.

2012-2014 **Scholarship Award for Students with Outstanding Academic Achievement**
School of Informatics and Computing, Indiana University–Purdue University Indianapolis (IUPUI), $83,000
Role: Master student in Health Informatics

The goal of this scholarship is to support students with outstanding academic achievement to pursue their academic and professional goals.

2010-2012 **A Clinical Decision Support System for Early Detection of Pediatric Asthma and identifying Asthmatic Patients at Risk of Negative Outcomes (Asthma Exacerbation and Emergency Department Visits)**
Immunology & Asthma & Allergy Research Institute (IAARI) at Tehran University Medical Science and Academic Center for Education, Culture and Research (ACECR) Tehran, IRAN – $150,000
Role: PI

The goal of this study was to use ontology-driven design and fuzzy logic for knowledge base construction on the integration of multiple data points extracted from electronic health records (EHR) and patients' self-reported assessments about their quality of life. We used the method of modulatory design to enhance flexibility and usability of this system in the presence of missing information (e.g., laboratory data) and the feasibility of its integrating into EHR system.

2009-2011 **Feasibility Study of Implementing a National Portal for Small Business in IRAN**
(PI: Vahid Faaliyat)
Communication and Information Technology Research Institute, Tehran, IRAN, $150,000
Role: Co-Investigator (contribution: Designing a methodological framework for identifying strengths and weaknesses of small businesses in receiving financial support from investors)

This study aimed to develop a platform for small business to improve their access to potential financial sources and business knowledge. Access to this information could enhance the chance of small business' success in the market.

2010 **Development of a rule-based expert system for early identification of childhood asthma**
Academic Center for Education, Culture and Research (ACECR) - $24,000
Role: PI

This study aimed to use knowledge engineering and rule-based algorithms to estimate the probability of asthma in children (aged between 5-18) with respiratory symptoms.

2006-2008 **Using Fuzzy logic to Model Uncertainty in Asthmatic Patients' Self-Reported Symptoms**
Immunology, Asthma & Allergy Research Institute (IAARI), Tehran University Medical Science, Tehran, IRAN – $5,000
Role: PI

This study aimed to represent uncertainty in self-reported symptoms of asthmatic patients using fuzzy logic. Representing this uncertainty could improve the performance of downstream tasks, such as machine learning algorithms built on patient data for early screening of asthmatic patients.

PATENTS

- Patent awarded by the Iran Intellectual Property Center for CDS system for Clinical Decision Support System for Screening Asthmatic Patients, Tehran, Iran

Pending Patents

- Systems and methods for speech processing-based identification of patients with cognitive impairment, Columbia University Medical Center, 2025

Advising and Mentorship

Thesis and Dissertation Mentoring

- **Samaneh Omranian,** Dissertation Title: Information retrieval of opioid dependence medications reviews from health-related social media, Department of Computer Science, University of Wisconsin-Milwaukee, Milwaukee, WI, 2020 – Present (*member of the Dissertation committee: Advising the student on designing data Science methodology*)
- **Ali Zonour,** Thesis Title: Using multilingual speech-processing system for identifying patients with Alzheimer's disease, Department of Computer Science, University of Tehran IRAN, March 2020 – Present (*member of the Thesis committee: Advising the student on designing data Science methodology*)
- **Christina Eldredge**, Dissertation Title: Adverse hypersensitivity events in cancer therapy: Evaluation of use of standard terminology in clinical cancer trial reporting, Department of Health Sciences, University of Wisconsin-Milwaukee, Milwaukee, WI, 2018- 2020 (*member of the Dissertation committee: Advising the student on designing data Science methodology*)
- **LR. Pondugala,** Thesis Title: Evaluation of various hospital websites based on Patient Engagement Framework, Department of Health Informatics, Indiana University, Indianapolis, IN, 2014 (*member of the the Thesis committee: Advising the student on qualitative analysis methods*)
- **SA. Darabi,** Thesis Title: Diagnosing adult asthma using case-based reasoning, Department of Industrial Engineering, Tarbiat Modares University, Tehran, IRAN, 2011-2012 (*member of the Thesis committee: Advising the student on data collection methods*)
- **Mahdis Bayani.** Thesis title: Diagnosing pediatric asthma using type 2 fuzzy clustering, Department of Industrial Engineering, Amirkabir University Technology, Tehran, IRA, 2010- 2011 (*member of the Thesis committee: Advising the student on designing data Science methodology*)

Postdoctoral Mentoring

- **Jihye Scroggins:** Postdoctoral Researcher, Nursing Informatics, School of Nursing, Columbia University
  Projects: I have mentored Dr. Scroggins for "Does synthetic data augmentation improve the performance of machine learning classifiers in identifying health problems from patient-nurse verbal communications in home healthcare settings?"
  Fall 2023 – Spring 2024

- **Zhihong Zhang**: Postdoctoral researcher at Data Science Institute – Columbia University
  Projects: I mentored Dr. Zhang for several studies, including: (1) Applying large language models (LLMs) in healthcare, developing pipelines for citation screening using LLMs; (2) building risk identification models with electronic health records (EHR); and (3) integrating audio-recorded patient-nurse communications with EHR data to predict emergency department (ED) visit risk.
  June 2024 – Current

PhD Students – School of Nursing, Nursing Informatics Program

- **Zidu Xu**
  Project: Voice for All: Evaluating the Accuracy and Equity of Automatic Speech Recognition Systems in Transcribing Patient Communications in Home Healthcare
  Role: Faculty Mentor; Fall 2023 – Spring 2024
- **Madison Horton**
  Project: Utilizing Machine Learning to Identify Key Variables Associated with Low-Quality Healthcare Services
  Role: Faculty Mentor*;* Spring 2024
- **Justinna Dixon**
  Project: Developing Risk Identification Models Using Machine Learning to Predict Emergency Department Visits
  Role*:* Faculty Mentor*;* Summer 2024
- **Helen N. Dinh**
  Project: Identifying Financial Insecurity in Patients with Heart Failure Using Natural Language Processing
  Role: Faculty Mentor*;* Spring 2025

Mentoring Research Assistants in Computer Science and Artificial Intelligence

All individuals listed below served as Research Assistants (RA) under my supervision.

