Matthew R Boutell

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Education

University of Rochester (Rochester, NY), May, 2005
Ph.D. in Computer Science
Dissertation: Exploiting Context for Semantic Scene Classification
Co-advisors: Dr. Christopher M. Brown and Dr. Jiebo Luo

University of Rochester (Rochester, NY), May, 2002
M.S. in Computer Science
Area Paper: State of the Art in Semantic Scene Classification

University of Massachusetts (Amherst, MA), August, 1994
M.Ed. in Mathematics Education

Worcester Polytechnic Institute (Worcester, MA), May, 1993
B.S. in Mathematical Science with High Distinction

Teaching Experience

Rose-Hulman Institute of Technology (Terre Haute, IN), 2005-present
Associate Professor in the Department of Computer Science and Software Engineering. Taught Introduction to Software Development, Object-Oriented Software Development, Data Structures and Algorithm Analysis, Fundamentals of Software Development Honors, Cryptography, Fractals and Chaotic Dynamical Systems, and Mechatronics. Developed and taught a new course in Image Recognition and a new section of Introduction to Software Development using robotics programming. Rose-Hulman has been ranked for 13 years in a row as the #1 college for undergraduate engineering among institutions where a doctorate is not offered by *U.S. News and World Report*.

Stonehill College (Easton, MA), 1999-2000 (three semesters)
Adjunct Professor for *Computer Science I and II*, including C++ programming and introductory data structures. Stonehill was ranked #1 Comprehensive College in the North by *U.S. News and World Report*.

Norton High School (Norton, MA), 1994-2000
Teacher of mathematics (*Honors Precalculus, Algebra II, College Geometry, Honors Geometry, Pre-Algebra, Basic Math*) and computer programming courses (*Advanced Placement C++, BASIC*), with 4300+ hours of classroom time. Developed curriculum for school's first AP C++ course (over 70% of students who took it earned a '4' or '5'). Successfully incorporated *Geometer's Sketchpad* discovery software into all Geometry courses. Advised Math Team, Bible Club, Classes of 1998, 1999, and 2000).

University of Rochester (Rochester, NY), 2001-2002

Teaching Assistant for *Computer Models and Limitations* (Spring 2002; Prof. Lenhart Schubert), *Design and Analysis of Algorithms* (Fall 2001; Prof. Joel Seiferas), and *Visual Computing* (Spring 2001; Prof. Kyros Kutulakos). Held weekly recitations, and taught classes in instructors' absence. Led a team of assistants in grading assignments and answering student questions.

Teaching Philosophy and Evaluation

My teaching philosophy is that teaching is causing students to learn. I am only a successful teacher if my students succeed. I see three facets to this success:

1. My students achieve the outcomes of my courses (which I can measure).

2. My students aspire to study more after the course is completed (curiosity and interest).

3. My students develop integrity (academic honesty, professionalism, strong work ethic).

My teaching style is characterized by the enthusiasm I gain from continually learning. I don't want students to listen passively to my lectures, so I encourage active learning through in-class quizzes and outlines, mini-programming assignments done in class, and modeling of the problem solving process by developing code in class. I am clear with my expectations, grading all projects using a rubric shared in advance with my students.

My teaching has been evaluated primarily through anonymous student evaluations of my courses. Rose-Hulman students' overall ratings of me as a professor are on average **4.78/5.0 (5.0 = top), well above the third quartile at the Institute.** Average ratings of all characteristics of my courses are above the third quartile, and most are well above it. Some quotes that characterize my teaching are:

> "He is a very engaging professor that I would love to have again. He taught me quickly and effectively. At first I thought I wasn't going to even like this class, but now this is by far my favorite class..."
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> "He is an excellent teacher with sense of humor. He is always well prepared, interested in the class, and what is most important very interested in the well being of all students."
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> "I love Dr. B's fun and energetic borderline ecstatic teaching style that makes you excited about class...yeah for real, and he makes everything so clear and if he doesn't it's almost like he can sense it and will through in an xtra (sic) example just to solidify the idea being discussed."
>
> "Every day, we learned something with PRACTICAL application. All of the topics covered in this course seemed to be VERY usable in the workplace."
>
> He's a solid prof. And he's still got a passion for teaching. He hasn't been broken by student apathy, and still believes we enjoy doing homework. We like him for that.

