2017-06-30

Data analytics based positioning of health informatics programs

CSECS 2017, pp. 001- 012

The 13th Annual International Conference on
Computer Science and Education in Computer Science,

June 30-July 03 2017, Albena, Bulgaria

DATA ANALYTICS BASED POSITIONING OF HEALTH INFORMATICS PROGRAMS

Guanglan ZHANG, Vladimir BRUSIC, Lou CHITKUSHEV

Boston University, Metropolitan College, Computer Science Department

***Abstract**:* The Master of Science in Computer Information Systems (CIS) with concentration in Health Informatics (HI) at Metropolitan College (MET), Boston University (BU), is a 40-credit degree program that are delivered in three formats: face-to-face, online, and blended. The MET CIS-HI program is unique because of the population of students it serves, namely those interested in gaining skills in HI technology field, to serve as data analysts and knowledge-based technology drivers in the thriving health care industry. This set of skills is essential for addressing the challenges of Big Data and knowledge-based health care support of the modern health care. The MET CIS-HI program was accredited by the Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM) in 2017.

***Keywords**: Health informatics, Computer Information Systems, Data Analytics*

***ACM Classification Keywords**: K.3.2 Computer and Information Science Education - Information systems education*

Introduction

The provision of modern healthcare is both an information- and knowledge-intensive activity. Healthcare providers increasingly depend on information technology (IT) to deliver high-quality care, reduce medical errors, lower cost, and improve efficiency. Health informatics (HI) is “the interdisciplinary study of the design, development, adoption, and application of IT-based innovations in healthcare services delivery, management, and planning” [Procter R. 2009]. It is a systematic application of IT and computer science in medicine, public health, and related disciplines [Yasnoff, O'Carroll et al. 2000]. The main activities of HI are the acquisition, management, and use of biomedical and related data, information, and knowledge and their application in medicine and health care. The interchangeable terms for HI include healthcare informatics, medical informatics, nursing informatics, and clinical informatics. HI is a complex multi-disciplinary field. In the recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics, IMIA’s Working Group on Health and Medical Informatics Education pointed out the most important disciplines that contribute to biomedical and healthcare informatics. These disciplines and their relationships are shown in Fig. 1.

American healthcare system has been going through unprecedented change. HI workers have been in high demand as providers rushing to implement certified electronic health records (EHRs) to quality for the incentive programs in Meaningful Use program and seeking to mine data to meet quality requirements under new value-based payment models. According to [Buring Glass Technologies, 2015], there was strong evidence that the nation already faced a shortage of qualified health informatics workers. A McKinsey & Co. study predicted the U.S. could see a shortage of two million healthcare analytics workers by 2018.

Emerging health informatics positions stay open twice as long as the ones they are replacing. According to [Bureau of Labor Statistics, 2015], health information managers fall into the larger employment category known as health services and medical managers. Employment for these professionals will be expected to grow by 17% from 2014 to 2024, and the BLS suggests that the median average salary is above $96,000. It was found that, in healthcare, the entry level positions have been declining and the high-growth jobs require higher level of expertise. For example, the demand for clinical application developers has increased 232% from 2007 to 2012. The healthcare industry is entering into Big Data era and a workforce that has expertise in IT, data analytics, and healthcare is required. [Buring Glass Technologies, 2015].

