Curriculum Vitae

Carol Friedman
Date of Preparation: 7/01/2023

Contact Information

Name: Carol Friedman (Previous: Carol Raze)
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Academic Appointments

7/2023 -present	Professor Emerita, Columbia University
7/2019 -7/2023	Professor, Columbia University
7/2012 -6/2019	Graduate Program Director, Department of Biomedical Informatics, Columbia University
7/2009 -6/2012	Vice Chair & Professor, Department of Biomedical Informatics, Columbia University
7/2002 -6/2009	Professor, Department of Biomedical Informatics, Columbia University
9/2000 - 6/2002	Senior Lecturer, Department of Medical Informatics, Columbia University
1/1999 - 6/2002	Professor, Computer Science, Queens College CUNY
7/1998 - 8/2000	Associate Professor, Department of Medical Informatics, Columbia University (on leave of absence since 9/1/1998)
1/1996 12/1998	Associate Professor, Computer Science, Queens College CUNY (on leave of absence since 7/1/1996)
1/1995 - 6/1998	Assistant Professor, Department of Medical Informatics, Columbia University
9/1991 - 6/1996	Adjunct Assistant Professor, Department of Medical Informatics, Columbia University
9/1990 12/1995	Assistant Professor, Computer Science, Queens College, CUNY
4/1989 - 8/1990	Assistant Professor, Department of Medicine, Columbia University

Academic Training

6/1986 -2/1989 Ph.D. Computer Science, New York University
9/1983 -5/1986. M.A. Computer Science, New York University
2/1959 -6/1962. B.S. Mathematics, City College CUNY, magna cum laude, elected to Phi Beta Kappa

Honors & Awards

Morris F Collen Award of Excellence, American College of Medical Informatics, 2017 (one recipient a year)
Elected to National Academy of Medicine, 2017
Board of Regents, National Library of Medicine, 2007-2011
Donald A. B. Lindberg Award for Innovation in Biomedical Informatics, American Medical Informatics Association, 2010 (one recipient a year)
Board of Scientific Counselors, Lister Hill Center, National Library of Medicine, 2001-2007
Chair, Board of Scientific Counselors, Lister Hill Center, National Library of Medicine, 2006-2007

Elected Fellow New York Academy of Medicine, 2006

Commissioned by the National Academies to write a report on Natural Language Processing and the Prevention of Medical Errors, 2003, included in IOM 2004 report on patient safety

Paper selected for Annual Yearbook of Medical Informatics, International Medical Informatics Association, 2001

Paper selected for Annual Yearbook of Medical Informatics, International Medical Informatics Association, 1999

Elected Fellow of the American College of Medical Informatics, 1998

American Medical Informatics Association Annual Symposium, best theoretical paper, 1998 (one recipient a year)

American Medical Informatics Association Annual Symposium, best paper on an application, 1996 (one recipient a year)

Computer Applications in Medical Care Symposium, Best Electronic Poster, 1995 (one recipient a year)

Elected to Phi Beta Kappa, 1962

Graduated Magna Cum Laude, 1962

Administrative Leadership and Academic Service

Academic Service

Committee on Human Rights, National Academy of Medicine, 2017-present

American College of Medical Informatics, Honors and Awards Committee, 2023-2025

Journal of Biomedical Semantics, Editorial Board Member, 2009-2012

Scientific Program Committee, American Medical Association Symposium, 2007, 2009, 2012

Extramural Committee, Board of Regents, National Library of Medicine, 2007-2011

American Medical Informatics Association, Annual Symposium, Vice Chair, 2010

National Health Standards Working Group, National Library of Medicine, 2008-2010

Journal Of Biomedical Informatics, Editorial Board, 2001-2010

Co-chair for BioNLP Pacific Symposium, 2007

Special Emphasis Review Panel, National Library of Medicine, 2006-2007

American College of Medical Informatics, Honors and Awards Committee, 2005-2007

Program Committee for HTL-NAACL 06 - Bio NLP, 2006

Program Committee for BioLink SIG - ISMB 06, 2006

Program Committee for 2nd International Symposium on Semantic Mining in Biomedicine, 2006