Research Experience

Rose-Hulman Institute of Technology (Terre Haute, IN), 2005-present

Continued image recognition research, including indoor scene classification. Supervised two undergraduate thesis students and four independent study students, leading to three conference and workshop papers. With a colleague, developed and published a pedagogical technique for challenging advanced first-year computer science students. With colleagues, researched, developed, and published an educational robotics curriculum.

Eastman Kodak Company (Rochester, NY), 2001-2005

Research Intern/Consultant in the Image Understanding group. Worked on several image classification problems, including scene and orientation recognition. Responsible for data collection (multiple photo databases of over 2000 images), design, implementation, and testing of several feature extraction algorithms and full classification systems. Used temporal, spatial, and camera metadata cues to improve classification. Documented work in technical reports.

University of Rochester (Rochester, NY), 2002-2005

Research assistant supported by grants from Eastman Kodak Company. Investigated use of several probabilistic graphical models (Markov random fields, Bayesian networks, and factor graphs) for classification problems. Implemented each model and analyzed performance. Advised three first-year PhD students each in class projects, leading to two conference papers and a journal publication.

Publications, Presentations, and Patents

Refereed Journal Papers

1. Matthew Boutell, Carlotta Berry, David Fisher, and Steve Chenoweth. A multidisciplinary robotics minor. *ASEE Computers in Education Journal, Special Issue on Novel Approaches to Robotics Education*, 1(3), pp. 102-111, July 2010.

2. Matthew Boutell, Jiebo Luo, and Christopher Brown. Scene parsing using region-based generative models. *IEEE Transactions on Multimedia,* 9(1), pp. 136-146, January 2007.

3. Jiebo Luo, Matthew Boutell, and Christopher Brown. Pictures are not taken in a vacuum: An overview of exploiting context for semantic scene content understanding. *IEEE Signal Processing Magazine,* 23(2), pp. 101-114, March 2006. **Nominated for the Best Paper award**.

4. Matthew Boutell, Jiebo Luo, and Christopher Brown. A generalized temporal context model for classifying image collections. *ACM Multimedia Systems*, 11(1), pp. 82-92, November 2005.

5. Jiebo Luo and Matthew Boutell. Natural scene classification using overcomplete ICA. *Pattern Recognition*, 38(10), pp. 1507-1519, October 2005.

6. Jiebo Luo, Matthew Boutell, Robert T. Gray, and Christopher Brown. Image transform bootstrapping and its applications to semantic scene classification. *IEEE Transactions on Systems, Man, and Cybernetics, Part B*, 35(3), June 2005.

7. Matthew Boutell and Jiebo Luo. Beyond pixels: Exploiting camera metadata for photo classification. *Pattern Recognition, Special Issue on Image Understanding for Digital Photos*, 38(6), June 2005.

8. Jiebo Luo and Matthew Boutell. Automatic image orientation detection via confidence-based integration of low-level and semantic cues. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 27(5), pp. 715-726, May 2005.

9. Matthew Boutell, Xipeng Shen, Jiebo Luo, and Christopher Brown. Learning multi-label semantic scene classification. *Pattern Recognition*, 37(9), pp. 1757-1771, September 2004.

10. Jiebo Luo, David Crandall, Amit Singhal, Matthew Boutell, and Robert T. Gray. Psychophysical study of image orientation perception. *Spatial Vision*, 16(5), pp. 429-457, December 2003.

Refereed Conference and Workshop Papers

11. Matt Boutell and Curt Clifton. SPLICE: Self-Paced Learning in an Inverted Classroom Environment. *SIGCSE 2011 Technical Symposium on Computer Science Education*, Dallas, TX, March 11, 2011.

12. Andrew Hettlinger and Matthew Boutell. A simulator for teaching robotics using the iRobot Create. *AAAI 2010 Symposium on Educational Advances in Artificial Intelligence*, Atlanta, GA, June 2010.