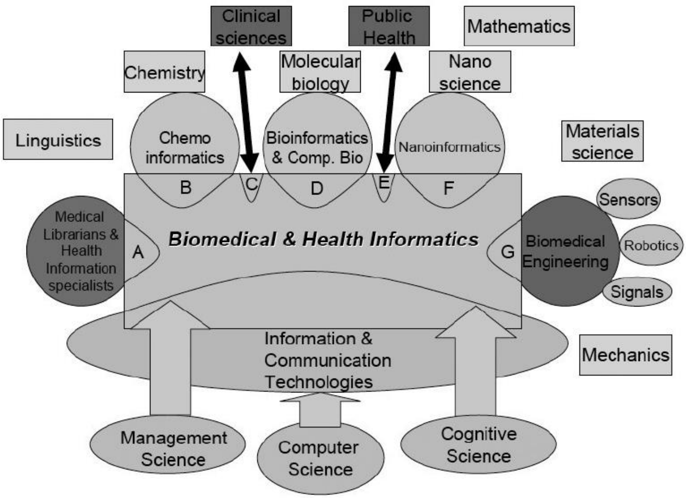

Fig. 1. Biomedical and health informatics and related fields. Overlapping areas: A – medical information science, B – medical chemo-informatics, C – clinical informatics, D – medical (translational) bioinformatics, E – public health informatics, F – medical nano-informatics, G – medical imaging and devices (adapted from [Mantas et al., 2010])

The bodies of knowledge in the field of computer science/information technology and the biomedical sciences are distinct and typically do not overlap. To design, develop and maintain an interdisciplinary HI curriculum, it is essential to have a faculty team consisting of experts and practitioners in both fields, who work together to select and integrate the topics relevant for training health IT professionals. Currently the majority of the HI master programs in the United States reside in the departments of biomedicine or nursing. They focus on training students with a background in one of the health-related professions and preparing them to be expert users of health information systems. The MET CIS-HI training program aims to develop a high-quality HI master degree program with interdisciplinary curriculum within a computer science department. Our focus is on training students who have IT or engineering background and are interest in collecting, organizing and analyzing healthcare data, developing health IT applications, and implementing healthcare information systems. Our students are trained to work closely with health care specialists so that they can modify, adjust, and develop HI systems and components at their work and solve problems specific for their own workplace, beyond the capacity of commercially available HI systems.

Health Informatics Program at Boston University

The Master of Science in Computer Information Systems (CIS) concentration in Health Informatics (HI) at Metropolitan College (MET), Boston University (MET CIS-HI), is a 40-credit degree program that are delivered in three formats: face-to-face, online, and blended. The HI initiative at MET started about ten years ago with the cultivation of several courses that integrated health informatics and computer science. The first course, CS 580 Health Informatics, was introduced on campus in Fall 2009. The Ms. CIS concentration in HI was approved in December 2010, established on campus in Spring 2011 and online in

Summer 2012. The MET CIS-HI Ms. program mission is to prepare information technology and health care professionals for careers in development, implementation, and use of modern health care information systems. The program provides an interdisciplinary and integrated approach to health care IT, and teaches both the fundamental concepts and the cutting-edge IT technologies used in the design, implementation, and management of health care IT applications. Students must complete both the core curriculum and the concentration requirements. The core curriculum consists of five 4-credit courses and aims to educate students on the technical aspects of information systems and build their knowledge of managerial and organizational issues. The HI concentration requirements include five 4-credit courses focusing on healthcare electronic applications, the collection, processing, and storage of biomedical and health data, medical decision support systems, standards, and other healthcare IT topics.

Academic advising of students is conducted by a team consisting of HI program director, faculty coordinator for HI concentration, as well as student support service coordinators for the online students. The program director and faculty coordinator work closely with the admissions and recruitment staff. They provide general information on the program to the admissions and recruitment staff and provide advice and suggestions when consulted by the staff. The advising is provided using multiple media - including email, phone, video conferencing - and in person. In addition to this, each student has an academic faculty advisor at the Computer Science department who provides recommendations for course sequences and scheduling as well as prerequisites. In addition, invited guest lecturers often share with students their first-hand experience as IT leaders in local hospitals, companies, and government health care agencies.

Students in the online HI program receive advising from both the Online Program Coordinator and the Graduate Student Academic Advisor. In the online classes, students interact with lecturers through online live classroom sessions at least twice per week, and have access to multiple course facilitators. A typical course facilitator has more than five years of teaching experience and holds a full-time job in the health care industry. Each facilitator supports a maximum of 15 students in one course to ensure that each student receives sufficient academic attention.

Students who are interested in research are encouraged to join MET Health Informatics Research Lab (http://www.met-hilab.org/) and carry out research projects under faculty supervision. The HI students and faculty contribute to the improvement of healthcare by pursuing research and development in health informatics, bioinformatics, and clinical research. The work carried out involves standardization, cataloging, and implementation of medical algorithms, development of classification algorithms for bioinformatics, and implementation of knowledge-based systems for biomedicine [Andre et al, 2015, Long et al, 2017, Ruth et al, 2016].

