

# NIGEL BOSCH

Curriculum Vitae

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National Center for Supercomputing Applications  
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## Education

- 2017 PhD, Computer Science  
University of Notre Dame, Notre Dame, IN 46556
- 2016 MS, Computer Science  
University of Notre Dame, Notre Dame, IN 46556
- 2012 BS, Computer Science  
Abilene Christian University, Abilene, TX 79699

## Appointments

- 2017–Present Postdoctoral Researcher  
National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign
- 2012–2017 Graduate Research Assistant  
Emotive Computing Lab, University of Notre Dame
- 2010–2012 Software Development Intern  
Milsoft Utility Solutions, Abilene, TX

## Grants

- 2016 National Science Foundation Travel Award (\$1449). 24<sup>th</sup> ACM Conference on User Modeling, Adaptation and Personalization (UMAP)
- 2015 National Science Foundation Travel Award (\$2398). 17<sup>th</sup> ACM International Conference on Multimodal Interaction (ICMI).
- 2015 National Science Foundation Travel Award (\$1250). 20<sup>th</sup> ACM Conference on Intelligent User Interfaces (IUI 2015).

- 2015 National Science Foundation Travel Award (\$1000). 8<sup>th</sup> International Conference on Educational Data Mining (EDM 2015) and 17<sup>th</sup> International Conference on Artificial Intelligence in Education (AIED 2015).
- 2015 University of Notre Dame Professional Development and Graduate Student Union Conference Presentation Grant (\$2600). 8<sup>th</sup> International Conference on Educational Data Mining (EDM 2015) and 17<sup>th</sup> International Conference on Artificial Intelligence in Education (AIED 2015).
- 2013 National Science Foundation Travel Award (\$1300). Doctoral Consortium at 16<sup>th</sup> International Conference on Artificial Intelligence in Education (AIED 2013).

## Awards

**AIED 2018 Best Student Paper Award:** Jiang, Y., **Bosch, N.**, Baker, R. S., Paquette, L., Ocumpaugh, J., Andres, J. M. A. L., ... Biswas, G. (2018). Expert feature-engineering vs. deep neural networks: Which is better for sensor-free affect detection? In C. Rosé, R. Martínez-Maldonado, H. U. Hoppe, R. Luckin, M. Mavrikis, K. Porayska-Pomsta, ... B. du Boulay (Eds.), *Proceedings of the 19th International Conference on Artificial Intelligence in Education (AIED 2018)* (pp. 198–211). London, UK: Springer, Cham.

**UMAP 2017 Best Student Paper Award:** Hutt, S., Mills, C., **Bosch, N.**, Krasich, K., Brockmole, J., & D’Mello, S. K. (2017). Out of the fr-"eye"-ing pan: Towards gaze-based models of attention during learning with technology in the classroom. In *Proceedings of the 2017 Conference on User Modeling, Adaptation, and Personalization (UMAP 2017)* (pp. 94–103). New York, NY: ACM.

**EDM 2017 Best Student Paper Award:** Stewart, A., **Bosch, N.**, & D’Mello, S. K. (2017). Generalizability of face-based mind wandering detection across task contexts. In X. Hu, T. Barnes, A. HersHKovitz, & L. Paquette (Eds.), *Proceedings of the 10th International Conference on Educational Data Mining (EDM 2017)* (pp. 88–95). International Educational Data Mining Society.

**AIED 2015 Best Paper Award:** **Bosch, N.**, D’Mello, S., Baker, R., Ocumpaugh, J., & Shute, V. J. (2015). Temporal generalizability of face-based affect detection in noisy classroom environments. In C. Conati, N. T. Heffernan, A. Mitrovic, & M. Felisa Verdejo (Eds.), *Proceedings of the 17th International Conference on Artificial Intelligence in Education (AIED 2015)* (pp. 44–53). Berlin Heidelberg: Springer-Verlag.

**EDM 2015 Best Student Paper Award:** Kai, S., Paquette, L., Baker, R., **Bosch, N.**, D’Mello, S., Ocumpaugh, J., ... Ventura, M. (2015). Comparison of face-based and interaction-based affect detectors in physics playground. In C. Romero, M. Pechenizkiy, J. Boticario, & O. Santos (Eds.), *Proceedings of the 8th International Conference on Educational Data Mining (EDM 2015)* (pp. 77–84). International Educational Data Mining Society.

**IUI 2015 Honorable Mention for Best Paper Award:** **Bosch, N.**, D’Mello, S., Baker, R., Ocumpaugh, J., Shute, V. J., Ventura, M., ... Zhao, W. (2015). Automatic detection of learning-centered affective

states in the wild. In *Proceedings of the 2015 International Conference on Intelligent User Interfaces (IUI 2015)* (pp. 379–388). New York, NY: ACM.