13. Carlotta Berry, Matthew Boutell, Steve Chenoweth, and David Fisher. MERI: Multidisciplinary educational robotics initiative. *Proceedings of the American Society for Engineering Education*, Austin, TX, June 2009.

14. Joshua Burbrink, Justin Miller, and Matthew R. Boutell. Comparison of two methods in detecting late-night talk shows using pattern recognition. *American Society for Engineering Education IL/IN Section Conference*, Terre Haute, IN, April 3-5, 2008.

15. Lisa C. Kaczmarczyk, Matthew R. Boutell, and Mary Z. Last. Challenging the advanced first-year student's learning process through student presentations. *The Third International Computing Education Research Workshop*, Atlanta, GA, September 15-16, 2007.

16. Brian Ayers and Matthew Boutell. Home interior classification using SIFT keypoint histograms. *International Workshop on Semantic Learning Applications in Multimedia* (in conjunction with CVPR2007), Minneapolis, MN, June 2007.

17. Matthew Boutell, Jiebo Luo, and Christopher Brown. Factor-graphs for region-based whole-scene classification. International *Workshop on Semantic Learning Applications in Multimedia* (in conjunction with CVPR2006), New York, NY, June 2006.

18. Matthew Boutell, Anustup Choudhury, Jiebo Luo, and Christopher Brown. Using semantic features for scene classification: How good do they need to be? *IEEE International Conference on Multimedia and Expo*, Toronto, July 2006.

19. Matthew Boutell and Jiebo Luo. Overcomplete ICA for manmade scene classification. *IEEE International Conference on Multimedia and Expo*, Amsterdam, NL, July 2005.

20. Matthew Boutell, Jiebo Luo, and Christopher Brown. Improved semantic region labeling based on scene context. *IEEE International Conference on Multimedia and Expo*, Amsterdam, NL, July 2005.

21. Matthew Boutell and Jiebo Luo. Photo classification by integrating image content and camera metadata. *International Conference on Pattern Recognition*, Cambridge, UK, August 2004.

22. Matthew Boutell and Jiebo Luo. Incorporating temporal context with content for classifying image collections. *International Conference on Pattern Recognition*, Cambridge, UK, August 2004.

23. Matthew Boutell, Jiebo Luo, and Christopher Brown. Learning spatial configuration models using modified Dirichlet priors. *Workshop on Statistical Relational Learning* (in conjunction with ICML2004), Banff, Alberta, July 2004.

24. Matthew Boutell and Jiebo Luo. Bayesian fusion of camera metadata cues in semantic scene classification. *IEEE Conference on Computer Vision and Pattern Recognition*, Washington, DC, June 2004.

25. Matthew Boutell and Jiebo Luo. A generalized temporal context model for semantic scene classification. *IEEE Workshop on Learning in Computer Vision and Pattern Recognition* (in conjunction with CVPR2004), Washington, DC, June 2004.

26. Jiebo Luo and Matthew Boutell. A probabilistic approach to image orientation detection via confidence-based integration of low-level and semantic cues. *4th International Workshop on Multimedia Data and Document Engineering* (in conjunction with CVPR2004), Washington, DC, July 2004.

27. Xipeng Shen, Matthew Boutell, Jiebo Luo, and Christopher Brown. Multi-label machine learning and its application to semantic scene classification. *International Symposium on Electronic Imaging*, San Jose, CA, January, 2004.

28. Jiebo Luo, Matthew Boutell, Robert T. Gray, and Christopher Brown. Using image transform-based bootstrapping to improve scene classification. *2004 International Symposium on Electronic Imaging*, San Jose, CA, January 2004.

29. Matthew Boutell, Jiebo Luo, and Robert T. Gray. Sunset scene classification using simulated image recomposition. *IEEE International Conference on Multimedia and Expo*, Baltimore, MD, July 2003.

Non-refereed Papers

30. Delvin Defoe, Matt Boutell, and Curtis Clifton. PyTetris. CCSC:Midwest 2010 Nifty Tools and Assignments, Franklin, IN, Sept 25, 2010.