The Student Population and Google Trend

By 2017 spring semester, 181 students either have completed or are studying for MS CIS with HI concentration at MET. Among them, 69 are and female and 112 are male students. Other student statistics are: 22 on-campus *vs.*159 online, 14 international *vs.* 167 domestic, and five full-time *vs.* 176 part-time students. Our student age ranges from 24 to 66 with median age of 38, Fig. 2. Of our students, 26% have computer science, IT, engineering, or mathematics background; 17% students are from medicine, nursing, pharmacy, biology and healthcare, 29% of students are from other academic areas such as administrative science or management; while 28% students did not report their background, Fig. 3. Our students are from 29 states in the US and seven other countries (Bulgaria, Canada, China, Germany, Grenada, India, and United Arab

Emirates). The top ten US states based on the number of students are shown in Table 1.

Table 1. The top six US states based on the number of students.

STATES	NUMBER OF STUDENTS
MA	36
CA	17
NY	17
PA	13
NJ	10
TX	10
FL	7
GA	7
NC	7
VA	6

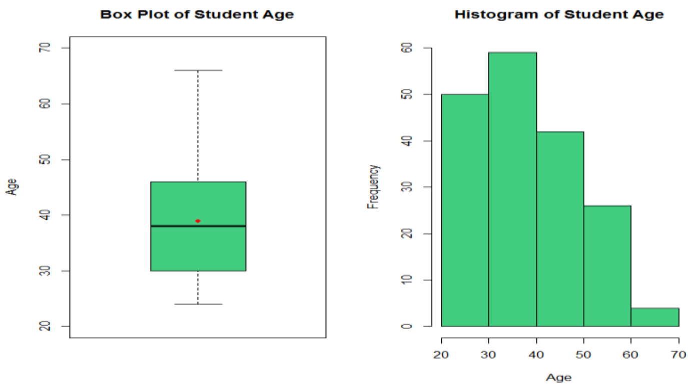

Fig. 2. Distribution of the MET CIS-HI student age

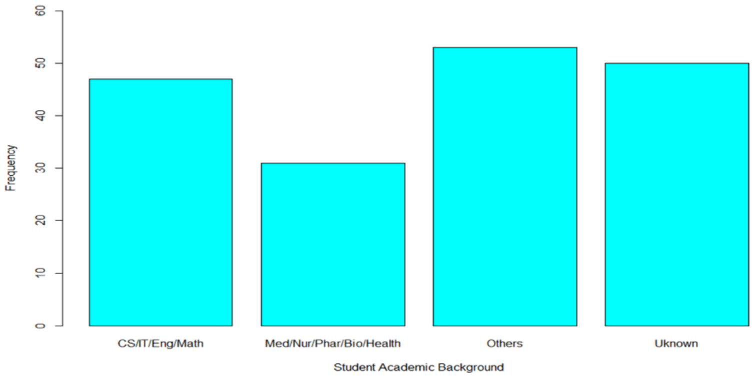

Fig. 3. Distribution of student academic background.

Google Trends is a public web facility of Google Inc., based on Google Search. It shows how often a particular search term is queried relative to the total search-volume across various regions of the world over a specific period of time. The data are anonymized, categorized and aggregated. The horizontal axis of the main graph represents time and the vertical is how often a term is queried in relation to the total number of searches. Fig. A4 shows the 5-year trend of HI job demands (red line) vs. interests in HI master programs (blue line). The blue and red curves show a delayed correlation showing that the interest in master programs in HI is highly influenced by the job demands. Fig. B4 shows the 13-year trend and geographical distribution of the interests in Registered Health Information Technician (RHIT) in blue line, Registered Health Information Administrator (RHIA) in red line, and health informatics in yellow line. It shows the interest in health informatics has been increasing steadily while the interest in RHIA and RHIA has remained more or less the same. The geographical distributions of the interest in RHIA and RHIT are almost identical concentrating on east and west coasts and several Mid-South states. The geographical distribution of the interest in health informatics is slightly different between the US states - people from the east and west coasts and Texas are showing more interest in HI studies. This corresponds to the distribution of our students shown in Table 1.