- **Sina Rashidi**, MS in Artificial Intelligence
  Project: SpeechCura: A Novel Speech Augmentation Framework to Tackle Data Scarcity in Healthcare
  RA: Columbia University, January 2024 – Present
- **Hossein Azad Maleki**, MS in Artificial Intelligence
  Projects: (1) SpeechCARE: Harnessing Multimodal Innovation to Transform Cognitive Impairment Detection*;* (2) TransformerCARE: A Novel Speech Analysis Pipeline Using Transformer-Based Models and Audio Augmentation Techniques
  RA: Columbia University, July 2023 – Present
- **Mohammad Javad Momeni Nezhad**, MS in Artificial Intelligence
  Project: The Diagnostic Potential of Large Language Models: A Study on Cognitive Impairment Identification from Patient Language
  RA: Columbia University, January 2024 – Present
- **Elyas Esmaeili**, MS in Artificial Intelligence
  Project: SpeechDetect: An Explainable Automated Acoustic Processing Framework for Early Detection of Cognitive Impairment
  RA: Columbia University, October 2023 – September 2024
- **Seyed Mohammad Bagher Hosseini**, PhD in Computer Science
  Project: Employing Language Models for Patient Self-Report Analysis: Extracting Expressions of Adverse Drug Reactions to Antidepressants
  RA: Columbia University, February 2023 – March 2025
- **Yasaman Haghbin**, MS in Artificial Intelligence
  Project: Mitigating Bias in Speech Processing Algorithms: Developing Fairness-Aware Models for Cognitive Impairment Detection

RA: Columbia University, October 2024- Present

- **Maryam Dadkhah & Fatemeh Taherinezhad,** MS in Computer Science
  Project: SpeechCARE Explainability Framework: Interpretable Multimodal Detection of Cognitive Impairment with Insights from the NIA Alzheimer's Challenge
  RA: Columbia University, December 2024- Present
- **Krystal Briggs**, MS in Computer Science
  Decoding Disparities: Evaluating ASR System Performance in Transcribing Black and White Patient Verbal Communication with Nurses in Home Healthcare
  RA: Columbia University, September 2023- July 2024
- **Alexander Ge, Ashvin Jagadeesan, Kaan Yarali, & Feroz Ahmad,** MS in Computer Science
  Project: Quantifying Properties of Patients' Spoken Language for Diagnosing Alzheimer's Disease
  RA: Columbia University, Summer 2021–2022
- **Elham Sagheb,** MS in Computer Science
  Project: Developing a Natural Language Processing Pipeline for Analyzing News Documents Collected from News Media
  RA: Mayo Clinic, September-December 2018

Collaborative Project Mentorship in Health and Clinical Informatics

- **Masoud Khani & AmirSajjad Taleban**, PhD in Medical Informatics
  Project: Synthetic Speech Data Generation for Cognitive Impairment Detection
  University of Wisconsin–Milwaukee, January 2023– June 2024
- **Yi Shuan Shirley Wu, Pharm.D.& Kelly Xu, Pharm.D.**
  Project: Annotating Patient Self-Reports on Antidepressants and Mapping to UMLS
  National Library of Medicine/NIH, *June* 2016– December 2017
- **Sasha Vergez, MS in Public Health & Sridevi Sridharan, MS in Biomedical Informatics**
  Project: Interview Coding, Data Analysis, and EHR-based ML Development
  Visiting Nurse Service of NY, September 2020– July 2022
- **Samar Binkheder & Michelle Linox, PhD in Health Informatics**
  Project: Developing a Framework for Evaluating Hospitals' Involvement in Promoting Patient Engagement Activities and Outcomes
  Indiana University, Spring 2013

Other mentoring Experiences

- Mentor of High School Students Attended American Medical Informatics Association (AMIA), November 2019
- Career Development Mentor for Women in AMIA Career Development Program, November 2020

SKILLS

- Visionary leadership, product development, team building, organizational restructuring, public speaking, creative writing
- Advanced Natural language processing methods: Named Entity Recognition, Normalization, Deep learning, Machine learning, Clustering, Text Generation Methods, Sentence Compression
- Experience with Keras, PyTorch, Mallet, Weka, spaCy, scikit-learn, Matlab
- Speech Analysis methods: OpenSmile, Praat
- Programming languages: Python, R, SQL, XML/CSS, Matlab
- Amazon AWS Services: General and Medical Transcribe, Amazon Medical Comprehend, Sage Maker
- Medical Controlled Terminologies: SNOMED-CT, RX-NORM, MEDRA, ICD-10, DSM, NANDA, NIC, NOC, ICF

