

## Yanshan Wang, PhD, FAMIA

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CONTACT INFORMATION	Department of Health Information Management University of Pittsburgh Forbes Tower, Pittsburgh, PA 15260	yanshan.wang@pitt.edu
RESEARCH INTERESTS	My research focuses on natural language processing, artificial intelligence, machine/deep learning methodologies and applications in healthcare.	
EDUCATION	<b>Mayo Clinic</b> , Rochester, USA  Postdoc, Biomedical Informatics, Mar 2018 <ul style="list-style-type: none"><li>• Research Topic: <i>Clinical Natural Language Processing and Biomedical Informatics</i>.</li><li>• Advisors: Hongfang Liu, Ph.D</li></ul> <b>Korea University</b> , Seoul, Korea  Ph.D., Information Management Engineering, Feb 2015 <ul style="list-style-type: none"><li>• GPA: 4.25/4.5</li><li>• Thesis: <i>A Study of Ensemble Models for Document Ranking in Information Retrieval</i>.</li><li>• Advisors: In-Chan Choi, Ph.D</li></ul> M.S., Information Management Engineering, Aug 2012 <ul style="list-style-type: none"><li>• GPA: 4.0/4.5</li><li>• Thesis: <i>Stock price direction prediction using principal component analysis and support vector machine</i>.</li><li>• Advisors: In-Chan Choi, Ph.D</li></ul> <b>Harbin Institute of Technology</b> , Harbin, China  B.S., Computer Science and Technology, July 2010 <ul style="list-style-type: none"><li>• GPA: 85/100</li><li>• <i>Summa Cum Laude</i></li></ul>	
EXPERIENCE	<b>Assistant Professor of Health Informatics</b> Department of Health Information Management, University of Pittsburgh	Jun 2021 to present
	<b>Vice Chair of Research</b> Department of Health Information Management, University of Pittsburgh	Jun 2021 to present
	<b>Assistant Professor of Biomedical Informatics</b> Division of Digital Health Sciences, Department of Health Sciences Research, Mayo Clinic	Oct 2019 to May 2021
	<b>Associate Consultant I</b> Division of Digital Health Sciences, Department of Health Sciences Research, Mayo Clinic	Oct 2019 to May 2021

- Research Associate** Mar 2018 to Oct 2019  
 Department of Health Sciences Research,  
 Mayo Clinic  
 Supervisor: Hongfang Liu, Ph.D
- Research Fellow** Mar 2015 to Mar 2018  
 Department of Health Sciences Research,  
 Mayo Clinic  
 Supervisor: Hongfang Liu, Ph.D
- Research Assistant** Sep 2010 to Feb 2015  
 System Optimization Lab,  
 Korea University  
 Supervisor: In-Chan Choi, Ph.D
- Assistant Engineer** Oct 2005 to July 2006  
 Artificial Intelligence and Bioinformatics Lab,  
 Harbin Institute of Technology  
 Supervisors: Shicheng Hu, Ph.D