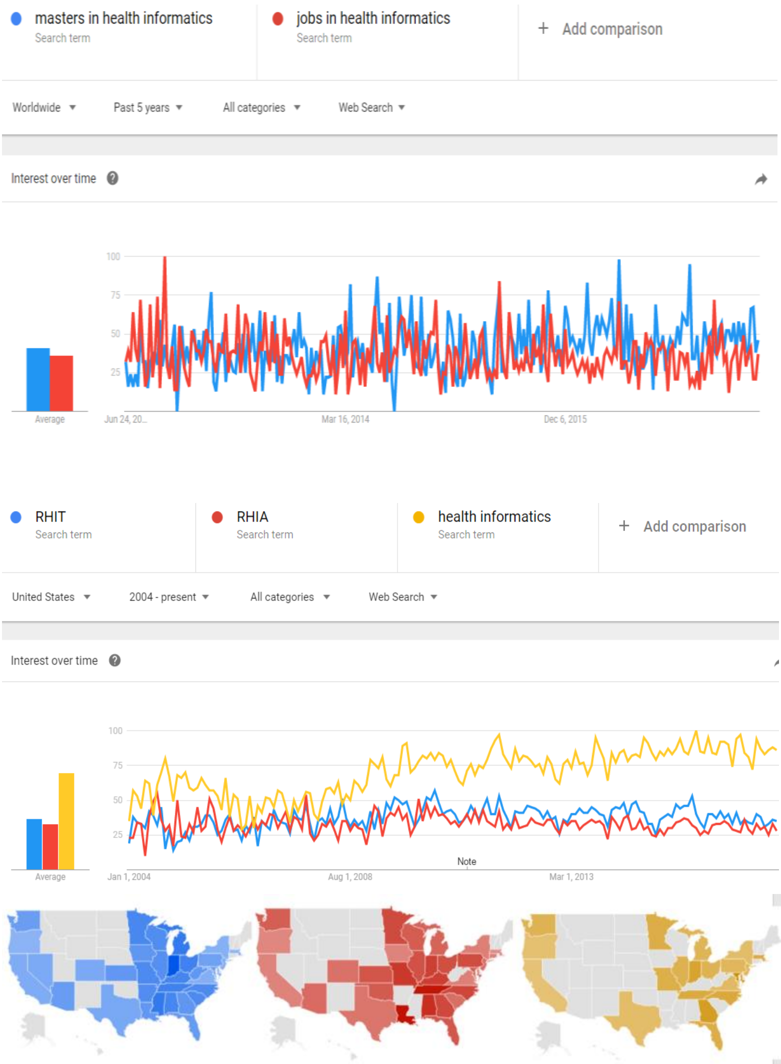

Fig. 4. Google trend data (from June 2012 to June 2017). Upper panel: HI job demands vs. interest in HI master programs. Lower panel: Interest of HI, Registered Health Information Administrator (RHIA) and Registered Health Information Technician (RHIT) in US from 2004 to 2017.

Discussion and Conclusion

Health Informatics positions are in high demand in the US job market. Based on the statistical analysis of our students, we found that a typical student is a 38 year old from the US employed in health care industry or wanting to change career and work in health care. The educational and professional background of our students is almost equally distributed three broad areas: CS/IT/Engineering/Math (technical), administration/management (administrative), and health care (health), A main challenge in developing graduate level programs to educate health informatics professionals is balancing the diverse requirements from stakeholders: formal accreditation, academic excellence and teaching constraints, governmental policies, and industry demands (Chitkushev, Zhang et al. 2014). Since the establishment of MET CIS-HI Ms program in 2011, we achieved a major milestone in 2017 – the degree program was fully accredited by the Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM). CAHIIM is the accrediting organization for degree-granting programs in health informatics and health information management. This globally recognized accreditation confirms that our curriculum meets or exceeds the academic standards set by the CAHIIM Board of Directors, and provides the assurance to the employers that graduates of the MET CIS-HI Ms program are trained to the highest professional standards and are prepared to excel in health IT careers. Our graduates are now eligible for a variety of services, certifications, scholarships, stipends, and resources through the CAHIIM member associations, the American Health Information Management Association (AHIMA) and the American Medical Informatics Association (AMIA). For example, one of the eligibility requirements for applying for RHIA and RHIT is to successfully complete the academic requirements, at the master's level, of an HIM program accredited by CAHIIM. So far nine health informatics master programs have been accredited by CAHIIM. In 2017, our program is the first and only program taught in the Computer Science Department. Our graduates have dual skills – they have the knowledge of health care requirements needed required from an expert user of IT technologies in health care, while at the same time they are trained to develop HI technology and solutions required for their own workplaces.