PUBLICATIONS

**** Senior author***

Peer-Reviewed Journals

1. Azadmaleki, H., Haghbin, Y., Rashidi, S., Momeni Nezhad, M. J**., Zolnoori, M.*** (2025). SpeechCARE: Dynamic multimodal modeling for cognitive screening in diverse linguistic and speech task contexts*. Nature Digital Medicine.*
2. Zhang, Z., Nezhad, M. J. M., Gupta, P., Zolnour, A., Azadmaleki, H., Topaz, M., & **Zolnoori, M.*** (2025). Enhancing AI for citation screening in literature reviews: Improving accuracy with ensemble models. *International Journal of Medical Informatics*, 106035.
3. Zhang, Z., Gupta, P., Song, J., **Zolnoori, M.,** & Topaz, M. (2025). From Conversation to Standardized Terminology: An LLM-RAG Approach for Automated Health Problem Identification in Home Healthcare. *Journal of Nursing Scholarship.*
4. **Zolnoori, M.**, Zolnour, A., Vergez, S., Sridharan, S., Spens, I., Topaz, M., Noble, J. M., Bakken, S., Hirschberg, J., Bowles, K. H. & McDonald, M. V. (2025). Beyond EHR data: Leveraging natural language processing and machine learning to uncover cognitive insights from patient-nurse verbal communications. *Journal of the American Medical Informatics Association.*
5. **Zolnoori, M.,** Xu, Z., Vergez, S., Esmaeili, E., Scroggins, J. K., Briggs, K. A., Hosseini ebrahimabad, S. F., Zolnour, A., Noble, J. M., Bakken & S. Sridevi, & McDonald, M. V. (2025). Decoding disparities: Evaluating ASR system performance in transcribing Black and White patient verbal communication with nurses in home healthcare. *JAMIA Open.*
6. Scroggins, J. K., Topaz, M., Song, J., & **Zolnoori, M***. (2024). Does synthetic data augmentation improve the performance of machine learning classifiers for identifying health problems in patient-nurse verbal communications in home healthcare settings? *Journal of Nursing Scholarship*
7. **Zolnoori, M.,** Sridharan, S., Zolnour, A., Vergez, S., McDonald, M. V., Kostic, Z., ... & Topaz, M. (2024). Utilizing patient-nurse verbal communication in building risk identification models: the missing critical data stream in home healthcare. *Journal of the American Medical Informatics Association*, *31*(2), 435-444
8. Barrón, Y., Ryvicker, M., Song, J., **Zolnoori, M**., & Topaz, M. (2023). Identifying new ADRD diagnoses in home health care patients using natural language processing of nurses' notes. *Innovation in Aging,* 7(Suppl 1), 1060.
9. Ryvicker, M., Barrón, Y., Song, J., **Zolnoori, M.,** Shah, S., Burgdorf, J. G., ... & Topaz, M. (2024). Using Natural Language Processing to Identify Home Health Care Patients at Risk for Diagnosis of Alzheimer's Disease and Related Dementias. *Journal of Applied Gerontology*, 07334648241242321.
10. **Zolnoori, M.,** Williams, M. D., Angstman, K. B., Wi, C. I., Leasure, W. B., Patel, S., & Ngufor, C. (2024). Emergency department risk model: timely identification of patients for outpatient care coordination. *The American Journal of Managed Care*, 30(5), e147-e156.
11. Aguree, S., **Zolnoori, M.,** Atwood, T. P., & Owora, A. (2023). Association between choline supplementation and Alzheimer's disease risk: a systematic review protocol. *Frontiers in Aging Neuroscience.*
12. Zolnour, A., Eldredge, C. E., Faiola, A., Khani, M., Yaghoobzadeh, Y., Foy, D., ... & **Zolnoori, M.*** A Risk Identification Model for Detection of Patients at Risk of Antidepressant Discontinuation. *Frontiers in Artificial Intelligence*, 6, 1229609.
13. **Zolnoori, M.**, Barrón, Y., Song, J., Noble, J., Burgdorf, J., Ryvicker, M., & Topaz, M. (2023). HomeADScreen: Developing Alzheimer's disease and related dementia risk identification model in home healthcare. *International Journal of Medical Informatics*, 177, 105146.

14. **Zolnoori, M.,** Vergez, S., Sridharan, S., Zolnour, A., Bowles, K., Kostic, Z., & Topaz, M. (2023). Is the patient speaking or the nurse? Automatic speaker type identification in patient–nurse audio recordings. *Journal of the American Medical Informatics Association*, ocad139.

15. **Zolnoori, M.,** Zolnour, A., & Topaz, M. (2023). ADscreen: A speech processing-based screening system for automatic identification of patients with Alzheimer's disease and related dementia. *Artificial Intelligence in Medicine*, 102624.

16. Omranian, S., **Zolnoori, M.**, Huang, M., Mcroy, S., Predicting Patient Satisfaction with Medications for Treating Opioid Use Disorder: A Case Study Using Automated Analysis of Reviews of Methadone and Buprenorphine/Naloxone from Health-related Social Media, *JMIR Infodemiology* [ACCEPTED, December 2022]

17. Topaz, M., **Zolnoori, M.,** Norful, A. A., Perrier, A., Kostic, Z., & George, M. (2022). Speech recognition can help evaluate shared decision making and predict medication adherence in primary care setting. *Plos one*, 17(8), e0271884.

18. Topaz, M., Barrón, Y., Song, J., Onorato, N., Sockolow, P., **Zolnoori, M.**, ... & McDonald, M. V. (2022). Risk of Rehospitalization or Emergency Department Visit is Significantly Higher for Patients who Receive Their First Home Health Care Nursing Visit Later than 2 Days After Hospital Discharge. *Journal of the American Medical Directors Association*, 23(10), 1642-1647.

19. **Zolnoori, M.,** Vergez, S., Kostic, Z., Jonnalagadda, S. R., McDonald, M. V., Bowles, K. K., & Topaz, M. (2022). Audio Recording Patient-Nurse Verbal Communications in Home Health Care Settings: Pilot Feasibility and Usability Study. *JMIR Human Factors*, 9(2), e35325.

20. **Song, J., Zolnoori, M.,** Scharp, D., Vergez, S., McDonald, M.V., Sridharan, S., Kostic, Z., & Topaz, M. (2022) Do nurses document all discussions of patient problems and nursing interventions in the electronic health record? A pilot study in home healthcare, *JAMIA Open*, 5(2), ooac034 **(first co-author)**

21. Alarifi, M., Jabour, A., Foy, D. M., & **Zolnoori, M*.** (2022). Identifying the Underlying Factors Associated with Antidepressant Drug Discontinuation: Content Analysis of Patients' Drug Reviews. *Informatics for Health and Social Care*, 1-10.

22. **Zolnoori, M.,** Song, J., McDonald, M. V., Barrón, Y., Cato, K., Sockolow, P., ... & Topaz, M. (2021). Exploring Reasons for Delayed Start-of-Care Nursing Visits in Home Health Care: Algorithm Development and Data Science Study. *JMIR nursing*, *4*(4), e31038.

23. Song, J., **Zolnoori, M**., McDonald, M.V., Barron, Y., Cato, K., Sockolow, P., Sridharan, S., Onorato, N., Bowles, K. H., & Topaz, M. (2021). Factors Associated with Timing of the Start-of-care Nursing Visits in Home Health Care. *Journal of the American Medical Directors Association.* DOI: 10.1016/j.jamda.2021.03.005

24. Topaz, M., Woo, K., Ryvicker, M., **Zolnoori, M.**, & Cato, K. (2020). Home Healthcare Clinical Notes Predict Patient Hospitalization and Emergency Department Visits. *Nursing Research*, 69(6), 448-454. DOI: 10.1097/NNR.0000000000000470

25. **Zolnoori, M**., McDonald, M., Cato, K., Sockolow, P., Onorato, N., Barron-Vaya, Y., Bowles, K., Topaz, M. (2020). Improving Patient Prioritization During Hospital-homecare Transition: A Protocol of a Mixed-methods Study of a Clinical Decision Support Tool Implementation. *Journal of JMIR Research Protocols,*10(1):e20184, DOI:10.2196/20184

