Dillon Lohr | Ph.D. Student, NSF Fellow

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Research Area

Eye movement analysis, feature extraction from classified eye movements, eye tracking data quality assessment, and user authentication based on eye movements.

Education

Texas State University — **San Marcos, TX**
Ph.D., Computer Science (Information Management) — *Aug 2018 – present*

- Advisor: Dr. Oleg V. Komogortsev
- 4.0 GPA
- Anticipated graduation: May 2023

Texas State University — **San Marcos, TX**
B.S., Computer Science — *Aug 2014 – May 2018*

- 4.0 GPA (summa cum laude)

Awards, Scholarships, & Fellowships

Graduate Research Excellence Award — **San Marcos, TX**
Texas State University — *Apr 2019*

NSF Graduate Research Fellowship — **San Marcos, TX**
Texas State University — *Aug 2018 – present*

Undergraduate Academic & Research Excellence Awards — **San Marcos, TX**
Texas State University — *Apr 2016*

Terry Foundation Scholarship — **San Marcos, TX**
Texas State University — *Aug 2014 – May 2018*

Work Experience

Undergraduate Research Student — **San Marcos, TX**
Texas State University — *Sep 2015 – Aug 2018*

- Advisor: Dr. Oleg V. Komogortsev
- Primarily worked on research relating to eye movement biometrics. Developed an application with C++/OpenGL that displayed stimuli inside a VR headset using OpenVR and recorded eye movements using APIs from SMI and FOVE eye trackers. Created a library with C#/WPF to display dot, image, and movie stimuli for various eye tracking studies. This library was also used by a postdoc in the same lab for his own research. Created an application with C#/WPF that compared smooth pursuit– and dwell-based selection methods at varying levels of spatial accuracy using a Tobii EyeX eye tracker. Extended an existing biometric framework to include a component that detected the onset of eye fatigue.

Research

Metric Learning for Biometric Authentication via Eye Movements: Developed a machine-learning application with PyTorch that uses metric learning (via triplet loss) to create meaningful embeddings of eye movement features. Later expanded this work to use multi-similarity loss and to embed raw eye movement signals directly.

Eye Tracking in Virtual Reality: Created an application with C++/OpenGL to present stimuli that elicit specific eye movement responses (saccades, smooth pursuits, vergence) inside a VR headset using OpenVR and recorded eye movements using APIs from SMI and FOVE eye trackers. Later moved to Unity to accelerate development. Started data collection for a large, longitudinal dataset (currently on hold due to COVID-19).

Eye Tracker Data Quality: Developed a pipeline to quantitatively and qualitatively assess the data quality of eye trackers. Quality measures included spatial accuracy, spatial precision, temporal precision, linearity, and crosstalk.

Publications

D. Lohr, H. Griffith, & O. Komogortsev. 2021. "Eye Know You: Metric Learning for End-to-end Biometric Authentication Using Eye Movements from a Longitudinal Dataset." arXiv:2104.10489 [cs.HC]

H. Griffith, **D. Lohr**, E. Abdulin, & O. Komogortsev. 2021. "GazeBase: A Large-Scale, Multi-Stimulus, Longitudinal Eye Movement Dataset." *Sci Data* **8**, 184 (2021).

D. Lohr, H. Griffith, S. Aziz, & O. Komogortsev. 2020. "A Metric Learning Approach to Eye Movement Biometrics." 2020 IEEE International Joint Conference on Biometrics (IJCB).

A. Karpov, J. Liberman, **D. Lohr**, & O. Komogortsev. 2020. "Parallel Oculomotor Plant Mathematical Model for Large Scale Eye Movement Simulation." arXiv:2007.09884 [cs.HC]

D. Lohr, S. Aziz, & O. Komogortsev. 2020. "Eye Movement Biometrics Using a New Dataset Collected in Virtual Reality." In ACM Symposium on Eye Tracking Research and Applications (ETRA '20 Adjunct).

D. Lohr, L. Friedman, & O. Komogortsev. 2019. "Evaluating the Data Quality of Eye Tracking Signals from a Virtual Reality System: Case Study using SMI's Eye-Tracking HTC Vive." arXiv:1912.02083 [cs.HC]

D. Lohr, S.-H. Berndt, & O. Komogortsev. 2018. "An Implementation of Eye Movement–driven Biometrics in Virtual Reality." In Proceedings of the 2018 ACM Symposium on Eye Tracking Research & Applications (ETRA '18), Warsaw, Poland.

D. Lohr & O. Komogortsev. 2017. "A Comparison of Smooth Pursuit– and Dwell-based Selection at Multiple Levels of Spatial Accuracy." In Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems (CHI '17), Denver, Colorado.

D. Lohr, E. Abdulin, & O. Komogortsev. 2016. "Detecting the Onset of Eye Fatigue in a Live Framework." In Proceedings of the Ninth Biennial ACM Symposium on Eye Tracking Research & Applications (ETRA '16), Charleston, South Carolina.

Skills

- Skilled with C++, Python (and PyTorch), and MATLAB
- Familiar with C#/WPF, Unity, OpenGL, CUDA
- Experience working with various eye tracker APIs (Tobii, SMI, FOVE)