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RESEARCH INTEREST

Intelligent Tutoring Systems; Data mining; User modeling in learning systems

EDUCATION

- **Ph.D. in Computer Science, Worcester Polytechnic Institute, Worcester, MA** **Aug., 2009**
Advisor: Prof. Neil T. Heffernan GPA: 4.0/4.0
Dissertation committee: Kenneth Koedinger (CMU), Joseph Beck (WPI), Carolina Ruiz (WPI)
Dissertation: Towards assessing students' fine grained knowledge: Using an intelligent tutor for assessing.
- **M.S. in Computer Science, Tianjin University, Tianjin, China** **May, 2002**
Advisor: Prof. Zheng Zhao
Thesis: A workflow and CORBA based, reconfigurable information system GPA 85/100
- **B.S. in Computer Science, Tianjin University, Tianjin, China, English minor** **May, 1999**
Thesis: The Application of Browser/Server Model in Enterprise Intranet GPA 88/100

RESEARCH & DEVELOPMENT EXPERIENCE

- **Summer research intern.** June, 1st - August 1st, 2008
Research and Development, Education Testing Service (ETS), Princeton, NJ
Mentor: Dr. Eric Hansen

Worked on the project of "Pilot testing of Evidence Centered Design (ECD) for learning-oriented products". Reviewed and helped enhance the framework of ECD for learning by bringing up some practical issues based on my experience in ASSISTment project. Then I used the ECDL framework to examine the ASSISTment system. (Related publication: CP7, WP4, O2).
- **Research Assistant** Jan 2004 - present
Department of Computer Science, Worcester Polytechnic Institute

Primary member of the ASSISTment project (<http://www.assistment.org>). We developed a web-based tutoring system to help middle and high school students to prepare for a high-stake standardized state test required by *No Child Left Behind* act. The system is currently being used regularly by more 3000 students from Worcester Public Schools, MA. I was the first database architect of the project, designed and implemented the first generation of logging and reporting system. I am in charge of the maintenance of more than 10 million individual student actions, and other meta data about users of our system. I have also done many data analysis works in order to increase assessment accuracy and instruction efficacy in ASSISTment.
- **Software Engineer** Oct., 2002 - Aug., 2003
Beijing Si-Tech Information Technology Co. , Beijing, China

Development of Information On Demand System 2.0, a system that provides text message services to cell phone users. The system was implemented on SunOS, by Sybase ASE, C language plus Java and Java

Script, J2EE.

- **Research Assistant**

Sept. 1999 - May, 2002

Dept. of Computer Science, Tianjin University

Primary member of National 863 High Technology Paradigm Project (team project of over 20 people), cooperated with Kelon Corp. I interviewed end-users, did user case analysis, designed database architecture and implemented a sales & marketing information management system. The system was based on Browser/Server computing architecture, distributed Database (Oracle), and national-scale Intranet. I mentored 3 undergraduate students, too. (related publications: J1, J2)

- **Teaching Assistant**

Sept. 2001 - May, 2002

Dept. of Computer Science, Tianjin University

Teaching assistant of graduate course Object-Oriented Methodology

SELECTED RESEARCH PROJECTS

- Reliable math proficiency assessment using statistical modeling method
 - a) **Dynamic testing** – Traditional tests only pay attention to whether a student’s response to a question is correct or wrong. But an intelligent tutoring system has the potential to use far more. I exploited the fine grained data in ASSISTment system to improve the accuracy of modeling a learner. I showed that you can do a better job of assessing students if you take into account students’ effort, and the nature and amount of help students need to solve a problem. In fact, my results suggested that there is more information in how much assistance they need than whether students got the questions correct or not. (related publications: J6, CP5, CP3, CP2, WP2)
 - b) **Longitudinal data analysis** – Student knowledge is not static but developed over time. In order to better understand the learning process and thus better assess student performance, I investigated student knowledge development longitudinally using mixed-effects modeling approach. (related publications: JS2, CP4, CP3, CP2, PP1, WP3)
 - c) **Cognitive assessment** – On top of overall performance estimate, both instructors and students want detailed reports to inform their instruction and learning. We constructed different grain sized cognitive models and developed skill-level reports. Additionally, I analyzed item level, longitudinal data and showed that by paying attention a fine grained model of what students are learning, that I could better predict students state test score. (related publication: J5, JS2, CP4, PP1, WP3)
 - d) **Refine cognitive model** through learning factor analysis (in progress) - Creating an accurate model of a students’ knowledge can be quite difficult due to various sources of uncertainty. The first model is the best guess and should be iteratively refined after usage in intelligent tutoring systems. In addition to providing data analysis results to subject matter experts so that they can manually improve the existing models, I am working on refine existing models using Learning Factor Analysis (LFA), a method involving artificial intelligent searching, and statistical modeling.
- Effectiveness of tutoring within the intelligent tutoring system