## PUBLICATIONS

1. Marika Cusick, Prakash Adekkanattu, Thomas R. Campion Jr, Evan T. Sholle, Annie Myers, Samprit Banerjee, George Alexopoulos, **Yanshan Wang**, and Jyotishman Pathak. "Using weak supervision and deep learning to classify clinical notes for identification of current suicidal ideation." *Journal of psychiatric research* (2021).
2. Anusha Bompelli\*, **Yanshan Wang\***, Ruyuan Wan, Esha Singh, Yuqi Zhou, Lin Xu, David Oniani, Bhavani Singh Agnikula Kshatriya, E. Balls-Berry, and Rui Zhang. "Social determinants of health in the era of artificial intelligence with electronic health records: A systematic review." *arXiv preprint arXiv:2102.04216* (2021). [\*co-first authors]
3. Zitao Shen, Yoonkwon Yi, Anusha Bompelli, Fang Yu, **Yanshan Wang**, and Rui Zhang. "Extracting Lifestyle Factors for Alzheimer's Disease from Clinical Notes Using Deep Learning with Weak Supervision." *arXiv preprint arXiv:2101.09244* (2021).
4. Marika Cusick, Prakash Adekkanattu, Thomas R. Campion Jr, Evan T. Sholle, Annie Myers, Samprit Banerjee, George Alexopoulos, **Yanshan Wang**, and Jyotishman Pathak. "Using Weak Supervision and Deep Learning to Classify Clinical Notes for Identification of Current Suicidal Ideation." *Journal of Psychiatric Research* (2021).
5. Feichen Shen, Sijia Liu, Sunyang Fu, **Yanshan Wang**, Sam Henry, Ozlem Uzuner, and Hongfang Liu. "Family History Extraction From Synthetic Clinical Narratives Using Natural Language Processing: Overview and Evaluation of a Challenge Data Set and Solutions for the 2019 National NLP Clinical Challenges (n2c2)/Open Health Natural Language Processing (OHNLP) Competition." *JMIR Medical Informatics* 9, no. 1 (2021): e24008.
6. **Yanshan Wang**, Sunyang Fu, Feichen Shen, Sam Henry, Ozlem Uzuner, and Hongfang Liu. The 2019 n2c2/OHNLP Track on Clinical Semantic Textual Similarity: Overview. *JMIR Medical Informatics*. 2020.

7. Bhavani Agnikula Kshatriya, Joy Balls-Berry, **Yanshan Wang**. Completeness of Social Determinants of Health in Electronic Health Records: A case study on the Patient-Provided Information from a minority cohort with sexually transmitted diseases. under review.
8. Andrew Wen, Liwei Wang, Huan He, Sijia Liu, Sunyang Fu, Sunghwan Sohn, Jacob A.Kugel, Vinod C. Kaggal, Ming Huang, **Yanshan Wang**, Feichen Shen, Jungwei Fan, Hongfang Liu. "An aberration detection-based approach for sentinel syndromic surveillance of covid-19 and other novel influenza-like illnesses." *Journal of Biomedical Informatics* 113 (2021): 103660.
9. David Oniani, **Yanshan Wang**. A Qualitative Evaluation of Language Models on Automatic Question-Answering for COVID-19. *the 2020 ACM International Conference on Bioinformatics, Computational Biology, and Health Informatics (ACM-BCB)*. 2020.
10. Sijia Liu, **Yanshan Wang**, Andrew Wen, Liwei Wang, Na Hong, Feichen Shen, Steven Bedrick, William Hersh, and Hongfang Liu. Implementation of a Cohort Retrieval System for Clinical Data Repositories Using the Observational Medical Outcomes Partnership Common Data Model: Proof-of-Concept System Validation. *JMIR medical informatics*, 2020.
11. Luke A. Carlson, Molly M. Jeffery, Sunyang Fu, Huan He, Rozalina G. McCoy, **Yanshan Wang**, W. Michael Hooten, Jennifer St Sauver, Hongfang Liu, and Jungwei Fan. Characterizing Chronic Pain Episodes in Clinical Text: Comprehensive Annotation and Corpus Analysis at Two Health Care Systems. *JMIR Medical Informatics*, 2020.
12. Steven R. Chamberlin, Steven D. Bedrick, Aaron M. Cohen, **Yanshan Wang**, Andrew Wen, Sijia Liu, Hongfang Liu, and William R. Hersh. Evaluation of patient-level retrieval from electronic health record data for a cohort discovery task. *JAMIA Open*, 2020.
13. Sam Henry, **Yanshan Wang**, Feichen Shen, and Ozlem Uzuner. "The 2019 National Natural language processing (NLP) Clinical Challenges (n2c2)/Open Health NLP (OHNLP) shared task on clinical concept normalization for clinical records." *Journal of the American Medical Informatics Association* (2020).
14. Nathan D Seligson, Jeremy L Warner, William S Dalton, David Martin, Robert S Miller, Debra Patt, Kenneth L Kehl, Matvey B Palchuk, Gil Alterovitz, Laura K Wiley, Ming Huang, Feichen Shen, **Yanshan Wang**, Khoa A Nguyen, Anthony F Wong, Funda Meric-Bernstam, Elmer V Bernstam, James L Chen, Recommendations for patient similarity classes: results of the AMIA 2019 workshop on defining patient similarity, *Journal of the American Medical Informatics Association*.
15. Sunyang Fu, David Chen, Huan He, Sijia Liu, Sungrim Moon, Kevin J Peterson, Feichen Shen, Liwei Wang, **Yanshan Wang**, Andrew Wen, Yiqing Zhao, Sunghwan Sohn, Hongfang Liu. Clinical Concept Extraction: a Methodology Review. *Journal of Biomedical Informatics*. 2020.
16. Fu S, Carlson LA, Peterson KJ, Wang N, Zhou X, Peng S, Jiang J, **Wang Y**, Sauver JS, Liu H. Natural Language Processing for the Evaluation of Methodological Standards and Best Practices of EHR-based Clinical Research. *AMIA Jt Summits Transl Sci Proc*. 2020; 2020:171-180.