**ICSE 2014 ACM Distinguished Paper Award:** Rodeghero, P., McMillan, C., McBurney, P. W., **Bosch, N.**, & D’Mello, S. (2014). Improving automated source code summarization via an eye-tracking study of programmers. In *Proceedings of the 36th International Conference on Software Engineering (ICSE 2014)* (pp. 390–401). New York, NY: ACM.

## Publications

### Peer-reviewed Published Conference Proceedings

**Bosch, N.**, Crues, R. W., & Shaik, N. (in press). Diverse learners, diverse motivations: Exploring the sentiment of learning objectives. In K. E. Boyer & M. V. Yudelson (Eds.), *Proceedings of the 11th International Conference on Educational Data Mining (EDM 2018)*. International Educational Data Mining Society.

Crues, R. W., **Bosch, N.**, Anderson, C. J., Perry, M., Bhat, S., & Shaik, N. (in press). Who they are and what they want: Understanding the reasons for MOOC enrollment. In K. E. Boyer & M. V. Yudelson (Eds.), *Proceedings of the 11th International Conference on Educational Data Mining (EDM 2018)*. International Educational Data Mining Society.

Crues, R. W., **Bosch, N.**, Perry, M., Angrave, L., Shaik, N., & Bhat, S. (2018). Refocusing the lens on engagement in MOOCs. In R. Luckin, K. R. Koedinger, & S. Klemmer (Eds.), *Proceedings of the 5th (2018) ACM Conference on Learning@Scale*. New York, NY: ACM.

**Bosch, N.**, Mills, C., Wammes, J. D., & Smilek, D. (2018). Quantifying classroom instructor dynamics with computer vision. In C. Rosé, R. Martínez-Maldonado, H. U. Hoppe, R. Luckin, M. Mavrikis, K. Porayska-Pomsta, ... B. du Boulay (Eds.), *Proceedings of the 19th International Conference on Artificial Intelligence in Education (AIED 2018)* (pp. 30–42). London, UK: Springer, Cham.

Jiang, Y., **Bosch, N.**, Baker, R. S., Paquette, L., Ocumpaugh, J., Andres, J. M. A. L., ... Biswas, G. (2018). Expert feature-engineering vs. deep neural networks: Which is better for sensor-free affect detection? In C. Rosé, R. Martínez-Maldonado, H. U. Hoppe, R. Luckin, M. Mavrikis, K. Porayska-Pomsta, ... B. du Boulay (Eds.), *Proceedings of the 19th International Conference on Artificial Intelligence in Education (AIED 2018)* (pp. 198–211). London, UK: Springer, Cham.

Paquette, L., **Bosch, N.**, Mercier, E., Jung, J., Shehab, S., & Tong, Y. (2018). Matching data-driven models of group interactions to video analysis of collaborative problem solving on tablet computers. In J. Kay & R. Luckin (Eds.), *Proceedings of the 13th International Conference of the Learning Sciences (ICLS) 2018, Volume 1* (pp. 312–319). London, UK: International Society of the Learning Sciences.