26. **Zolnoori M.,** Williams, MD, Leasure W.B., Angstman KB, Ngufor C. (2020). A systematic Framework for Analyzing Observation Data in Patient-centered Registries: A Case Study for Patients with Depression. *Journal of JMIR Research Protocols, 9(10)*:e18366, DOI:10.2196/18366

27. ***Zolnoori* M**., Patten C., Balls-Berry J.E., Brockman T. A., Huang, M., Yao L. (2019). Mining News Media for Understanding Public Health Concerns*. Journal of Clinical and Translational Science, 5(1)*. DOI: 10.1017/cts.2019.434

28. **Zolnoori M**., Patten C., Balls-Berry J.E., Brockman T. A., Huang, M., Yao L. A. (2019). A Systematic Framework for Analyzing Patient-generated Narrative Data: Protocol for a Content Analysis. *Journal of JMIR Research Protocols, 8 (8)*, e13914. DOI: 10.2196/13914

29. **Zolnoori M**., Fung, K., Patrick, T., Fontelo, P., Kharrazi, H., Faiola, A., et al. (2019). A Systematic Approach for Developing a Corpus of Patient Reported Adverse Drug events: A case Study for SSRI and SNRI Medications, *Journal of Biomedical Informatics*. 90, 103091. DOI: 10.1016/j.jbi.2018.12.005

30. **Zolnoori M**., Fung, K. W., Patrick, T. B., Fontelo, P., Kharrazi, H., Faiola, A., Wu, Y., Hamideh, M. (2019). The PsyTAR dataset: From Social Media Posts to a Corpus of Adverse Drug Events and Effectiveness of Psychiatric Medications*. Journal of Data in Brief*. 103838. DOI: 10.1016/j.dib.2019.103838

31. Huang, M., **Zolnoori M**., Patten C., Balls-Berry J.E., Brockman T. A., Yao L. (2018). Technological Innovations in Disease Management: Text Mining US Patent Data from 1995 to 2017. *Journal of medical Internet research, 21(4),* e13316. DOI: 10.2196/13316

32. **Zolnoori M**., Fung, K. W., Fontelo, P., Kharrazi, H., Faiola, A., Wu, Y. S. S., Patrick, T. (2018). Identifying the underlying Factors Associated with Patients' Attitudes Toward Antidepressants: Qualitative and Quantitative Analysis of Patient Drug Reviews. *JMIR mental health*, 5(4), e10726. DOI: 10.2196/10726

33. Huang, M., ElTayeby, O., **Zolnoori M**., & Yao, L. (2018). Public Opinions Toward Diseases: Infodemiological Study on News Media Data. *Journal of medical Internet research*, 20(5). DOI: 10.2196/10047

34. **Zolnoori, M.** (2017). Utilizing Consumer Health Posts for Pharmacovigilance: Identifying Underlying Factors Associated with Patients' Attitudes Towards Antidepressants (Doctoral dissertation, The University of Wisconsin-Milwaukee).

35. Alizadeh, B., Safdari, R., **Zolnoori M.**, & Bashiri, A. (2015). Developing an Intelligent System for Diagnosis of Asthma Based on Artificial Neural Network. *Acta Informatica Medica*, *23*(4), 220. DOI: 10.5455/aim.2015.23.220-223

36. Samad Soltani, T., Langarizadeh, M., & **Zolnoori M.** (2015). Data Mining and Analysis: Reporting Results For Patients With Asthma. *Payavard Salamat*, *9*(3), 224-234.

37. Darabi, S. A., Teimourpour, B., & **Zolnoori M.** (2014). Case-Based-Reasoning System for Feature Selection and Diagnosing Disease; Case Study: Asthma. *Innovative Systems Design and Engineering*, *5*(5), 43-59. DOI: 10.4018/978-1-5225-2515-8.ch019

38. **Zolnoori M.**, Jones, J. F., Moin, M., Heidarnejad, H., Fazlollahi, M. R., & Hosseini, M. (2013). Evaluation of user interface of computer application developed for screening pediatric asthma. In *Universal Access in Human-Computer Interaction. Applications and Services for Quality of Life* (pp. 563-570). Springer Berlin Heidelberg.

39. Taha Samad Soltani Heirs, M., Mahmoodvand, Z., & **Zolnoori, M.** (2013). Intelligent Diagnosis of Asthma Using Machine Learning Algorithms. *International Research Journal of Applied and Basic Sciences*. 4, 4041-6.

40. **Zolnoori M.,** Zarandi, M. H. F., Moin, M., Heidarnezhad, H., & Kazemnejad, A. (2012). Computer-aided intelligent system for diagnosing pediatric asthma. *Journal of medical systems*, *36*(2), 809-822. DOI: 10.1007/s10916-010-9545-5

41. **Zolnoori M.,** Fazel Zarandi M.H., Moin M. (2012). Fuzzy Rule-Based Expert System for Evaluating Level of Asthma Control, *Journal of Medical Systems*, 36(5), 2947-2958, DOI: 10.1007/s10916-011-9773-3,

42. **Zolnoori M.,** Fazel Zarandi M. H., Moin M. (2012). Application of Intelligent Systems in Asthma Disease: Designing a Fuzzy Rule-Based System for Evaluation Level of Asthma Exacerbation, *Journal of Medical Systems*, 36(4), 2071-2083. DOI: 10.1007/s10916-011-9671-8

43. **Zolnoori M.,** Fazel Zarandi M.H., Moin M., Teimorian S. (2012). Fuzzy Rule-Based Expert System for Assessment Severity of Asthma, *Journal of Medical Systems*, 36(3), 1707-1717, DOI: 10.1007/s10916-010-9631

44. **Zolnoori M.**, Fazel Zarandi M.H., Moin M. (2011). Fuzzy Rule-Based Expert System for Evaluation Possibility of Fatal Asthma, *Journal of Health Informatics in Developing Countries*, 5(1), 171-184, DOI: 10.19082/5974
45. Fazel Zarandi M.H., **Zolnoori M.,** Moin M., Heidarnejad H. (2010). Fyzzy Expert System for Diagnosing Asthma, *Journal of Scientia Iranica: Transaction E: Industrial Engineering*, 17 (2), 129-142, https://irjabs.com/files_site/paperlist/r_1412_130914153732.pdf
46. **Zolnoori, M.,** Zarandi, M. H. F., Moin, M., & Teimorian, S. (2007). Designing fuzzy expert system for Diagnosing and Evaluating Childhood Asthma, *Department of Information Technology Management, Tarbiat Modares University. Master of Science in Information Technology Management*, *199*.