17. **Yanshan Wang**, Yiqing Zhao, Terry M. Therneau, Elizabeth J. Atkinson, Ahmad P. Tafti, Nan Zhang, Shreyasee Amin, Andrew H. Limper, Sundeep Khosla, and Hongfang Liu. Unsupervised Machine Learning for the Discovery of Latent Disease Clusters and Patient Subgroups Using Electronic Health Records. *Journal of Biomedical Informatics*. 2020.
18. Andrew Wen, **Yanshan Wang**, Vinod C. Kaggal, Sijia Liu, Hongfang Liu, and Jungwei Fan. Enhancing Clinical Information Retrieval through Context-Aware Queries and Indices. *the 2019 IEEE International Conference on Big Data (Big Data)*, 2019.
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20. Ahmad P Tafti, **Yanshan Wang**, Feichen Shen, Elham Sagheb, Paul Kingsbury, Hongfang Liu. Integrating word embedding neural networks with PubMed abstracts to extract keyword proximity of chronic diseases. *2019 IEEE EMBS International Conference on Biomedical & Health Informatics (BHI)*. 2019.
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40. Liwei Wang, Majid Rastegar-Mojarad, Zhiliang Ji, Sijia Liu, Ke Liu, Sungrim Moon, Feichen Shen, **Yanshan Wang**, Lixia Yao, John M Davis III, Hongfang Liu. Detecting pharmacovigilance signals combining electronic medical records with spontaneous reports: a case study of conventional disease-modifying antirheumatic drugs for rheumatoid arthritis. *Frontiers in Pharmacology*. 2018.
41. Xin Zhou, Hongfang Liu, **Yanshan Wang**. A Comparison of Lifestyle Interventions for Alzheimer’s Disease Extracted from Clinical Notes and Literature. *IEEE International Conference on Healthcare Informatics Workshop*. 2018.
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56. Sijia Liu, Feichen Shen, **Yanshan Wang**, Majid Rastegar-Mojarad, Ravikumar Komandur Elayavilli, Vipin Chaudhary, Hongfang Liu. Attention-based Neural Networks for Chemical Protein Relation Extraction. *Proceedings of BioCreative VI*, 2017.
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69. **Yanshan Wang**, Stephen Wu, Dingcheng Li, Saeed Mehrabi, and Hongfang Liu. "A Part-Of-Speech Term Weighting Scheme for Biomedical Information Retrieval." *Journal of Biomedical Informatics*, 2016.
70. **Yanshan Wang**, Stephen Wu, and Hongfang Liu. "MayoNLP Team at the 2016 CLEF eHealth Information Retrieval Task.", *CLEF eHealth 2016*.
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PEER-REVIEWED  
ABSTRACTS

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18. Yanshan Wang, Stephen Wu, Dingcheng Li, Hongfang Liu. Influence of Part-of-Speech on the Clinical Information Retrieval, AMIA iHealth Clinical Informatics Conference, 2016.
19. Yanshan Wang, Stephen Wu, Dingcheng Li, Hongfang Liu. POS-MRF: A Part-Of-Speech Weighted Markov Random Field Model for Clinical Information Retrieval, AMIA 2016 Joint Summits on Translational Science, 2016.
20. Yanshan Wang, Dingcheng Li, Stephen Wu, Hongfang Liu. Improving Clinical Information Retrieval by Incorporating Part-Of-Speech Tagging. *Delivery Science Summit*, 2015.