Bibliography

[Andre et al, 2015] Andre,J., Lu,C., Zhang,Y., Chayka,B., Huff,M., Shi,W., Xue,Y., Liu,Y., Huang,Y., Zhang,Y., Brusic,V., Zhang,G.L., Chitkushev L. T2DMS: An Online Education System for Type II Diabetes Management, Proceedings of CSECS 2015, July 20-23, Boston, MA, USA.

[Bureau of Labor Statistics, 2015] Bureau of Labor Statistics. Occupational Outlook Handbook.

[Burning Glass Technologies, 2015] Burning Glass Technologies. Missed Opportunities? The Labor Market in Health Informatics.

[Chitkushev et al, 2014] Chitkushev, L., Zhang,G.L., Zhang,Y., Schudy,R.B., Zlateva,T., Student Project Development Group, Brusic,V. Building graduate Health Informatics programs in the age of information technologies: balancing accreditation, academic, government and industry requirements for online education in the USA. The International Mobile Learning Festival. Bali, Indonesia.

[Long et al, 2017] Long,J., Zhang,Y., Brusic,V., Chitkushev,L., Zhang,G.L. Antidote Application: an educational system for treatment of common toxin overdose. ACM-BCB 2017, Aug 20-23, Boston, USA.

[Mantas et al, 2010] Mantas,J., Ammenwerth,E., Demiris,G., Hasman,A., Haux,R., Hersh,W., Hovenga,E., Lun,K.C., Marin,H., Martin-Sanchez,F., Wright,G., IMIA Recommendations on Education Task Force. Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics. First Revision. Methods Inf Med, 2010, 49(2): 105-120.

[Procter R, 2009] Procter,R. (Editor, Health Informatics Journal, Edinburgh, United Kingdom). Definition of health informatics [Internet]. Message to:

Virginia Van Horne (Content Manager, HSR Information Central, Bethesda, MD). 2009 Aug 16

[Ruth et al, 2016] Ruth,C, Yu,EA, Huey,S, Chitkushev,L, Mehta,SL, Zhang,GL. ConnEDCt: A Development Framework for Mobile Electronic Data Capture in Disconnected Communities. Computer Science and Education in Computer Science, 2016, 12, 219-233.

[Yasnoff et al, 2000] Yasnoff, W.A., O'Carroll,P.W., Koo,D., Linkins,R.W., Kilbourne,E.M.. Public health informatics: improving and transforming public health in the information age. J Public Health Manag Pract, 2000,6(6): 67-75.

Authors' Information

Guanglan ZHANG, Ph.D. and Assistant Professor, Boston University, guanglan@bu.edu

Major Fields of Scientific Research: *Bioinformatics, Health Informatics, Machine Learning, and Data Analytics.*

Vladimir BRUSIC, Ph.D., MBA, and Adjunct Professor, Boston University; Professor, Menzies Health Institute, Griffith University, v.brusic@griffith.edu.au

Major Fields of Scientific Research: *Bioinformatics, Health Informatics, Data Analytics, and Artificial Intelligence in Medicine.*

Lou CHITKUSHEV, Ph.D. and Associate Professor, Boston University, ltc@bu.edu

Major Fields of Scientific Research: *Health informatics, Data Communications, Computer Networks, and network security.*