Member at Large, American College of Medical Informatics, Executive Committee, 2005-2006

Grant reviewer for National Science Foundation, 2003,2006

Grant reviewer for Genome Canada, 2005

Journal of Biomedical Discovery and Collaboration, Editorial Board Member, 2005-2008

Guest co-editor for Special Named Entity Recognition Issue of Journal of Biomedical Informatics, 2004

Journal of American Medical Informatics Association, 1999-2004

American Medical Informatics Association Publications Committee, 1998-2004

American College of Medical Informatics Scientific Affairs Committee, 2003-2004

Grant reviewer for California Breast Cancer Research Program, 2002, 2003, 2004

Guest editor for Special Sublanguage Issue of Journal of Biomedical Informatics, 2003

Co-chair for Natural Language Track, Pacific Symposium in Biocomputing, 2003

Program Committee for BIOLINK Workshop, National Science Foundation, 2003

Program Committee for Natural Language Workshop in Biomedicine, Association for Computational Linguistics Conference, 2002, 2003

Search Committee for Editor of Journal of American Medical Informatics Association, 2002

Program Committee for Pre-Trek Track Workshop in Bioinformatics, JDL Conference, 2002

Data Structures Course Coordinator, Queens College, CUNY, 2002

Honors and Awards Committee, Queens College CUNY, 1991-2002

Faculty Advisor, Queens College CUNY, 1991-2002
Curriculum Committee, Queens College CUNY, 1991-2002
Special Emphasis Review Panel, National Library of Medicine, 2000, 2001
Ad Hoc Member of Genome Study Section, National Library of Medicine, 6/2001
Chair, Departmental Search Committee, Queens College CUNY, 1999
Howard Hughes Scientific Awards Committee, Queens College CUNY, 1994-1997
Library Committee, Queens College CUNY, 1992-1995
Manuscript reviewer for
 International Journal of Medical Informatics
 Journal of American Medical Informatics Association
 Journal of Biomedical Informatics
 Natural Language Engineering
 American Medical Informatics Association Fall Symposium
 Methods of Information in Medicine
 Artificial Intelligence in Medicine
 Bioinformatics
 Nature Reviews Genetics
 BMC Bioinformatics
 BMC Medical Decision Making
 International Journal of Clinical Pharmacology and Therapeutics

Administrative Leadership at CUIMC and NYP

Academic Appointments Committee, Biomedical Informatics, Columbia University, 2002-present
Executive Committee, Department of Biomedical Informatics, Columbia University, 2007-present
Training Committee, Department of Biomedical Informatics, Columbia University, 2007-2022
Coordinating Admissions Committee, Graduate School of Arts and Sciences, Columbia University, 2008-2022
Executive Training Committee, Department of Biomedical Informatics, 2013-2022
Graduate Program Director, Department of Biomedical Informatics, 2012-2019
Chair, Faculty Search Committee, Department of Biomedical Informatics, 2009-2014
Vice Chair, Department of Biomedical Informatics, 2009-2012
IT Committee, Department of Biomedical Informatics, 2009-2014
Ad-hoc Tenure Committee, Columbia University, 2004, 2005

Patents and Inventions

Patent US10275424
 Carol Friedman
 System and method for language extraction and encoding, issued 4/30/2019
Patent US9710431
 Carol Friedman, Dan Riskin
 Systems and methods for processing patient information, issued 7/18/2017
Patent US7974788
 Andrey Rzhetsky Carol Friedman Sergey Kalachikov Michael O. Krauthammer Pauline Kra
 Gene discovery through comparisons of networks of structural and functional relationships
 Among known genes and proteins, Issued 7/5/2011
Patent US6182029
 Carol Friedman
 System and method for language extraction and encoding utilizing the parsing of text data in
 accordance with domain parameters, issues 1/30/2001
Patent US6950753
 Andrey Rzhetsky Carol Friedman Sergey Kalachikov Michael O. Krauthammer Pauline Kra
 Methods for extracting information on interactions between biological entities from natural
 Language text data, issued 4/14/2000