HONORS                      Fellow of American Medical Informatics Association (FAMIA)                      2020

PROFESSIONAL              Member, American Medical Informatics Association (AMIA)                      2015-  
MEMBERSHIPS              Member, Association for Computing Machinery (ACM)                              2016-  
Member, Association for Computational Linguistics (ACL),                              2016-

RESEARCH  
ACTIVITIES

**Organizer:**

- HealthNLP 2018, 2019, 2020
- BioCreative/OHNLP Challenge 2018 Task 2: Clinical Semantic Textual Similarity
- National NLP Clinical Challenges (n2c2)/OHNL Challenge 2019

**Editorial Member of the following journals/proceedings:**

Frontiers in Artificial Intelligence; Biomedical Informatics Insights; Biomedical Informatics Insights Special Issue on Precision and Individualized Medicine; JMIR Medical Informatics Special Issue; MedInfo

**Program Committee of of the following conferences:**

AMIA; IEEE ICHI; BIOTECHNO; NLPCC; IHKDM; KDTBI; LREC; NAACL; EMNLP; COLING

**Student Paper Competition Committee:**

AMIA 2017, 2018

**Reviewer of the following journals:**

Journal of Biomedical Informatics; Knowledge-Based Systems; Neurocomputing; Journal of Biomedical Engineering; International Journal of Image Mining; Journal of Multimedia Tools and Applications; Plos One; Applied Clinical Informatics; Journal of Medical Internet Research; SDRP Journal of Biomedical Engineering; Journal of Healthcare Informatics Research; Pharmaceutical Medicine; Nucleic Acids Research; Journal of Primary Care and Community Health; Journal of American Medical Informatics; Scientific Data; International Journal of Medical Informatics; Journal of Healthcare Informatics Research; IEEE Transactions on

Neural Networks and Learning Systems; IEEE Transactions on Knowledge and Data Engineering.

**Reviewer of the following conferences:**

COLING 2016-2020; EMNLP 2016-2020; ACM-BCB 2015-2020; BIBM 2015-2020; AMIA Joint Summits on Translational Science 2016-2020; AMIA Annual Symposium 2016-2020; International Workshop on Semantic Evaluation; SEPDA 2017; ICIBM 2017; HEALTHINFO 2017, 2018; BIOTECHNO 2017, 2018; SEPDA 2017; NAACL 2018-2020.

**Session Chair of the following conferences:**

HealthNLP 2018, 2019, 2020; CBMS 2020; ACM-BCB 2020.