31. Matthew Boutell and Jiebo Luo. Indoor-outdoor scene classification: Re-implementation. Eastman Kodak Company Technical Memorandum, June 9, 2003.

32. Matthew Boutell, Jiebo Luo, Amit Singhal, and Christopher Brown. Survey on the state of the art in semantic scene classification. Eastman Kodak Company Technical Report, June 19, 2002 and Technical Report 799, University of Rochester, Rochester, NY, December 2002.

33. Matthew Boutell and Jiebo Luo. Single-frame orientation using low-level features. Eastman Kodak Company Technical Report and Technical Report 758, University of Rochester, Rochester, NY, September 2001.

Research Presentations

1. "Probabilistic Graphical Models for Improving Photograph Classification", *Engineer's Week* presentation at Raytheon Technical Services Company, Indianapolis, IN, February 23, 2011.

2. "Teaching Computers In From Out", *Wabash College Mathematics and Computer Science Colloquium*, Crawfordsville, IN, February 12, 2008.

3. "Probabilistic Graphical Models for Improving Photograph Classification", *Indiana University Biocomplexity Institute Seminar*, Bloomington, IN, October 31, 2006.

4. "Factor-graphs for region-based whole-scene classification", *International Workshop on Semantic Learning Applications in Multimedia* (in conjunction with CVPR2006), New York, NY, June 18, 2006.

5. "Expanding your vision: Using context for photograph classification" presented to Rose-Hulman Institute of Technology Department of Computer Science, Terre Haute, IN; Rochester Institute of Technology Department of Computer Science, Rochester, NY; Hobart and William Smith Colleges Department of Mathematics and Computer Science, Geneva, NY; General Electric Visualization and Computer Vision Laboratory, Niskayuna, NY; February-March 2005.

6. Annual presentations given at Eastman Kodak Company Imaging Science Division Technical Presentations, 2001-2004.

7. "Manmade-natural photo classification using ICA", *IEEE Western New York Image Processing Workshop*, September 24, 2004. **Won "Best Student Paper" Award**.

8. "A generalized temporal context model for semantic scene classification", *IEEE Workshop on Learning in Computer Vision and Pattern Recognition* (in conjunction with CVPR2004), Washington, DC, June 28, 2004.

9. "Multi-label machine learning and its application to semantic scene classification", *International Symposium on Electronic Imaging*, January 21, 2004.

10. "Using image transform-based bootstrapping to improve scene classification", *International Symposium on Electronic Imaging*, January 21, 2004.

11. "Outdoor scene classification", *IEEE Western New York Image Processing Workshop*, October 17, 2003.

12. "Sunset scene classification using simulated image recomposition", *International Conference on Multimedia and Exp*o, July 8, 2003.

13. "Sunset scene classification", *URCS Vision Group*, April 2, 2003.

14. "MASSES: Material and spatial simulated experimental scenes", *Center for Electronic Imaging Systems (CEIS) Electronic Imaging Research Showcase*, January 29, 2003.

15. "State of the art in scene categorization", *URCS Vision Group*, April 17, 2002.

16. "Single-frame orientation using low-level features", *Center for Electronic Imaging Systems (CEIS) Winter Technology Interchange*, January 30, 2002.

17. "Single-frame orientation using low-level features", *URCS Vision Group*, October 24, 2001.

18. "Twenty-first century portraits by Van Gogh: Learning and using a painter's style", Joint work with Kyros Kutulakos and Andrew Blake, *URCS Vision Group*, January 26, 2001.

Patents

1. Jiebo Luo, Matthew Boutell, Robert T. Gray, "Method for using effective spatio-temporal image recomposition to improve scene classification", U.S. Patent number 7,313,268, issued December 25, 2007.

2. Jiebo Luo, Matthew Boutell, Robert T. Gray, "Method for semantic scene classification using camera metadata and content-based cues", U.S. Patent number 7,555,165, issued June 30, 2009.

3. Jiebo Luo, Matthew Boutell, "Method of using temporal context for image classification", U.S. Patent number 7,680,340, issued March 16, 2010.

Grant Activity

MERI: Multidisciplinary Educational Robotics Initiative: Developing a Robotics Certificate Program at Rose-Hulman, $100,000, 2008-2011.