Manuscripts currently under review

1. **Zolnoori, M.,** Esmaeili, E., Morovati, T., Noble, J., Azad Maleki, H., Zolnour, A. (under review – minor revision requested) SpeechDetect: An Explainable Automated Acoustic Processing Framework for Early Detection of Cognitive Impairment. " *Journal of Health Information Science and Systems*
2. **Zolnoori, M.,** Zolnour, A., Rashidi, S., Spens, I., Haghbin, Y., Azad Maleki, H., Vergez, S., Flaherty, G., Onorato, N., Vasquez, F., Noble, J. M., & McDonald, M. (under review – minor revision requested). Detecting mild cognitive impairment using follow-up call speech and EHR data in home healthcare settings. *Journal of Gerontological Nursing: Technology Innovations section.*
3. **Zolnoori, M.** (under review – minor revision requested), Developing a Multimodal Screening Algorithm for Mild Cognitive Impairment and Early Dementia in Home Healthcare: Protocol for a Cross-Sectional Case–Control Study Using Speech Analysis, Large Language Models, and Electronic Health Records, Journal of *JMIR Research Protocol*
4. Zolnour, A., Azadmaleki, H., Haghbin, Y., Rashidi, S. **Zolnoori, M**.* (under review – revision requested). LLMCARE: Alzheimer's Detection via Transformer Models Enhanced by LLM-Generated Synthetic Data. arXiv preprint arXiv:2508.10027. *Journal of Frontiers in Artificial Intelligence*
5. AzadMaleki, H., Zolnour, A., Esmaeili, E., **Zolnoori, M.*** (under-review – revision requested) TransformerCARE: A Novel Speech Analysis Pipeline Using Transformer-Based Models and Audio Augmentation Techniques for Cognitive Impairment Detection. *International Journal of Medical Informatics*
6. Spens, I., Zhang, Z., Azad Maleki, H., Vergez, S., Flaherty, G., Onorato, N., Noble, J.M., McDonald, M., **Zolnoori, M.*** (under review). Capturing Cognitive Clues Through Speech: Feasibility and Acceptability of Audio-Recorded Assessments in Black Home Healthcare Patients. *Journal of Nursing Research*
7. Zhang, Z., Momeni Nezhad, M. J., Hosseini, S. M. B., Zolnour, A., Zonour, Z., Hosseini, S. M., Topaz, M., & **Zolnoori, M.*** (under-review) Advancing healthcare with large language models: A scoping review of applications and future directions. *International Journal of Medical Informatics*
8. Taherinezhad, F., Nezhad, M. J. M., Karimi, S., Rashidi, S., **Zolnoori, M.*** (under review). Speech-Based Cognitive Screening: A Systematic Evaluation of LLM Adaptation Strategies. arXiv preprint arXiv:2509.03525. *Journal of JMIR artificial Intelligence*
9. Rashidi, S., Zonour, A., Azad Maleki, H., **Zonori, M.*** (under review) Augmenting Speech Data to Improve Cognitive Impairment Detection: Comparative Analysis of Methods. *2025 IEEE International Conference on Acoustics, Speech, and Signal Processing*
10. Haghbin, Y., Rashidi, S., **Zolnoori, M.*,** (under review) Attention-Driven Multimodal Modeling of Speech and EHR for Cognitive Impairment Screening in Home Healthcare. *2025 IEEE International Conference on Acoustics, Speech, and Signal Processing*

Manuscripts under development

1. Zhang, Z., Haghbin, Y., Zolnour, A., Ho, W., Chen, Y.-W., Rashidi, S., Nadi, F., Vergez, S., Flaherty, G., Spens, I., Vasquez, F., Gupta, P., McDonald, M., Kostic, Z., Hirschberg, J. B., Topaz, M., & **Zolnoori, M.***

Speech-enhanced multimodal prediction of hospitalization and ED visits in home healthcare. Manuscript in preparation. This manuscript is in the final stage of preparation for revision.

2. **Zolnoori, M.** Azad Maleki, H., Rashidi, Sina., Esmaeili, E.(under-review) SpeechCARE Explainability Framework: Interpretable Multimodal Detection of Cognitive Impairment with Insights from the NIA Alzheimer's Challenge

3. Taherinezhad, F., Nezhad, M. J. M., **Zolnoori, M.*** Continual Learning After Deployment in Clinical Setting: Using Human Feedback to Strengthen Speech-based Clinical Decision Support for Mild Cognitive Impairment

4. Haghbin, Y., Rashidi, S., **Zolnoori, M.*,** Mitigating Demographic Bias in Speech-Based Cognitive Screening: A Three-Stage Framework with Augmentation, Adversarial Learning, and Calibration

5. Haghbin, Y., Rashidi, S., **Zolnoori, M.*,** SpeechCARE-MTL: A Multi-Task Learning Framework Leveraging Related Speech Disorders for Alzheimer's and Dementia Screening