**Talks**

- Invited Talk. University of Pittsburgh, Feb, 2021.
- Invited Talk. Merck & Co., Jan, 2021.
- Invited Talk. United Health Group, Dec, 2020.
- Invited Talk. USF Moffitt Cancer Center, Dec, 2020.
- Keynote: Simple Introduction to Natural Language Processing and Its Clinical Applications in the Era of Artificial Intelligence, South Dakota State University Data Science Symposium, 2020.
- An Introduction to Natural Language Processing in Artificial Intelligence, Neuroscience Convergence 2019, 2019.
- CREATE: Cohort Retrieval Enhanced by Analysis of Text from Electronic Health Records, AMIA, 2018.
- BioCreative/OHNLP Challenge 2018, ACM-BCB, 2018.
- Towards A Distant Supervision Paradigm for Clinical Information Extraction: Creating Large Training Datasets for Machine Learning, South Dakota State University Data Science Symposium, 2018.
- Leveraging both Structured and Unstructured Data for Precision Information Retrieval, the Text REtrieval Conference (TREC), 2017.
- An Ensemble Approach of Clinical Information Extraction and Retrieval, the Text REtrieval Conference (TREC), 2016. [only 5 out of 24 teams were invited to give a presentation.]
- Systematic Analysis of Free-Text Family History in Electronic Health Record, AMIA Summits on Translational Science Proceedings
- MayoNLP Team at TREC 2016 Clinical Decision Support Track: An Ensemble Approach of Clinical Information Extraction and Retrieval, the Text REtrieval Conference (TREC), Nov 17, 2016.
- Retrieval of Semantically Similar Healthcare Questions in Healthcare Forums, the IEEE International Conference on Healthcare Informatics, Oct 21, 2015.
- A Frequency-filtering Strategy of Obtaining PHI-free Sentences from Clinical Data Repository, the 6th ACM Conference on Bioinformatics, Computational Biology and Health Informatics, Sep 10, 2015.
- Deep Structured Semantic Models, the Deep Learning Seminar, May 14, 2015.
- Document Ranking by Ensemble Models”, Korea Business Intelligence and Data Mining Conference, 2013.

TEACHING  
EXPERIENCE

**Lectures/Tutorials**

- RNN / LSTM Architectures and their applications in clinical note analytics, OSCT

Annual Meeting: Deep Learning Foundation and Application with a Special Focus on Medical Informatics, May 6, 2019.

- Applications of Natural Language Processing in Clinical Research and Practice, the 2019 Conference of the North American Chapter of the Association for Computational Linguistics (NAACL), June 2, 2019.
- Methods and Applications of Natural Language Processing in Medicine, 2020 International Conference on Artificial Intelligence in Medicine (AIME), August 25, 2020.
- A Simple Introduction to Natural Language Processing and Its Clinical Applications in the Era of Artificial Intelligence. South Dakota State University Data Science Symposium, 2020.

### Courses

HINF 5610 (001) Foundations of Biomedical Natural Language Processing (Spring 2020), University of Minnesota, April 24, 2020. [Invited Speaker]

Natural Language Processing & Health (Spring 2021), Weill Cornell Medical College, March 3, 2021. [Invited Speaker]

GRANTS  
FUNDED

### Mayo Clinic

- PI CHECE, Center for Health Equity and Community Engagement Research Award 02/01/2020 – 01/31/2021  
Title: Developing Artificial Intelligence Models to Automatically Identify Social Determinants of Health Among Minority Populations from the Electronic Health Records and to Provide Implications for Health Equity

### Industry

- PI Amazon, AWS Diagnostic Development Initiative (DDI) Award 10/01/2020 – 12/31/2021  
Title: Multimodal Machine Learning for Rapid Diagnosis

### NIH

- Co-I NIMH-R01MH121924 09/05/2019 – 05/31/2024  
Title: Leveraging EHR-linked biobanks for deep phenotyping, polygenic risk score modeling, and outcomes analysis in psychiatric disorders
- Co-I NCATS-UL1TR02377 07/18/2017 – 06/30/2022  
Title: Mayo Clinic Center for Clinical and Translational Science (CCaTS)
- Co-I NLM-R01LM011934 09/01/2014 – 07/31/2020  
Title: Semi-structured Information Retrieval in Clinical Text for Cohort Identification
- Co-I NIH-UL1TR02377 08/01/2018 – 07/31/2019  
Title: Supplement Investigation of Chronic Pain Management Based on Electronic Health Records
- Co-I NIH-R01NS102233 06/01/2017 – 05/31/2021  
Title: Enabling Comparative Effectiveness Research in Silent Brain Infarction Through Natural Language Processing and Big Data

GRANTS  
PENDING

### NIH

- site-PI NCATS-U24 04/01/2022 – 03/31/2027  
Title: Open Health Natural Language Processing Collaborative Center