- Bosch, N.**, Crues, R. W., Henricks, G. M., Perry, M., Angrave, L., Shaik, N., ... Anderson, C. J. (2018). Modeling key differences in underrepresented students' interactions with an online STEM course. In *Proceedings of TechMindSociety '18*. New York, NY: ACM.
- Stewart, A., **Bosch, N.**, Chen, H., Donnelly, P. J., & D'Mello, S. K. (2017). Face forward: Detecting mind wandering from video during narrative film comprehension. In E. André, R. S. Baker, X. Hu, M. M. T. Rodrigo, & B. du Boulay (Eds.), *Proceedings of the 18th International Conference on Artificial Intelligence in Education (AIED 2017)* (pp. 359–370). Berlin Heidelberg: Springer.
- Stewart, A., **Bosch, N.**, & D'Mello, S. K. (2017). Generalizability of face-based mind wandering detection across task contexts. In X. Hu, T. Barnes, A. HersHKovitz, & L. Paquette (Eds.), *Proceedings of the 10th International Conference on Educational Data Mining (EDM 2017)* (pp. 88–95). International Educational Data Mining Society.
- Kahn, S., Suendermann-Oeft, D., Evanini, K., Williamson, D. M., Paris, S., Qian, Y., Huang, Y., **Bosch, N.**, D'Mello, S. K., Loukina, A., & Davis, L. (2017). MAP: Multimodal assessment platform for interactive communication competency. In S. Shehata & J. P.-L. Tan (Eds.), *Practitioner Track Proceedings of the 7th International Learning Analytics & Knowledge Conference (LAK17)* (pp. 6–12). SoLAR.
- Hutt, S., Mills, C., **Bosch, N.**, Krasich, K., Brockmole, J., & D'Mello, S. K. (2017). Out of the fr-"eye"-ing pan: Towards gaze-based models of attention during learning with technology in the classroom. In *Proceedings of the 2017 Conference on User Modeling, Adaptation, and Personalization (UMAP 2017)* (pp. 94–103). New York, NY: ACM.
- D'Mello, S. K., Mills, C., Bixler, R., & **Bosch, N.** (2017). Zone out no more: Mitigating mind wandering during computerized reading. In X. Hu, T. Barnes, A. HersHKovitz, & L. Paquette (Eds.), *Proceedings of the 10th International Conference on Educational Data Mining (EDM 2017)* (pp. 8–15). International Educational Data Mining Society.
- D'Mello, S. K., Kopp, K., Bixler, R., & **Bosch, N.** (2016). Attending to attention: Detecting and combating mind wandering during computerized reading. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (pp. 1661–1669). New York, NY: ACM.
- Bosch, N.**, D'Mello, S. K., Baker, R. S., Ocumpaugh, J., Shute, V., Ventura, M., ... Zhao, W. (2016). Detecting student emotions in computer-enabled classrooms. In *Proceedings of the 25th International Joint Conference on Artificial Intelligence (IJCAI 2016)* (pp. 4125–4129). Menlo Park, CA: AAAI Press.
- Bosch, N.** (2016). Detecting student engagement: Human versus machine. In *Proceedings of the 2016 Conference on User Modeling, Adaptation, and Personalization (UMAP 2016)* (pp. 317–320). New York, NY: ACM.

- Dillon, J., **Bosch, N.**, Chetlur, M., Wanigasekara, N., Ambrose, G. A., Sengupta, B., & D’Mello, S. K. (2016). Student emotion, co-occurrence, and dropout in a MOOC context. In T. Barnes, M. Chi, & M. Feng (Eds.), *Proceedings of the 9th International Conference on Educational Data Mining (EDM 2016)* (pp. 353–357). International Educational Data Mining Society.
- Stewart, A., **Bosch, N.**, Chen, H., Donnelly, P. J., & D’Mello, S. K. (2016). Where’s your mind at? Video-based mind wandering detection during film viewing. In *Proceedings of the 2016 Conference on User Modeling, Adaptation, and Personalization (UMAP 2016)* (pp. 295–296). New York, NY: ACM.
- Bosch, N.**, Chen, H., Baker, R., Shute, V., & D’Mello, S. (2015). Accuracy vs. availability heuristic in multimodal affect detection in the wild. In *Proceedings of the 17th International Conference on Multimodal Interaction (ICMI 2015)* (pp. 267–274). New York, NY: ACM.
- Bosch, N.**, D’Mello, S., Baker, R., Ocumpaugh, J., Shute, V. J., Ventura, M., ... Zhao, W. (2015). Automatic detection of learning-centered affective states in the wild. In *Proceedings of the 2015 International Conference on Intelligent User Interfaces (IUI 2015)* (pp. 379–388). New York, NY: ACM.
- Kai, S., Paquette, L., Baker, R., **Bosch, N.**, D’Mello, S., Ocumpaugh, J., ... Ventura, M. (2015). Comparison of face-based and interaction-based affect detectors in physics playground. In C. Romero, M. Pechenizkiy, J. Boticario, & O. Santos (Eds.), *Proceedings of the 8th International Conference on Educational Data Mining (EDM 2015)* (pp. 77–84). International Educational Data Mining Society.
- Mills, C., D’Mello, S., **Bosch, N.**, & Olney, A. (2015). Mind wandering during learning with an intelligent tutoring system. In C. Conati, N. T. Heffernan, A. Mitrovic, & M. Felisa Verdejo (Eds.), *Proceedings of the 17th International Conference on Artificial Intelligence in Education (AIED 2015)* (pp. 267–276). Berlin Heidelberg: Springer-Verlag.
- Bosch, N.** (2015). Multimodal affect detection in the wild: Accuracy, availability, and generalizability. In *Proceedings of the 17th International Conference on Multimodal Interaction (ICMI 2015 doctoral consortium)* (pp. 645–649). New York, NY: ACM.
- Bosch, N.**, D’Mello, S., Baker, R., Ocumpaugh, J., & Shute, V. J. (2015). Temporal generalizability of face-based affect detection in noisy classroom environments. In C. Conati, N. T. Heffernan, A. Mitrovic, & M. Felisa Verdejo (Eds.), *Proceedings of the 17th International Conference on Artificial Intelligence in Education (AIED 2015)* (pp. 44–53). Berlin Heidelberg: Springer-Verlag.
- Chen, Y., **Bosch, N.**, & D’Mello, S. (2015). Video-based affect detection in noninteractive learning environments. In C. Romero, M. Pechenizkiy, J. Boticario, & O. Santos (Eds.), *Proceedings of the 8th International Conference on Educational Data Mining (EDM 2015)* (pp. 440–443). International Educational Data Mining Society.