European Patents 0929870 and 236832
    Carol Friedman
    System and method for language extraction and encoding, Issued 3/24/2004 and 5/19/2004
Patent US6055494
    Carol Friedman
    System and method for medical language extraction and encoding, Issued 4/25/2000
Patent US6182029
    Carol Friedman
    System and method for language extraction and encoding utilizing the parsing of text data in accordance with domain parameters, Issued 1/30/2001

Grant Support

NIH from NLM (R01LM06910), co-PI (PI, Hripcsak), 9/30/2013–9/29/2023
3UOT2OD02655, co-PI (Goldstein/Gharavi/Hripcsak),7/6/2016-12/31/2022
5IU0TR002062-02, co-PI (Liu/Jiang,Pakhomov),9/01/2017-8/31/2022
NIH from NLM (R02LM010016), PI, 7/1/2013-6/31/2017
NHGRI: U01 HG006380, investigator (PI, Weng), 8/2011–7/2015
NIH from NLM (R01LM010016-01), PI, 7/1/2009-6/31/2013
NIH from NLM (R01LM010016-01S1), PI, 9/1/2009-8/31/2011
NIH from NLM (R01LM010016-01S2), PI, 9/1/2009-8/31/2011
NIH from NLM (R01LM06910), co-PI (PI, Hripcsak), 9/30/2009–9/29/2013
NIH from NLM (R01LM009886), co-PI (PI, Weng), 4/1/2009-3/31/2012
NIH from NLM (R01LM10140), co-PI (PI, Rabadan), 7/1/2009-6/30/2011
NIH from NCI (R01CA141307), co-PI (PI, Xu), 10/1/2009-7/31/2013
NIH from NLM (R01LM008635), PI, 7/1/05-6/30/10 ($2,190,693)
NIH from NLM (R21LM009638), PI, 09/30/07-09/29/09
NYC/DOHMH Center of Excellence in Public Health Informatics, investigator (PI, Hripcsak), 06/01/07-07/01/09
NIH from NLM (R01LM007659), PI, 7/1/03-6/30/07 ($1,902,831)
NSF SEI+III(BIO), PI of Columbia subcontract, 9/1/04-8/31/07 ($249,000)
NIH U54 (GM072980),co-PI (PI:Califano), 9/6/05-7/31/10 ($2,480,315,first yr)
NIH from NLM (R01GN01372), co-PI (PI:Rzhetsky), 7/1/01-6/30/08 ($250,000/yr)
NIH S2114-22/22, co-PI, (PI:Kukafka), 10/1/02-9/30/04 ($76,453/yr)
NIH from NLM, (R01LM07268), co-PI (PI:Johnson), 7/01/2002-6/30/2005 ($346,376/yr)
NIH from NLM (R01LM0610), (PI:Hripcsak), 04/01/2000-03/31/2006 ($250,000/yr)
EIA from NSF (EIA-0312250), PI, 2/1/03-1/31/04 ($61,162)
NIH from NLM (R01LM06274), PI, 7/1/97-12/31/2003 ($250,000)
NSF ITR/IM+AP, co-PI, (PI:Rzhetsky), 9/1/01-8/31/03 ($6,139)
AHRQ , investigator, (PI:Hripcsak), 09/01/2001 $223,030
DLI2 from NSF IIS 9817434, co-PI, (PI:McKeown), 9/1/99-8/31/05 ($5,000,375)
PSC-CUNY Research Awards (6-64044, 6-61483), PI, 7/1/91-6/30/94 ($9,000)
NIH Grant from NLM (R29LM05627), PI, 1/1/92-6/31/97 ($549,271)
New York State Science and Technology Foundation, PI, 11/1/94-6/30/97 ($210,000)
NIST ATP Subcontract with Sunquest Systems, PI, 11/1/96-10/30/98 ($220,000)
NIST ATP Subcontract with Kurzweil, PI, 12/1/97-11/30/99 ($561,988)
New York State Science and Technology Foundation, co-PI, 7/1/97-6/30/99 ($298,474)
NIH Grant from NLM (R01LM06274), PI . 7/1/97-6/30/00 ($632,000 award)
New York State Science and Technology Foundation, co-PI, 1/1/98-6/30/99 ($201,795)
New York State Science and Technology Foundation, PI, 4/1/01-6/30/01 ($30,000)