GRANTS  
SUBMITTED

### NIH

- PI NIA-R01 07/01/2021 – 06/30/2025  
Title: Advancing lifestyle research in Alzheimer's Disease through Informatics

- Approach
- PI NLM-R01 04/01/2021 – 03/31/2025  
Title: Advancing patient education through methodology development for automatic summarization, personalization, and generalization of patient education materials
  - MPI NIAID-R01 01/01/2021 – 12/31/2025  
Title: Discovery, Characterization, and Surveillance for COVID-19 Complications by Using Multi-Domain Health Data and Integrative Analytics
  - Co-I NIDDKD-R03 09/01/2020 – 03/31/2025  
Title: Digital Phenotyping of Nonalcoholic Fatty Liver Disease
  - Co-I NIBIB-NOSI 04/01/2021 – 03/31/2025  
Title: Secondary Use of EMRs for Surgical Complication Surveillance
  - Co-I NLM-R01 04/01/2021 – 03/31/2025  
Title: Semi-structured Information Retrieval in Clinical Text for Cohort Identification
  - PI NLM-R01LM013134 2018  
Title: An Information Retrieval Framework for Cohort Discovery from Electronic Health Records
  - PI NCATS-R21TR03408 07/01/2020 - 06/30/2022  
Title: Advancing lifestyle intervention research in Alzheimer’s disease through digital phenotyping.
  - PI NIDUS Delirium Network 04/01/2020 - 03/31/2021  
Title: Study the interrelationship of delirium and dementia via advanced informatics and artificial intelligence approaches  
Role: Principal Investigator
  - Co-I NCATS-U01TR03192 2019  
Title: Acquiring and applying data-driven evidence to support shared decision making for chronic pain management
  - Co-I NLM-R01GM102282 2019  
Title: Natural language processing for clinical and translational research
  - Co-I NIH-U01TR03192 04/01/2020 - 03/31/2024  
Title: Acquiring and applying data-driven evidence to support shared decision making for chronic pain management

### Mayo Clinic

- PI Kern Center Augmented Human Intelligence Care of Tomorrow Award 2019  
Title: An Intelligent Conversation Agent for Patients with Dementia
- PI Kern Center Practice Innovation Award Submitted  
Title: Automated Clinical Trial Eligibility Screening using Electronic Health Records
- PI Alzheimer’s Disease Research Center Developmental Projects 2019  
Title: Automatic Early Detection of Alzheimer’s Disease Using an AI Chatbot
- PI CCaTS and the Kogod Center Innovation on Aging Award 2019  
Title: Using Artificial Intelligence on Electronic Health Records to Discover Comorbidity Clusters and Patient Subgroups for Elders
- PI Benefactor-funded Career Development Awards in Cancer Research 2020  
Title: Predicting Pancreatic Cancer Treatment Outcomes using Social Determinants of Health from Electronic Health Records

### American Heart Association

- Co-I American Heart Association - National 04/01/2020 - 03/31/2024  
Title: Batch Enrollment for an Artificial Intelligence-Guided Intervention to Lower Neurologic Events in Patients with Unrecognized Atrial Fibrillation

CONSULTING  
SERVICES

**Leverage AI techniques to improve the Clinical Practice in Mayo Clinic, the National #1 Hospital (Selected Projects)**

- NLP to Enhance Patient Enrollment onto Cancer Clinical Trials
- AI to Predict Chemotherapy/Radiotherapy Outcomes using EHRs and Phenotyping Data
- AI for Smart Patient Scheduling
- NLP for Automatic Fracture Identification
- AI for Automatic Outside Materials Retrieval and Extraction
- Multimodal Machine Learning for Patient Satisfaction Assessment
- Chatbot for Automatic Healthcare Question-Answering
- Automatic Patient Education Materials Summarization

PROGRAMMING  
SKILLS

Python (Machine Learning, Deep Learning, NLP packages), R (Statistical Analysis and Statistical Learning Libraries), Java (UIMA, cTAKES, MedTagger, Elasticsearch, Deep4J, etc.), C, C++, Matlab, Perl.