- Rodeghero, P., McMillan, C., McBurney, P. W., **Bosch, N.**, & D’Mello, S. (2014). Improving automated source code summarization via an eye-tracking study of programmers. In *Proceedings of the 36th International Conference on Software Engineering (ICSE 2014)* (pp. 390–401). New York, NY: ACM.
- Bosch, N.**, & D’Mello, S. (2014). It takes two: Momentary co-occurrence of affective states during computerized learning. In S. Trausan-Matu, K. E. Boyer, M. Crosby, & K. Panourgia (Eds.), *Proceedings of the 12th International Conference on Intelligent Tutoring Systems (ITS 2014)* (pp. 638–639). Switzerland: Springer International Publishing.
- Bosch, N.**, Chen, Y., & D’Mello, S. (2014). It’s written on your face: Detecting affective states from facial expressions while learning computer programming. In S. Trausan-Matu, K. E. Boyer, M. Crosby, & K. Panourgia (Eds.), *Proceedings of the 12th International Conference on Intelligent Tutoring Systems (ITS 2014)* (pp. 39–44). Switzerland: Springer International Publishing.
- Mills, C., **Bosch, N.**, Graesser, A., & D’Mello, S. (2014). To quit or not to quit: Predicting future behavioral disengagement from reading patterns. In S. Trausan-Matu, K. E. Boyer, M. Crosby, & K. Panourgia (Eds.), *Proceedings of the 12th International Conference on Intelligent Tutoring Systems (ITS 2014)* (pp. 19–28). Switzerland: Springer International Publishing.
- Bosch, N.**, & D’Mello, S. (2013). Programming with your heart on your sleeve: Analyzing the affective states of computer programming students. In H. C. Lane, K. Yacef, J. Mostow, & P. Pavlik (Eds.), *Proceedings of the 16th International Conference on Artificial Intelligence in Education (AIED 2013)* (pp. 908–911). Berlin Heidelberg: Springer-Verlag.
- Bosch, N.**, D’Mello, S., & Mills, C. (2013). What emotions do novices experience during their first computer programming learning session? In H. C. Lane, K. Yacef, J. Mostow, & P. Pavlik (Eds.), *Proceedings of the 16th International Conference on Artificial Intelligence in Education (AIED 2013)* (pp. 11–20). Berlin Heidelberg: Springer-Verlag.
- Mills, C., D’Mello, S., Lehman, B., **Bosch, N.**, Strain, A., & Graesser, A. (2013). What makes learning fun? Exploring the influence of choice and difficulty on mind wandering and engagement during learning. In H. C. Lane, K. Yacef, J. Mostow, & P. Pavlik (Eds.), *Proceedings of the 16th International Conference on Artificial Intelligence in Education (AIED 2013)* (pp. 71–80). Berlin Heidelberg: Springer-Verlag.

## Peer-reviewed Journal Publications

- Bosch, N.**, & Paquette, L. (in press). Metrics for discrete student models: Chance levels, comparisons, and use cases. *Journal of Learning Analytics*.
- Monkaresi, H., **Bosch, N.**, Calvo, R. A., & D’Mello, S. K. (2017). Automated detection of engagement using video-based estimation of facial expressions and heart rate. *IEEE Transactions on Affective Computing*, 8(1), 15–28.
- Bosch, N.**, & D’Mello, S. (2017). The affective experience of novice computer programmers. *International Journal of Artificial Intelligence in Education*, 27(1), 181–206.

**Bosch, N., D’Mello, S. K., Ocumpaugh, J., Baker, R. S., & Shute, V. (2016).** Using video to automatically detect learner affect in computer-enabled classrooms. *ACM Transactions on Interactive Intelligent Systems (TiiS)*, 6(2).

Shute, V. J., D’Mello, S., Baker, R., Cho, K., **Bosch, N.**, Ocumpaugh, J., ... Almeda, V. (2015). Modeling how incoming knowledge, persistence, affective states, and in-game progress influence student learning from an educational game. *Computers & Education*, 86, 224–235.