Departmental and University Committees

Honors and Awards Committee, Queens College CUNY, 1991-2002
Curriculum Committee, Queens College CUNY, 1991-2002
Faculty Advisor, Queens College CUNY, 1991-2002
Library Committee, Queens College CUNY, 1992-1995
Howard Hughes Scientific Awards Committee, Queens College CUNY, 1994-1997
Chair, Departmental Search Committee, 1999
Data Structures Course Coordinator, Queens College, CUNY, 2002
Academic Appointments Committee, Biomedical Informatics, Columbia University, 2002-present
Ad-hoc Tenure Committee, Columbia University, 2004, 2005
Training Committee, Biomedical Informatics, Columbia University, 2007-present
Executive Committee, Biomedical Informatics, Columbia University, 2007-present
Coordinating Admissions Committee, Graduate School of Arts and Sciences, Columbia University, 2008-present
IT Committee, Biomedical Informatics, Columbia University, 2009-present
Chair, Faculty Search Committee, Biomedical Informatics, Columbia University, 2009-present
Executive Training Committee, Biomedical Informatics, Columbia University, 2013-present

Teaching Experience and Advising

Database Management Systems
Programming Language Theory
Natural Language Programming
Data Structures
Software Design
Independent Study
Research Seminar
Text mining
Pharmacovigilance

Graduate Research Advisor - CUNY
Galit Blum, 194, 1995 Use of N-GRAMS for vocabulary discovery
Leon Tat-Kim, 1996 Integrating a natural language parser into a working Clinical Information System
Samer Salame, 2001 Use of regular expression to recognize noun phrases
Hongfang Liu (Ph.D. advisor), 1999-2002 Corpus-based ambiguity resolution of biomedical terms based on knowledge sources and machine learning

Research Advisor Columbia University
Nilesh Jain, 1996 Using NLP to detect patients suspicious for tuberulosis
Nilesh Jain, 1997 Using NLP to detect findings in mammogram reports
Irina Shablinsky, 1997 2000 Elliciting information needs of physicians from information in patient records
Qing Zeng, 1998 Training NLP system to interpret findings in electrocardiogram reports
Donald Harrington, 1998, 1999 Summarizing findings in chest x-rays over time
Michael Krauthammer, 1998 Using BLAST to identify the names of genes and proteins in text
Hong Yu, 1998, 1999 Identifying abbreviations in biomedical text and mapping them to their full forms
Adam Wilcox, 2000 Natural language as a tool in the development of a controlled vocabulary.
Rahul Bajaj, 2000-2001 Assessing natural language processing to detect congestive heart failure from chest x-ray reports
Bhanu Bahl, 2002-2004 Using NLP to structure and extracting chromosome analysis test and results in pathology reports
Hua Xu, 2002-2008 Methods for improving NLP systems
Lifeng Chen, 2003-2005 Modeling relation between phenotypic and genotypic information in