Peer-Reviewed Conference/Workshop: Full Paper

1. Chen, Y.-W., Ho, W., Vergez, S. M., Flaherty, G., Gupta, P., Zhang, Z., **Zolnoori, M.,** McDonald, M. V., Topaz, M., Kostić, Z., & Hirschberg, J. (2025). Hearing health in home healthcare: Leveraging LLMs for illness scoring and ALMs for vocal biomarker extraction. Proceedings of the Second Workshop on GenAI for Health: Potential, Trust, and Policy Compliance (NeurIPS 2025). [Paper Presentation].
2. Hosseini, S.M.B., Momeni Nezhad, M. J., Karimi, S., & **Zolnoori, M.*** (2025). Employing Language Models for Patient Self-Report Analysis: Extracting Expressions of Adverse Drug Reactions to Antidepressants. Accepted for presentation at the MedInfo 2025 Conference, August 2025, Taipei, Taiwan.
3. Topaz, M., **Zolnoori, M.**, Xu, Z., & Song, J. (2024). Voices Unheard: Exploring New Data Sources in Nursing Through Speech Processing. In Proceedings of the 16th International Congress in Nursing Informatics, NI2024 (pp. x-xx). Manchester, UK. [Paper Presentation].
4. Song, J., **Zolnoori, M.,** Scharp, D., Vergez, S., McDonald, M.V., Sridharan, S., Kostic, Z., & Topaz, M. (2020) Is Auto-generated Transcript of Patient-Nurse Communication Ready to Use for Identifying the Risk for Hospitalization or Emergency Department Visits in Home Health Care? A Natural Language Processing Pilot Study, *American Medical Informatics Association,* Washington DC. [paper presentation]
5. Hobensack, M., Song, J., Chae, S., Kennedy, E., **Zolnoori, M.,** Bowles, K.H., McDonald, M.V., Evans, L., Topaz, M. (2022). Capturing Concerns about Patient Deterioration in Narrative Documentation in Home Healthcare. *American Medical Informatics Association*. [paper presentation]
6. Huang, M., **Zolnoori M**., Patten C., Balls-Berry J.E., Brockman T. A., Yao L. (2018). Temporal sequence alignment in electronic health records for computable patient representation, *International Conference on Bioinformatics and Biomedicine,* Madrid. [Article presentation].
7. **Zolnoori M.**, Patrick, T. B., Fung, KW., Fontelo P., Faiola, A., Wu YS. S., Xu, K., Zhu, J., Eldredge, C. E. (2017). Development of an Adverse Drug Reaction Corpus from Consumer Health Posts. *American Medical Informatics Association, Annual Symposium*, Washington, DC. [Article presentation].
8. Elahi.G., Shahrivari S., **Zolnoori M.** (2011). Comparison the results of linear (Discriminative Analysis, and Logistic Regression) and nonlinear (SVM, Neural Network, and Decision Tree) Techniques in evaluating credit of Banks' Customer (in Persian). *5th National Conference on Data Mining*, Tehran, Iran. [Article presentation].
9. **Zolnoori M.**, Shahrivari S., Faliat V. (2011). Strategic Planning: A Framework for Internal Analysis, *this paper presented at 5th International Conference on Strategic Management,* Tehran, Iran. [Article presentation]. http://www.civilica.com/EnPaper-ICSM05-ICSM05_116.html
10. **Zolnoori M.**, Fazel Zarandi M.H., Moein M. (2010). Intelligent Systems in Medicine: Designing a Fuzzy Expert System for Evaluation Severity of Asthma Exacerbation (in Persian), *6th International Conference on*

information and communication technology, Tehran, Iran. [Article presentation]. http://www.civilica.com/Paper-ICTM06-ICTM06_030.html

11. **Zolnoori M**., Fazel Zarandi M.H., Moein M., Teimorian S. (2010). Intelligent Systems in Medicine: Designing a Fuzzy Expert System for Evaluation Severity of Asthma Exacerbation*. 17th International Conference on Medical Engineering,* Tehran, Iran. [Article presentation]. http://www.civilica.com/Paper-ICTM06-ICTM06_030.html
12. **Zolnoori M**., Fazel Zarandi M.H., Moein M. (2010). Designing an Expert System for Evaluating Possibility of Fatal Asthma, *presented at 10th Iranian Conference on Fuzzy Systems*, Tehran, Iran. [Article presentation]. http://ifs10.sbu.ac.ir/Files/Proceeding.pdf
13. Faaliate V., **Zolnoori M**. (2010). Is It Possible to Create Software Clusters in Iran? (in Persian)*, 6th International Conference on Information Technology Management*, Tehran, Iran. [Article presentation]. http://www.civilica.com/Paper-ICTM06-ICTM06_052.html
14. Bohrani A., **Zolnoori M**. (2010). A systematic approach for designing national portal (in Persian), *6th International Conference on Information Technology Management*, Tehran, Iran. [Article presentation]. http://www.civilica.com/Paper-ICTM06-ICTM06_004.html

Peer-Reviewed Conference/Workshop: Podium Presentations and posters

15. Dinh, H., Zhang, Z., **Zolnoori, M.,** & Masterson Creber, R. (2025, August). Identifying financial insecurity in patients with heart failure using natural language processing [Conference presentation]. Graduate Nursing Student Academy (GNSA) Conference, American Association of Colleges of Nursing, Washington, DC.
16. Yu, D., Vergez, S. M., Flaherty, G. K., **Zolnoori, M.,** Onorato, N., Hirschberg, J., Topaz, M., & McDonald, M. (2025, November). Evaluating the accuracy of automatic speech recognition systems in home healthcare settings [Poster accepted for presentation]. Gerontological Society of America 2025 Annual Scientific Meeting, Boston, MA.
17. Xu, Z., Vergez, S., Esmaeili, E., Zolnour, A., Briggs, K. A., Kim Scroggins, J., Hosseini Ebrahimabad, S. F., Noble, J. M., Topaz, M., Bakken, S., Bowles, K. H., Spens, I., Onorato, N., Sridharan, S., McDonald, M. V., **& Zolnoori, M.*** (2025, August). Voice for all: Evaluating the accuracy and equity of automatic speech recognition systems in transcribing patient communications in home healthcare. *MedInfo 2025*, Taipei. [Poster presentation]
18. Zhang, Z., Momeni Nezhad, M. J., Gupta, P., Topaz, M., & **Zolnoori, M.*** (2025, August). Performance of LLMs in citation screening: A comparison across datasets with varied inclusion rates. *MedInfo 2025*, Taipei. [Poster presentation]
19. Zhang, Z., Momeni Nezhad, M. J., Hosseini, S. M. B., Zolnour, A., Zonour, Z., Hosseini, S. M., Topaz, M., & **Zolnoori, M.*** (2025, August). A scoping review of large language model applications in healthcare. *MedInfo 2025*, Taipei. [Poster presentation]
20. Rashidi, S., Azadmaleki, H., Zolnour, A., Momeni Nezhad, M. J., & **Zolnoori, M.*** (2025, August 9–13). SpeechCura: A novel speech augmentation framework to tackle data scarcity in healthcare. *MedInfo 2025*, Taipei. [Poster presentation]
21. Azadmaleki, H., Haghbin, Y., Rashidi, S., Momeni Nezhad, M. J., Naserian, M., Esmaeili, E., Zolnour, A., & **Zolnoori, M.*** (2025, August). SpeechCARE: Harnessing multimodal innovation to transform cognitive impairment detection – Insights from the National Institute on Aging Alzheimer's Speech Challenge. *MedInfo 2025*, Taipei. [Poster presentation]
22. **Zolnoori, M.,** Zolnour, A., Vergez, S., Sridharan, S., Spens, I., Topaz, M., Noble, J. M., Bakken, S., Hirschberg, J., Bowles, K. H., Onorato, N., & McDonald, M. V. (2025, August). Unlocking clues to cognitive impairment: Insights from patient-nurse verbal communications. *MedInfo 2025*, Taipei. [Poster presentation]

23. **Zolnoori, M.,** Topaz, M. (2022). Development of a Diagnostic Algorithm for Early Identification of Patients with Alzheimer's Disease and Related Dementias, *American Medical Informatics Association,* Washington DC. [Podium presentation].