## Book Chapters

D’Mello, S. K., **Bosch, N.**, & Chen, H. (in press). Multimodal, multisensory affect detection. In S. Oviatt, B. Schuller, P. Cohen, D. Sonntag, G. Potamianos, & A. Krüger (Eds.), *The Handbook of Multimodal-Multisensor Interfaces*. ACM Books/Morgan Claypool.

## Peer-reviewed Workshop Papers

**Bosch, N., & Paquette, L. (2017).** Unsupervised deep autoencoders for feature extraction with educational data. In *Deep Learning with Educational Data Workshop at the 10th International Conference on Educational Data Mining*.

**Bosch, N., & D’Mello, S. (2014).** Co-occurring affective states in automated computer programming education. In E. Walker & C. K. Looi (Eds.), *Proceedings of the Workshop on AI-supported Education for Computer Science (AIEDCS) at the 12th International Conference on Intelligent Tutoring Systems* (pp. 21–30).

**Bosch, N., & D’Mello, S. (2013).** Sequential patterns of affective states of novice programmers. In E. Walker & C. K. Looi (Eds.), *Proceedings of the First Workshop on AI-supported Education for Computer Science (AIEDCS 2013)* (pp. 1–10).

## Teaching and Mentorship

### Teaching and Tutoring Activities

- Guest Lecturer, Qualitative Analysis of Video Data
- Guest Lecturer, User Modeling
- Guest Lecturer, Introduction to Educational Data Mining
- Guest Lecturer, Introduction to Computer Science
- Teaching Assistant, Programming I
- Tutor, Programming I
- Tutor, Programming II: Data Structures

### Undergraduate Students Mentored

- University of Illinois at Urbana-Champaign

- Eddie Huang (2018)
- Dean Lin (2018, SPIN—Students Pushing INnovation intern)
- University of Notre Dame
  - Yuxuan Chen (2013-2016, First employment: Graduate student at Columbia University)
  - Huili Chen (2015-2016, First employment: Graduate student at Massachusetts Institute of Technology)
  - Jianan Wang (2016)
  - Jacob Beiter (2016)
  - Timothy Pusateri (2015)

## **High School Students Mentored**

- Connor Sullivan (2016)
- Gustavo Van Overberghe (2013-2014)

## **Professional Activities**

### **Professional Memberships (Past and Current)**

- Association for Computing Machinery
- International Artificial Intelligence in Education Society
- International Educational Data Mining Society

### **Journal Reviews**

- British Journal of Educational Technology (BJET)
- IEEE Access
- IEEE Transactions on Affective Computing (TAFFC)
- IEEE Transactions on Learning Technologies (TLT)
- Image and Vision Computing (IMAVIS)
- International Journal of Human-Computer Interaction (IJHCI)

### **Conference Reviews**

- International Conference of the Learning Sciences (ICLS), 2018
- IEEE Conference on Automatic Face and Gesture Recognition (FG), 2017, 2018
- IJCAI Workshop on Artificial Intelligence in Affective Computing, 2017
- AAAI Conference on Artificial Intelligence, 2016
- International Conference on Intelligent Tutoring Systems (ITS), 2016
- ACM International Conference on Multimodal Interaction (ICMI), 2014-2018
- ACM CHI Conference on Human Factors in Computing Systems, 2017



- International Conference on Affective Computing and Intelligent Interaction (ACII), 2015, 2017
- International Conference on Artificial Intelligence in Education (AIED), 2017, 2018
- International Conference on Educational Data Mining (EDM), 2014, 2015, 2017, 2018
- International Conference on Computers in Education (ICCE), 2018
- International Workshop on Empathetic Computing, 2014, 2015

## Service

- Illinois Science Olympiad State Tournament Judge, 2017, 2018
- Northern Indiana Regional Science and Engineering Fair Judge, 2015, 2016
- University of Notre Dame Computer Science Graduate Student Board, 2014-2015, 2015-2016
- Notre Dame National Robotics Week Presenter, 2013

## Technical Skills

**Programming Languages.** Bash, C, C++, C#, Java, JavaScript, PHP, Python, R, Swift

**Markup/Query Languages.** CSS, HTML, SQL, XML

**Platforms.** Android, iOS/watchOS, Unix (Linux, Solaris, OSX), Windows, Web

**Methodologies.** Web development, distributed computing, machine learning, deep learning

**Software Tools.** Apache, Chrome DevTools, Excel, Git, Keras, Mercurial, MySQL, Node.js, NumPy/SciPy, PostgreSQL, RapidMiner, scikit-learn, SPSS, SVN, TensorFlow, WEKA