journal articles
Olivia Tuason, 2003-2004 Developing a biomedical terminological resource for natural language processing
Trevor Cohen, 2003-2004. Detecting psychiatric patients who are dangerous using NLP
Karina Tulipano, 2004-2008. Triaging MRI images to detect patients with stroke
Li Zhou, 2004-2008. NLP and analysis of time.
Ying Tao, 2004-2007. Knowledge discovery and visualization with NLP
Michael Bales, 2004 -2006. Investigating feasibility of ICF coding of clinical rehabilitation reports
Jung-Wei Fan, 2005-2010. Automated semantic classification to improve UMLS.
Xiaoyan Wang, 2007-present. Pharmacovigilance using NLP, statistics, and the EHR.
Krystl Haerian, 2010-present. Knowledge-based methods to reduce confounding and improve pharmacovigilance.
Ying Li, 2010-2015. Acquiring drug-related knowledge using NLP.
Wei-wei Wang, 2010-2013. Acquiring adverse event evidence from journal articles.
Hojjat Salmasian, 2010-2015. Automated methods for detecting medication overuse.
Qinlang Chen, 2013-2015. An accurate method to obtain and summarize adverse drug events from the literature.
Kuo Lin, 2013-2015. A method to retrieve drug-herb interactions from the literature.
Sivan Kinberg, 2013-2015. Studying the adverse effects of medications in patients with IBD using comprehensive information in the EHR.
Evelyn Rustia, 2013-present. Integrating genomic and clinical information for pediatric oncology patients.
Grant Reed, 2015-2015. Transforming a comprehensive database from clinical narrative reports to the standard form described by OHSDI.

Thesis Committee member for
Justin Starren From Multimodal Sublanguages to Medical Data Presentations , 1995-1997
Adam Wilcox Automated classification of medical text reports , 1997-2000
Hong Yu Acquiring synonyms and disambiguating homonyms in biomedical text , 1998 2002
Jen-Hsiang Chuang Detecting medical errors via clinical databases , 2000-2002
Michael Krauthammer Data mining the literature and patient database
to discover genomic connections using patient data, 1998 2004
David Campbell Natural language processing, 1998-2005
Li Zhou, 2005-2007
Trevor Cohen, 2005-2007

Other Professional Activities

AMIA Publications Committee – 1998-2004
Editorial Board Member for
   Journal of American Medical Informatics Association, 1999-present
   Journal of Biomedical Informatics, 2001-present
   Journal of Biomedical Discovery and Collaboration, 2005-present
   Journal of Biomedical Semantics, 2009-present
Search Committee for Editor of Journal of American Medical Informatics Association, 2002
Program Committee for Natural Language Workshop in Biomedicine, Association for Computational Linguistics Conference, 2002, 2003
Program Committee for Pre-Trek Track Workshop in Bioinformatics, JDL Conference, 2002
Co-chair for Natural Language Track, Pacific Symposium in Biocomputing, 2003
Program Committee for BIOLINK Workshop sponsored by NSF, 2003
Program Committee for 2nd International Symposium on Semantic Mining in Biomedicine, 2006
Program Committee for HTL-NAACL 06 - Bio NLP, 2006
Program Committee for BioLink SIG - ISMB 06, 2006
Scientific Program Committee, AMIA 2007, AMIA 2009, AMIA2012

Co-chair for BioNLP 2007
Manuscript reviewer for
    International Journal of Medical Informatics
    Journal of American Medical Informatics Association
    Journal of Biomedical Informatics
    Natural Language Engineering
    American Medical Informatics Association Fall Symposium
    Methods of Information in Medicine
    Artificial Intelligence in Medicine
    Bioinformatics
    Nature Reviews Genetics
    BMC Bioinformatics
    BMC Medical Decision Making
    International Journal of Clinical Pharmacology and Therapeutics

Guest editor for Special Sublanguage Issue of Journal of Biomedical Informatics, 2003
Guest co-editor for Special Named Entity Recognition Issue of Journal of Biomedical Informatics, 2004
Member at Large, ACMI Executive Committee, 2005-2006
ACMI Honors and Awards Committee, 2005-2007
Special Emphasis Review Panel, National Library of Medicine, 2000, 2001
Ad Hoc Member of Genome Study Section, National Library of Medicine, 6/2001
Grant reviewer for NSF, 2003,2006
Grant reviewer for California Breast Cancer Research Program, 2002, 2003, 2004
Grant reviewer for Genome Canada, 2005
Special Emphasis Review Panel, National Library of Medicine,2006-2007
ACMI Scientific Affairs Committee, 2003-2004
Extramural Committee, Board of Regents, National Library of Medicine, 2007-2011
National Health Standards Working Group, National Library of Medicine, 2008-2010
AMIA Annual Symposium, Vice Chair, 2010