24. Song, J., **Zolnoori, M.,** Scharp, D., Vergez, S., McDonald, M.V., Sridharan, S., Kostic, Z., & Topaz, M. (2022). To what extent are verbal conversations between patients and nurses in home healthcare documented in the electronic health record? *AMIA Clinical Informatics Conference*, Houston, TX [Podium presentation].

25. Zolnour, A., Eldredge, C., Yaghoobzadeh, Y., Topaz, M., Faiola, A., Fontelo, P., **Zolnoori, M.*** (2022). Developing a Risk Identification Algorithm for Identifying Patients at Risk of Medication Non-adherence in Patients with Depression, *AMIA Informatics Summit*, Chicago, IL. [Podium presentation]

26. **Zolnoori, M.,** Vergez, S., Zolnour, A., Kostic, Z., Topaz, M., IL. (2022) Creating Classifiers to Distinguish Between Speaker Types in Recorded Nurse-patient Verbal Communication in Home Healthcare: A Feasibility Study, *AMIA Informatics Summit,* Chicago, IL. [Podium presentation]

27. **Zolnoori, M.,** Vergez S., Kostic Z., Reddy S. & Topaz, M. (2021). Feasibility study of audio recording patient-clinician verbal communications in home healthcare settings. *American Medical Informatics Association, Annual Symposium,* San Diego, CA. [Poster presentation].

28. Hobensack, M., Song, J., **Zolnoori, M.,** Ojo, M., Bowles, K.H., Chae, S., Kennedy., McDonald, M.V., & Topaz, M. (2021). Identifying Narrative Documentation of Clinician Concern about Patient Deterioration in Home Healthcare: A Text Mining Study, *American Medical Informatics Association, Annual Symposium*, San Diego, CA. [Poster presentation].

29. Topaz, M. Woo, K., Ryvicker, **M., Zolnoori**, M., Cato, K. (2020). Predicting Patient Hospitalization and Emergency Department Visits Using Clinical Notes: A Data Science Study in Home Healthcare. *Annual International Conference on Home Healthcare, Hospice, and Information Technology (H3IT) conference, Virtual.* [Poster presentation].

30. **Zolnoori, M**., McDonald, M., Cato, K., Sockolow, P., Onorato, N., Barrón, Y., Sridharan, S., Bowles, K., Topaz, M. (2020). Using Data Science to Explore Reasons for Late Start of Care Nursing Visit in Home Healthcare. *Annual International Conference on Home Healthcare, Hospice, and Information Technology (H3IT) conference*, Virtual. [Podium presentation].

31. **Zolnoori M**., Sohn S., Faiola A., Balls-Berry J.E., Tafti A., Huang M., Eldredge C.E., Luo J., Patrick T.B. (2019). Identifying Factors Affecting Drug Discontinuation in Patients with Depression: Text Analysis of Patient Drug Review Posts. American Medical Informatics Association, Annual Symposium, Washington DC. [Podium presentation].

32. **Zolnoori, M.**, Fung, K., Patrick, T., Fontelo, P., Kharrazi, H., Faiola, A. (2018). The role of online healthcare communities in identifying risk factors associated with patients' negative attitudes toward antidepressants and medication non-adherence, *American Medical Informatics Association, Annual Symposium, San Francisco*, CA. [Podium presentation].

33. Patrick, T. **Zolnoori**, **M**. (2016). Depression Drug Side Effect Beyond Clinical Conditions". *American Public Health Association,* Denver. [Poster presentation].

34. **Zolnoori, M**. Patrick, T. Conway, M. Faiola A., Lue, J. (2016). Evaluating Acceptability and Efficacy of Antidepressant Medications using Patients Comments, *American Medical Informatics Association*, Chicago. [Poster presentation].

35. **Zolnoori, M**. Nambisan, P., Patrick, T. (2015). Seeking support on Facebook, Content Analysis of Depression Group*. American Medical Informatics Association*, San Francisco. [Poster presentation].

36. Jones, J., **Zolnoori, M**., Binkheder, S., Schilling, K., Lenox, M., Pondugala, L.R. (2015). The Extent to which U.S. Hospitals Promote Their Patient Engagement Activities and Outcomes: Preliminary Results of Quantitative Content Analysis Research. *American Medical Informatics Association*, Washington DC. [Poster presentation].

37. **Zolnoori, M**., Schilling, K., Jones, J. (2014). Patient-Centered Decision Support for Pediatric Asthma's Signs and Symptoms: Development of a Web-Based User Interface for Parents. *American Medical Informatics Association*, Washington DC. [Poster presentation].

38. Jones, J., Boston-Clay C., Kilaru A., **Zolnoori M**., Malika M. Building a Portal to Health Resources for Cancer Survivors**.** (2013)**.** *American Medical Informatics Association*, Washington DC. [Poster presentation].

IN NEWS

- Would You Want to Know if Alzheimer's Were in Your Future? Columbia Magazine: https://magazine.columbia.edu/article/would-you-want-know-if-alzheimers-were-your-future
- Dementia-Detecting AI Tool Wins National Institute on Aging Prizes, Columbia University Irving Medical Center, April 2025. https://www.nursing.columbia.edu/news/dementia-detecting-ai-tool-wins-national-institute-aging-prizes
- Advancing equitable AI-driven multimodal cognitive impairment detection in underserved populations. PennAITech Newsletter - December 2024
- A speech processing-based screening system for automatic identification of patients with Alzheimer's disease and related dementia. Medical Device News Magazine: https://infomeddnews.com/tcolumbia-nursing-news-11124/
- Detecting Early-Stage Dementia Through Speech, Penn Memory Center https://pennmemorycenter.org/detecting-early-stage-dementia-through-speech/
- Can AI Detect Earliest Stages of Dementia in Our Speech? Miragenews: https://www.miragenews.com/can-ai-detect-earliest-stages-of-dementia-in-992516/
- AI screening tool for dementia being developed by Columbia researcher, McKnight's Senior Living https://www.mcknightsseniorliving.com/home/news/tech-daily-news/ai-screening-tool-for-dementia-being-developed-by-columbia-researcher/
- The Island News, Speech and voice cues may signal earliest stages of dementia: https://yourislandnews.com/speech-and-voice-cues-may-signal-earliest-stages-of-dementia/
- DailyNurse: Columbia Nursing Study Demonstrates the Need for Verbal Communication Data in Home Health Care, https://dailynurse.com/columbia-nursing-study-demonstrates-the-need-for-verbal-communication-data-in-home-health-care/