I designed, carried out and analyzed experiments to detect if and how much students are learning from ASSISTment. I also applied educational data mining approaches to compare effectiveness of different instructional content, and thus demonstrated an easier and quicker approach of evaluating the quality of contents in a learning system other than experimental studies (related publications: CP8, CP6)
- Design and implement reporting system in the ASSISTment project

I designed and implemented the first web-based reporting system in the ASSISTment project in 2004.

It provided real-time performance evaluation reports to teachers while students were working. The reporting system performed experiment analysis and delivered the results automatically. (related publications: J4, J3, WP1)

PUBLICATIONS

Book chapters

- B2.** **Feng, M.**, Heffernan, N.T., & Koedinger, K.R. (in submission). Student modeling in an Intelligent Tutoring System. Submitted to Stankov, Glavinc, and Rosic. (Eds.) *Intelligent Tutoring Systems in E-learning Environments: Design, Implementation and Evaluation*. IGI Global. early 2010 (anticipated)
- B1.** [Razzaq, L.](#), [Feng, M.](#), [Heffernan, N.](#), [Koedinger, K.](#), [Nuzzo-Jones, G.](#), [Junker, B.](#), [Macasek, M.](#), [Rasmussen, K.](#), [Turner, T.](#), & [Walonoski, J.](#) (2007). Blending Assessment and Instructional Assistance. In Nedjah, Mourelle, Borges and Almeida (Eds). *Intelligent Educational Machines within the Intelligent Systems Engineering Book Series*. pp.23-49. Springer Berlin / Heidelberg.

Journal papers

- J8.** Razzaq, L., Parvarczki, J., Almeida, S.F., Vartak, M., **Feng, M.**, Heffernan, N.T. and Koedinger, K. (2009). The ASSISTment builder: Supporting the Life-cycle of ITS Content Creation. *IEEE Transactions on Learning Technologies*.
- J7.** [Feng, M.](#), [Heffernan, N.](#), [Heffernan, C.](#) & [Mani, M.](#) (2009). Using mixed-effects modeling to analyze different grain-sized skill models. *IEEE Transactions on Learning Technologies*. vol. 2, no. 2, pp. 79-92, Apr.-June 2009. (Featured article of the issue) (Based on [WP3](#))
- J6.** [Feng, M.](#), [Heffernan, N.T.](#), & [Koedinger, K.R.](#) (2009). Addressing the assessment challenge in an Online System that tutors as it assesses. *User Modeling and User-Adapted Interaction: The Journal of Personalization Research (UMUAI)*. 19(3), 243-266. (James Chen award nominee) (Based on [CP2](#))
- J5.** [Razzaq, L.](#), [Heffernan, N.](#), [Feng, M.](#), [Pardos, Z.](#) (2007). Developing Fine-Grained Transfer Models in the ASSISTment System. *Journal of Technology, Instruction, Cognition, and Learning* , Vol. 5. Number 3. Old City Publishing, Philadelphia, PA. 2007. pp. 289-304. (Based on [WP3](#))
- J4.** [Feng, M.](#) & [Heffernan, N.](#) (2007). Towards Live Informing and Automatic Analyzing of Student Learning: Reporting in the Assistment System. *Journal of Interactive Learning Research*. 18 (2), pp. 207-230. Chesapeake, VA: AACE. (Based on [J3](#), [WP1](#))
- J3.** [Feng, M.](#), [Heffernan, N.T.](#) (2006). Informing Teachers Live about Student Learning: Reporting in the Assistment System. *Technology, Instruction, Cognition, and Learning Journal*. Vol. 3. Old City Publishing, Philadelphia, PA. 2006. (Based on [WP1](#))
- J2.** **Feng, M.**, Zhao, Z., & Zhang, G. (2002). Data collision and its solution in distributed situation (in Chinese), *Computer Application Research* (Chinese kernel academic journal), 2002, 19 (2) :72-74.
- J1.** **Feng, M.**, & Zhao, Z. (2002). Research of Reconfigure Information System Based on Workflow and CORBA (in Chinese), *Microcomputer and Its Application* (Chinese kernel academic journal), 2002, 1, 36-38.