Publications

Peer Reviewed Articles

Finkelstein J, Chen Q, Adams H, Friedman C, Automated Summarization of Publications Associated with Adverse Drug Reactions from PubMed. AMIA Jt Summits Transl Sci Proc. 2016 Jul 20;2016:68-77. eCollection 2016. PMCID: PMC5001779.
Finkelstein J, Lin K, Friedman C. An automated system for retrieving herb-drug interaction related articles from MEDLINE. Proc AMIA Joint Summit. 2016 (in press).
Salmasian H, Friedman C. MAC Annotator: An interactive tool for translating medication appropriateness criteria into structured form. Proc AMIA Ann Symp. 2015 (in press).
Finkelstein J, Adams H, Chen Q, Lin K, Friedman C. Implementing automated delivery of evidence-based medication safety information to the point of care. Proc AMIA Ann Symp. 2015 (in press).
Salmasian H, Tran TH, Friedman C. Developing a Formal Representation for Medication Appropriateness Criteria. Proc AMIA Ann Symp. 2015 (in press).
Li Y, Ryan PB, Wei Y, Friedman C. A Method to Combine Signals from Spontaneous Reporting Systems and Observational Healthcare Data to Detect Adverse Drug Reactions. Drug Saf. 2015 Jul 8. Oct;38(10):895-908. PMCID:PMC4579260.
Salmasian H, Tran TH, Chase HS, Friedman C. Medication-indication knowledge bases: a systematic review and critical appraisal. J Am Med Inform Assoc. 2015 Sep 2. pii: ocv129. doi: 10.1093/jamia/ocv129. [Epub ahead of print] Review. PMID:26335981.

Adams H, Friedman C, Finkelstein J. Automated Determination of Publications Related to Adverse Drug Reactions in PubMed. AMIA Jt Summits Transl Sci. Proc. 2015 Mar 25;2015:31-5. eCollection 2015.

Li Y, Salmasian H, Vilar S, Chase H, Friedman C, Wei Y. A method for controlling complex confounding effects in the detection of adverse drug reactions using electronic health records. J Am Med Inform Assoc. 2014 Mar-Apr;21(2):308-14. PMCID:PMC3932454.

Vilar S, Ryan PB, Madigan D, Stang PE, Schuemie MJ, Friedman C, Tatonetti NP,Hripcsak G. Similarity-based modeling applied to signal detection in pharmacovigilance. CPT Pharmacometrics Syst Pharmacol. 2014 Sep 24;3:e137. PMCID:PMC4211266.

Vilar S, Uriarte E, Santana L, Friedman C, Tatonetti NP. State of the art and development of a drug-drug interaction large scale predictor based on 3D pharmacophoric similarity. Curr Drug Metab. 2014;15(5):490-501.

Vilar S, Uriarte E, Santana L, Lorberbaum T, Hripcsak G, Friedman C, Tatonetti NP. Similarity-based modeling in large-scale prediction of drug-drug interactions. Nat Protoc. 2014 Sep;9(9):2147-63. PMID:25122524.

*Friedman C, Rindflesch TC, Corn M. Natural language processing: state of the art and prospects for significant progress, a workshop sponsored by the National Library of Medicine. J Biomed Inform. 2013 Oct;46(5):765-73. PMID: 23810857.

Overby CL, Weng C, Haerian K, Perotte A, Friedman C, Hripcsak G. Evaluation considerations for EHR-based phenotyping algorithms: A case study for drug-induced liver injury. AMIA Jt Summits Transl Sci Proc. 2013; 2013: 130–134. PMCID: PMC3814479.

Overby CL, Pathak J, Gottesman O, Haerian K, Perotte A, Murphy S, Bruce K, Johnson, Talwalkar J, Shen Y, Ellis S, Kullo I, Chute C, Friedman C, Bottinger E, Hripcsak G, Weng C. A collaborative approach to developing an electronic health record phenotyping algorithm for drug-induced liver injury. J Am Med Inform Assoc. 2013 December; 20(e2): e243–e252. PMCID: PMC3861914.