SELECTED PRESENTATION

Invited Talks

1. **Columbia University Aging Center:** SpeechCARE: Advancing Early Detection of Cognitive Impairment through Multimodal Speech Processing Algorithms (scheduled for January 2026)
2. **CUIMC Medical Summit March 2025: Keynote speaker** at the CUIMC Medical Summit, co-organized with Weill Cornell Medicine, Icahn School of Medicine at Mount Sinai, and NYU Langone Health. Presented ADscreen: A speech processing-based screening system for automatic identification of patients with Alzheimer's disease and related dementia**.**
3. **Reach for Research Excellence (REX) Seminar Series April 23, 2025:** Presented at Columbia University School of Nursing on SpeechCARE: Advancing Early Detection of Cognitive Impairment through Multimodal Speech Processing Algorithms**.**
4. **DBMI Seminar Series April 14, 2025:** Presented research on SpeechCARE: Advancing Early Detection of Cognitive Impairment through Multimodal Speech Processing Algorithms
5. **Neurology Grand Rounds April 2025:** Invited to speak at the Neurological Institute of New York, Columbia University Irving Medical Center. Presentation titled Beyond electronic health record data: leveraging natural language processing and machine learning to uncover cognitive insights from patient-nurse verbal communications**.**

5. **JAMIA Journal Club January 2025**: Presented on Beyond electronic health record data: leveraging natural language processing and machine learning to uncover cognitive insights from patient-nurse verbal communications
6. **RCMAR Annual Meeting 2025**: Invited to present research on speech processing pipelines for cognitive impairment detection at the RCMAR National Coordinating Center's Annual Meeting, April 22–24, 2025, Crystal City Marriott, Arlington, Virginia.
7. **VNS Health Fall 2024**: Presented research on using speech and language analysis to identify cognitive impairment.
8. **Eastern Nursing Research Society (ENRS) April 2024**: Discussed opportunities, challenges, and case studies in harnessing generative AI in nursing education and research.
9. **JAMIA Journal Club February 2024**: Presented on utilizing patient-nurse verbal communication to build risk identification models in home healthcare.
10. **13th Annual NYP Nursing Research, Evidence-Based Practice & Innovation Symposium November 2023**: Highlighted innovations in nursing education and practice.
11. **Learning Healthcare System Symposium December 2022:** Presented research on using speech and language to identify home healthcare patients at risk of emergency department visits and hospitalization.
12. **Academic Medical Centers–Amazon Spring 2022:** Shared advancements in AI-based speech processing systems for timely identification of at-risk home healthcare patients.
13. **Department of Psychology and Psychiatry, Mayo Clinic Spring 2022:** Presented on ADscreen, a multimodal speech-processing-based screening system for Alzheimer's disease and related dementias.
14. **Columbia University School of Nursing Summer 2021:** Discussed the importance of patients' spoken language in identifying pathological entities and negative outcomes.
15. **Columbia Center of AI Technology Summer 2021 and 2022**: Showcased the development of a multimodal risk identification algorithm using audio-recorded patient-nurse communication and EHR data.
16. **Department of Electrical Engineering, Columbia University Spring 2021**: Presented on developing risk identification algorithms using audio-recorded patient-nurse communications.
17. **REX Seminar Fall 2020:** Discussed the feasibility of audio-recording patient-nurse verbal communications in home healthcare.
18. **H3IT Conference September 2020**: Presented findings on using data science to explore reasons for late nursing visits in home healthcare.
19. **Department of Psychology and Psychiatry, Mayo Clinic Summer 2020:** Addressed data quality issues in patient-centered registries for care coordination interventions for depression.
20. **Department of Psychology and Psychiatry, Mayo Clinic Summer 2019:** Shared applications of machine learning algorithms in predicting negative outcomes in patients with mental disorders.
21. **FDA Centers of Excellence in Regulatory Science and Innovation (CERSIs) Spring 2019:** Discussed the use of patient-generated data to identify factors associated with antidepressant non-adherence.
22. **AMIA Annual Symposium November 2018:** Highlighted the role of online healthcare communities in identifying risk factors for negative attitudes toward antidepressants.
23. **Artificial Intelligence Workshop, Mayo Clinic Fall 2018:** Presented the PsyTar Corpus, a benchmark for text mining adverse drug reactions and psychiatric medication effectiveness.

24. **SUNY Downstate Health Sciences University Spring 2018:** Discussed applications of AI in predicting negative healthcare outcomes.
25. **Department of Artificial Intelligence and Informatics, Mayo Clinic Spring 2018:** Analyzed patient narratives to identify contributors to healthcare deterioration and negative outcomes.
26. **University of Wisconsin-Milwaukee Spring 2017:** Shared pathways to successful research projects and lessons from collaboration with the National Library of Medicine.
27. **Lister Hill National Center for Biomedical Communications, NIH Summer 2016**: Presented on utilizing text mining to extract adverse drug reactions from online patient messages.
28. **Research Day, University of Wisconsin-Milwaukee Fall 2015:** Highlighted AI methods for improving healthcare outcomes in patients with asthma.
29. **Immunology & Asthma & Allergy Research Institute Summer 2012:** Discussed a clinical decision support system for improving pediatric asthma outcomes.
30. **National Conference on Data Mining Winter 2011:** Compared linear and non-linear machine learning algorithms for evaluating bank customer credit.
31. **Academic Center for Education, Culture, and Research (ACECR):** Presented on fuzzy expert systems for early diagnosis of asthma.
32. **International Conference on Strategic Management Spring 2011:** Presented on strategic planning frameworks for internal analysis.
33. **International Conference on Information and Communication Technology Spring 2010:** Discussed the design of a fuzzy expert system for evaluating asthma severity.
34. **International Conference on Information Technology Management Spring 2010:** Presented on feasibility studies for software clusters in Iran.