Strictly peer reviewed conferences (Percent acceptance rate in the 30s% or below)

- CP9.** [Feng, M.](#), [Beck, J.](#), [Heffernan, N.T.](#) (2009). Using Learning Decomposition and Bootstrapping with Randomization to Compare the Impact of Different Educational Interventions on Learning. In Barnes, Desmarais, Romero, & Ventura (Eds.), *Proceedings of the 2nd International Conference on Educational Data Mining*. pp. 51-60. Cordoba, Spain: Copisterias Don Folio, S.L.
- CP8.** [Feng, M.](#), [Heffernan, N.T.](#), [Beck, J.](#) (2009). Using learning decomposition to analyze instructional effectiveness in the ASSISTment system. In Dimitrova, Mizoguchi, du Boulay, and Grasser (Eds), *Proceedings of the 14th International Conference on Artificial Intelligence in Education (AIED-2009)*. pp. 523-530. Amsterdam, Netherlands: IOS Press.
- CP7.** [Hansen E. G.](#), [Zapata-Rivera, D.](#), & [Feng, M.](#) (2009). Beyond Accessibility: Evidence Centered Design for Learning (ECDL) for Improving the Efficiency of Instruction. Paper presented at the session of *Test use in special populations* at the National Council on Educational Measurement 2009 Annual Conference (NCME, 2009).

- CP6. [Feng, M., Heffernan, N., Beck, J. & Koedinger, K. \(2008\)](#). Can we predict which groups of questions students will learn from? In Baker & Beck (Eds.). *Proceedings of the 1st International Conference on Education Data Mining*. pp.107-116. Montréal 2008.
- CP5. [Feng, M., Beck, J., Heffernan, N., & Koedinger, K. \(2008\)](#). Can an Intelligent Tutoring System predict math proficiency as well as a standardized test? In Baker & Beck (Eds.). *Proceedings of the 1st International Conference on Education Data Mining*. pp.218-225. Montréal 2008. (Based on [CP2](#))
- CP4. [Feng, M., Heffernan, N. T. \(2007\)](#). Assessing students' performance longitudinally: Item difficulty parameter vs. skill learning tracking. Paper presented at the 2007 Annual meeting of National Council on Educational Measurement, Chicago, 2007. (Based on [WP3](#))
- CP3. [Feng, M., Heffernan, N.T., Koedinger K.R \(2006b\)](#). Predicting state test scores better with Intelligent Tutoring Systems: Developing metrics to measure assistance required. *Proceedings of the 8th International Conference on Intelligent Tutoring Systems*, Taiwan, Springer-Verlag: Berlin. pp. 31-40.
- CP2. [Feng, M., Heffernan, N.T, Koedinger, K.R. \(2006a\)](#). Addressing the testing challenge with a web-based e-assessment system that tutors as it assesses. *Proceedings of the 15th International World Wide Web Conference*. pp. 307-316. ACM Press: New York, NY. (**Best Student Paper Nominee**)
- CP1. [Razaq, L., Feng, M., Nuzzo-Jones, G., Heffernan, N.T., Koedinger, K. R., Junker, B., Ritter, S., Knight, A., Aniszczyk, C., Choksey, S., Livak, T., Mercado, E., Turner, T.E., Upalekar, R, Walonoski, J.A., Macasek, M.A., Rasmussen, K.P. \(2005\)](#). The Assistment project: Blending assessment and assisting. In C.K. Looi, G. McCalla, B. Bredeweg, & J. Breuker (Eds.) In *Proceedings of the 12th Annual Conference on Artificial Intelligence in Education*, pages 555-562. Amsterdam: ISO Press.