Freedberg DE, Salmasian H, Friedman C, Abrams JA. Proton Pump Inhibitors and Risk for Recurrent Clostridium Difficile Infection Among Inpatients. Am J Gastroenterol. 2013 November; 108(11): 1794–1801. PMCID: PMC3966060.

Salmasian H, Freedberg DE, Abrams JA, Friedman C. An automated tool for detecting medication overuse based on the electronic health records. Pharmacoepidemiol Drug Saf. 2013 February; 22(2): 183–189. PMCID: PMC3566345.

Salmasian H, Freedberg DE, Friedman C. Deriving comorbidities from medical records using natural language processing. J Am Med Inform Assoc. 2013 December; 20(e2): e239–e242. PMCID: PMC3861932.

Harpaz R, Vilar S, DuMouchel W, Salmasian H, Haerian K, Shah NH, Chase HS, Friedman C. Combing signals from spontaneous reports and electronic health records for detection of adverse drug reactions. J Am Med Inform Assoc. 2013 May-Jun; 20(3): 413–419. PMCID: PMC3628045.

Xu H, Wu Y, Elhadad N, Stetson PD, Friedman C. A new clustering method for detecting rare senses of abbreviations in clinical notes. J Biomed Inform. 2012 December; 45(6): 1075–1083. PMCID: PMC3729222.

Haerian K, Varn D, Vaidya S, Ena L, Chase HS, Friedman C. Detection of Pharmacovigilance-Related adverse Events Using Electronic Health Records and automated Methods. Clin Pharmacol Ther. 2012 August; 92(2): 228–234. PMCID: PMC3685297.

Vilar S, Harpaz R, Uriarte E, Santana L, Rabadan R, Friedman C. Drug–drug interaction through molecular structure similarity analysis. J Am Med Inform Assoc. 2012 Nov-Dec; 19(6): 1066–1074. PMCID: PMC3534468.

Vilar S, Harpaz R, Santana L, Uriarte E, Friedman C. Enhancing Adverse Drug Event Detection in Electronic Health Records Using Molecular Structure Similarity: Application to Pancreatitis. PLoS One. 2012; 7(7): e41471. PMCID: PMC3404072.

Harpaz R, DuMouchel W, Shah NH, Madigan D, Ryan P, Friedman C. Novel Data Mining Methodologies for Adverse Drug Event Discovery and Analysis. Clin Pharmacol Ther. Author manuscript; available in PMC 2013 June 7. Published in final edited form as: Clin Pharmacol Ther. 2012 June; 91(6): 1010–1021. PMCID: PMC3675775.

Haerian K, Salmasian H, Friedman C. Methods for Identifying Suicide or Suicidal Ideation in EHRs. AMIA Annu Symp Proc. 2012; 2012: 1244–1253. PMCID: PMC3540459.

Vilar S, Harpaz R, Chase HS, Costanzi S, Rabadan R, Friedman C. Facilitating adverse drug event detection in pharmacovigilance databases using molecular structure similarity: application to rhabdomyolysis. J Am Med Inform Assoc. 2011 December; 18(Suppl 1): i73–i80. PMCID: PMC3241177.

Li Y, Salmasian H, Harpaz R, Chase H, Friedman C. Determining the Reasons for Medication Prescriptions in the EHR using Knowledge and Natural Language Processing. AMIA Annu Symp Proc. 2011; 2011: 768–776. PMCID: PMC3243251.

Wang W, Haerian K, Salmasian H, Harpaz R, Chase H, Friedman C. A drug-adverse event extraction algorithm to support pharmacovigilance knowledge mining from PubMed citations. AMIA Annu Symp Proc. 2011; 2011: 1464–1470. PMCID: PMC3243206.

Fan JW, Friedman C. Deriving a probabilistic syntacto-semantic grammar for biomedicine based on domain-specific terminologies. J Biomed Inform. 2011 Oct;44(5):805-14. PMCID: PMC3172402.

