

# Nigel Bosch

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## Education

PhD, Computer Science (January 2017)  
M.S., Computer Science (May 2016)  
Advisor: Dr. Sidney D’Mello  
University of Notre Dame  
Notre Dame, IN 46556

B.S., Computer Science (May 2012)  
Abilene Christian University  
Abilene, TX 79699

## Professional experience

2017 – Present: **Postdoctoral researcher**. National Center for Supercomputing Applications, University of Illinois Urbana-Champaign

2012 – 2017: **Graduate research assistant**. Emotive Computing Lab, University of Notre Dame

2010 – 2012: **Software development intern**. Milsoft Utility Solutions, Abilene, TX

## Funding

2016: **Travel award (\$1449)**. 24<sup>th</sup> ACM Conference on User Modeling, Adaptation and Personalization (UMAP). National Science Foundation.

2015: **Travel award (\$2398)**. 17<sup>th</sup> ACM International Conference on Multimodal Interaction (ICMI). National Science Foundation.

2015: **Travel award (\$1250)**. 20<sup>th</sup> ACM Conference on Intelligent User Interfaces (IUI 2015). National Science Foundation.

2015: **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). National Science Foundation.

2015: **Travel award (\$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). University of Notre Dame Professional Development and Graduate Student Union Conference Presentation Grant.

2013: **Travel award (\$1300)**. Doctoral Consortium at 16<sup>th</sup> International Conference on Artificial Intelligence in Education (AIED 2013). National Science Foundation.

## Awards

**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

- 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.
- 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.
- 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., ... 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.
- 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., & 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*.
- 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.
- 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).
- 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.
- 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.

- 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.
- Bosch, N., & D’Mello, S. (2014a). 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).
- 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. <https://doi.org/10.1145/2568225.2568247>
- Bosch, N., & D’Mello, S. (2014b). 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. (2013a). 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. (2013b). 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).

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.

## **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
- IEEE Access
- IEEE Transactions on Affective Computing
- IEEE Transactions on Learning Technologies
- Image and Vision Computing

### **Conference reviews**

- IEEE Conference on Automatic Face and Gesture Recognition, 2017
- AAAI Conference on Artificial Intelligence, 2016
- International Conference on Intelligent Tutoring Systems, 2016
- ACM International Conference on Multimodal Interaction, 2014-2017
- International Conference on Affective Computing and Intelligent Interaction, 2015, 2017
- International Conference on Artificial Intelligence in Education, 2017
- International Conference on Educational Data Mining, 2014, 2015, 2017
- International Workshop on Empathetic Computing, 2014, 2015

### **Service**

- Illinois Science Olympiad State Tournament judge, 2017
- 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, 2013

## Mentorship

### Undergraduate students

- Yuxuan Chen
- Timothy Pusateri
- Huili Chen
- Jianan Wang
- Jacob Beiter
- Yurui Tong

### High school students

- Gustavo Van Overberghe
- Connor Sullivan

## 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.** OOP, client/server, event-based, multithreaded, distributed computing, Ajax, deep learning

**Development environments.** Android Studio, Eclipse, GCC/GDB, NetBeans, Visual Studio, Xcode

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