Published 3-4 page Papers (aka "Poster") in prestigious conferences (Percent acceptance rate in the 50-60s%)

- PP2. [Feng, M., Beck, J. \(2009\)](#). Back to the future: a non-automated method of constructing transfer models. In Barnes & Desmarais (Eds.), *Proceedings of the 2nd International Conference on Educational Data Mining*. pp. 240-249. Cordoba, Spain: Copisterias Don Folio, S.L.
- PP1. [Pardos, Z., Feng, M. & Heffernan, N. T. & Heffernan-Lindquist, C. \(2007\)](#). Analyzing fine-grained skill models using Bayesian and mixed effect methods. In Luckin, Koedinger & Greer (Eds.) *Proceedings of the 13th Conference on Artificial Intelligence in Education*. Amsterdam, Netherlands: IOS Press. pp. 626-628. (Based on [WP3](#))

Workshop and less stringently reviewed venues

- WP4. [Feng, M., Hansen, E. & Zapata, D. \(2009\)](#). Using Evidence Centered Design for Learning (ECDL) to examine ASSISTment. Paper presented at the annual meeting of America Educational Research Association (AERA), San Diego, CA. April, 2009.
- WP3. [Feng, M., Heffernan, N.T, Mani M., & Heffernan C. \(2006\)](#). Using mixed-effects modeling to compare different grain-sized skill models. In Beck, J., Aimeur, E., & Barnes, T. (Eds). *Educational Data Mining: Papers from the AAAI Workshop*. Menlo Park, CA: AAAI Press. pp. 57-66.
- WP2. [Feng, M., Heffernan, N.T., Koedinger, K.R., \(2005\)](#). Looking for sources of error in predicting student's knowledge. In Beck, J. (Eds). *Educational Data Mining: Papers from the 2005 AAAI Workshop*. AAAI Press: Menlo Park, California. pp. 54-61.
- WP1. [Feng, M., Heffernan, N.T. \(2005\)](#). Informing Teachers Live about Student Learning: Reporting in the Assistment System. In the *12th Annual Conference on Artificial Intelligence in Education 2005 Workshop on Usage Analysis in Learning Systems*, 2005, Amsterdam.

Other articles

- O2. Weitz, R., Heffernan, N.T., Rosenthal, D. & **Feng, M.** An analysis of middle-school math errors across schools. WPI Technical Report. WPI-CS-TR-08-07.

AWARDS

- All reviewers of the journal *User Modeling and User Adapted Interaction: The Journal of Personalization Research* nominated our paper (J6 in publication section) for best paper award of the year. Actual nomination pending.
- Student travel grant from the National Science Foundation (NSF) for the 9th International Conference on Intelligent Tutoring Systems, 2008
- Student travel grant from the National Science Foundation (NSF) for the 13th International Conference on Artificial Intelligence in Education, 2007
- Nominated for “Best Student Paper” award, the 15th International Conference on World Wide Web, 2006
- Huawei Outstanding Graduate Student Award (prize for the top 1st graduate student in the department), Tianjin University. China. 2002.
- Motorola Outstanding Undergraduate Student Award (prize for top 5 undergraduate students in the department). Tianjin University, 1996, 1997.
- Outstanding Student Prize. Tianjin University. China. Yearly, 1996-2001.

PROFESSIONAL SERVICE

- **Reviewer:** International Conference of Artificial Intelligence in Education (AI-ED), 2007; International Conference on Intelligent Tutoring Systems (ITS) 2008; International Conference on Educational Data Mining (EDM), 2008; International Conference on Computers in Education (ICCE), 2008; American Educational Research Association (AERA) annual meeting, 2009
- **Program Committee:** Workshop on Educational Data Mining as part of International Joint Conference on Artificial Intelligence (IJCAI), 2007.

COMPUTER SKILLS

- Software: SPSS, R, BILOG-MG, LISREL, S-plus, Eclipse, Microsoft Visual Studio, Tomcat, Apache
- Operating Systems: Linux/Unix (Solaris, SunOS, AIX(IBM Certified Professional)), MS Windows
- Database: Oracle, MySQL, Sybase ASE, DB2 (IBM Certified Specialist), PostgreSQL
- Languages: C, Java, JSP, Java Servlet, Java/VB Script, ASP, HTML, XML, SQL, PL/SQL

REFERENCES

- **Dr. Neil T. Heffernan** (Ph.D. Advisor)
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 - Title:** Professor of Human Computer Interaction and Psychology

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- **Dr. Joseph E. Beck** (Ph.D. committee member)

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- **Dr. Eric G. Hansen** (Summer intern mentor)

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