Holmes AB, Hawson A, Liu F, Friedman C, Khiabanian H, Rabadan R. PLoS One. Discovering disease associations by integrating electronic data and medical literature. 2011;6(6):e21132. PMCID: PMC3121722.

Harpaz R, Perez H, Chase HS, Rabadan R, Hripcsak G, Friedman C. Biclustering of adverse drug events in FDA's spontaneous reporting system. Nature - Clinical Pharmacology & Therapeutics. 2011 Feb;89(2):243-50. PMCID:PMC3282185.

Wang X, Chase H, Li J, Hripcsak G, Friedman C. Integrating heterogeneous knowledge sources to acquire executable drug-related knowledge. AMIA Annu Symp Proc. 2010:852-856. PMCID:PMC3041361.

Harpaz R, Haerian K, Chase H, Friedman C. Statistical mining of potential drug interaction adverse effects in FDA's spontaneous reporting system. AMIA Annu Symp Proc. 2010:281-285. PMCID:PMC3041376.

Borlawsky TB, Li J, Shagina L, Crowson MG, Liu Y, Friedman C, Lussier YA. Evaluation of an Ontology-anchored Natural Language-based Approach for Asserting Multi-scale Biomolecular Networks for Systems Medicine. AMIA Summits Transl SciProc. 2010 Mar 1;2010:6-10.

Harpaz R, Chase H, Friedman C. Mining multi-item drug adverse effect associations in spontaneous reporting systems. BMC Bioinformatics 2010 Oct 28;11 Suppl 9:S7. PMCID: PMC2967748.

Wang X, Hripcsak G, Friedman C. Characterizing environmental and phenotypic associations using information theory and electronic health records. BMC Bioinformatics 2009;10 Suppl 9; S13. PMCID: PMC2745684.

Hripcsak G, Soulakis ND, Li L et al. Syndromic Surveillance Using Ambulatory Electronic Health Records. J Am Med Inform Assoc 2009 March 4;16(3):354-361. PMCID: PMC2732227.

Xu H, Stetson PD, Friedman C. Methods for building sense inventories of abbreviations in clinical notes. J Am Med Inform Assoc2009 January;16(1):103-8.

Wang X, Hripcsak G, Markatou M, Friedman C. Active Computerized Pharmacovigilance using Natural Language Processing, Statistics, and Electronic Health Records: a Feasibility Study. J Am Med Inform Assoc 2009 March 4. PMCID: PMC2732239.

Sam LT, Mendonca EA, Li J, Blake J, Friedman C, Lussier YA. PhenoGO: an integrated resource for the multiscale mining of clinical and biological data. BMC Bioinformatics 2009;10 Suppl 2:S8. PMCID: PMC2646241.

Xu H, Stetson P, Friedman C. Methods for building sense inventories of abbreviations in clinical notes. J Am Med Inf Assoc 2009 Jan-Feb;15(1):87-98. PMCID: PMC2605589.

Fan JW, Friedman C. Word sense disambiguation via semantic type classification. AMIA Annu Symp Proc. 2008. p. 177-81.PMCID: PMC2655949.

Wang X, Chused A, Elhadad N, Friedman C, Markatou M. Automated knowledge acquisition from clinical reports. AMIA AnnuSymp Proc. 2008. p. 783-7. PMCID: PMC2656103.

Li L, Chase HS, Patel CO, Friedman C, Weng C. Comparing ICD9-encoded diagnoses and NLP-processed discharge summaries for clinical trials pre-screening: a case study. AMIA Annu Symp Proc. 2008. p. 404-8. PMCID: PMC2656007.

Fan JW, Friedman C. Semantic reclassification of the UMLS concepts. Bioinformatics. 2008 Sep 1;24(17):1971-3. PMCID: PMC2519163.

 Chen ES, Hripcsak G, Xu H, Markatou M, Friedman C. Automatic acquisition of disease drug knowledge from biomedical and clinical documents: an initial study. J Am Med Inf Assoc 2008. PMCID: PMC2274872.

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