With Carlotta Berry, Steven Chenoweth, and David Fisher, proposed and received a Lilly Endowment Faculty Success Grant. We developed a new Robotics Certificate program for students studying Mechanical, Electrical, Computer and Software Engineering and Computer Science. Students take courses in these areas and complete a multidisciplinary robotics senior project. Led the marketing of the program to prospective students, incoming freshmen, and upperclassmen through presentations, brochures, and a website (robotics.rose-hulman.edu). To date, 10 students have graduated with the certificate.

SPLICE: Self-Paced Learning in an Inverted Classroom Environment, $10,000, 2010.

With Curt Clifton, proposed and received a summer professional development grant from Rose-Hulman. For the project we created on-line videos that present concepts in C language programming, show examples, and model the problem solving process. We also developed a plan for assessing the effectiveness of this approach, and began seeking additional funding to extend the approach to the rest of our introductory curriculum. We will deploy the videos during the 2010-11 academic year. Our goal is that students will spend every class session over this material entirely in active learning activities with expert coaching, receive more individual attention, and be able to set their own pace.

Thesis, Project, and Independent Study Advising

- Jasmine Browne, Dominic Gates, Alexander Gumz, Timothy Wentz:*Beckman Coulter Electrophoresis User Interface*. ROBO410-430: Robotics Capstone Design I – III co-instructor, 2010-2011.

- Tony Ferrell, *Fractured Image Reconstruction*, CSSE Thesis advisor, 2009-2010. Tony was interested in figuring out how to match pieces of an image using image content only, ignoring the shapes of the pieces.
- Nathan Sickler, *Using Kalman Filtering to Improve Webcam Tracking*. Independent Study advisor, 2009. Nathan's project for the Imaging Systems Certificate was developed for my Image Recognition course.
- Nobu Hiro, Peter Leigh, Colin Shipley, Adam Wesley: *Terre Haute Children's Museum Robotic Arm Exhibit*. ROBO410-430: Robotics Capstone Design I – III co-instructor, 2009-2010.
- Matthew DeVries, *Robotic Part Selection, Positioning and Orientation Using Machine Vision*, Mechanical Engineering Masters Thesis committee member, 2009-2010.
- Joshua Burbrink, *Semantic Support Vector Machines*, CSSE Thesis advisor, 2008-2009. Joshua's project involved using ontologies to improve the classification of photos uploaded unto Flickr.
- Casimir Ksiazek III, *Efficient Guessing Strategies for Variations of Mastermind*, MA Thesis committee, 2008-2009.
- Andrew Hettlinger, *The Graphics Subset of the Roomba Simulator*, Advisor for Imaging Systems Certificate final project, 2009.
- John-Paul Verkamp, *Audio Depth Map as Replacement for Traditional Vision*. Independent Study advisor, 2008. JP studied the use of stereo-vision algorithms and three-dimensional stereophonic sound as a potential replacement for human vision.
- Brian Ayers, Home interior classification using SIFT keypoint histograms. Independent study advisor, 2006. Compared existing techniques of classifying indoor photographs, and developed a new technique to do so.

Professional Service, Outreach, and Memberships

- Co-organized with Jerod Weinman a special session at ACM SIGCSE, bringing together undergraduate educators in Imaging and Computer Vision, March, 2010.
- Led a Python Programming session at *Operation Catapult*, a summer program at Rose-Hulman for high school seniors interested in science and engineering. Taught 18 students in July 2007 and 20 students in June, 2010. In 2007, a team of my students, Bryan Watts, Chris Ohslund, and Jake Valentic, placed second out of 34 for their *Tanks* project. In 2010, a team of my students, Rodney Folz and AJ Piergiovanni, placed second out of 31 for their *Genesis* networked game engine project.
- Created, organized and led *APCS Gridworld*, a workshop for Indiana high school teachers of Advanced Placement Computer Science, at Rose-Hulman on August 8, 2007. Supported by PRISM and Rose-Hulman Ventures.
- Presented a unit on robotics programming at *Explore Engineering*, a campus outreach program for middle-school students, December, 2008.
- Department Representative to the *Computer Science Teachers Association*, 2007 - present.
- Program committee, Workshop on Semantic Learning Applications in Multimedia, *IEEE Conference on Computer Vision and Pattern Recognition*, 2006-2009.
- Reviewed papers for:

  Computer Vision and Image Understanding (April 11)

  IEEE Transactions on Circuits and Systems for Video Technology (Nov 09)

Pattern Analysis & Applications Journal (Jun 06; Dec 08)

IEEE International Conference on Multimedia and Expo (Mar 09)

International Workshop on Semantic Learning Applications in Multimedia (Apr 06; Apr 07; Apr 08; Apr 09)

Systems, Man and Cybernetics - Part B (Apr 09; Sep 09)

Pattern Recognition (Sep 06; Jun 09)

IEEE Transactions on Pattern Analysis and Machine Intelligence (May 08; Jul 08)

Advances in Engineering Education (Jul 08)

IEEE Transactions on Multimedia (Mar 07; May 08)

IEEE Transactions on Neural Networks (Dec 07)

ACM SIGCSE Technical Symposium on Computer Science Education (Nov 07; Oct 09; Sept 10)

IEEE International Conference on Development and Learning (Apr 07).

Iranian Journal of Electrical and Computer Engineering (Apr 06)

IEEE Signal Processing Magazine (pre-06)

SPIE Journal of Electronic Imaging (pre-06)

Image and Vision Computing (pre-06)

- Member of the *Institute of Electrical and Electronics Engineers (IEEE)* and the *IEEE Computer Society*.
- Member of the *Association of Computing Machinery (ACM)* and the *ACM Special Interest Group in Computer Science Education (SIGCSE)*.

Academic Service

- Academic advisor to 18 Computer Science majors, 2010-2011.
- Academic advisor to 16 Computer Science majors, 2006-2009.
- Director of the RHIT Imaging Systems Laboratory, 2007-present.
- Advised *Upsilon Pi Epsilon*, Indiana Alpha Chapter, 2008-present.
- Served on the Quality of Education Committee, 2009-2011.
- Served on the Admissions and Standing Committee, 2008-2009.
- Served on the Diversity Committee, 2008-2009.
- Chaired a departmental committee that coordinates student assistants in courses, 2007-2008.
- Served on a committee to update the CSSE Fundamentals sequence, 2006-2007.
- Served on the Graduate Studies Committee, 2006-2008.

- Assisted with Laptop orientation for first-year students, August 2005, 2006, and 2007.
- Represented CSSE department at Admissions open houses, 2005-2006.
- Served as a RosE-Portfolio rater, May 2006.
- URCS Curriculum Committee, 2004-5.
- Organized bi-weekly Vision Interest Meetings at URCS, 2004-5.
- URCS Graduate Representative to the Faculty, 2003-4.
- URCS Graduate Admissions Committee, 2002-3.

Other Information

Community Service

- Soccer coach or assistant coach, Vigo County Youth Soccer Association, ranging from U5 to U12, 2007-present.
- Elder and Financial Coordinator, *Mosaic Church*, 2008-present.

Honors

- Supported by a federal GAANN fellowship for first three years of PhD studies, 2000-2003.
- Award for most papers published by a graduate student, URCS, 2004.
- Best Student Paper award, *IEEE Western New York Image Processing Workshop*, 2004.
- Included six times in *Who's Who Among American Teachers and Educators* (editions 5, 6, 8, 9, 10, and 11, spanning 1998-2007).
- Inducted into *Pi Mu Epsilon* (math), *Tau Beta Pi* (engineering), and *Upsilon Pi Epsilon* (computer science) honor societies.
- Won *Worcester Polytechnic Institute Class of 1879 Prize for Outstanding Project in the Humanities* for "The Flood", an original composition for brass quintet, 1991.
- *Randall Burton Scholarship* for graduate studies, Plumbers and Pipefitters' Union Local No. 4, 2001.

Personal Data

Place of Birth: Gardner, Massachusetts, USA
Citizenship: USA

References

Available upon request