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## Curriculum

*Dan Witzner Hansen investigates to which extend information from images of eyes can be obtained through computationally tractable techniques and how this information can be used in future applications.*

His focus is on robust methods for extracting information from the eyes. He investigate how this information can be employed as a part of the next generation of contactless and continuous biometric identification modalities and how it can be used for the general public everyday and out-of-laboratory use. His research covers aspects from computer vision, machine learning, HCI, neuroscience and psychology. Among other things the has contributed to the research in eye-based biometric markers and development of novel and low-cost gaze trackers. These eye trackers have together with novel gaze-based interaction techniques been used for interaction for physically disabled persons with great success.

## Publications

### **High-Accuracy Gaze Estimation for Interpolation-Based Eye-Tracking Methods**

Batista Narcizo, F., dos Santos, F. E. D. & Hansen, D. W., 15 Sep 2021, In: *Vision*. 5, 3, p. 1 27 p.

### **Orangulas: effect of scheduled visual enrichment on behavioral and endocrine aspects of a captive orangutan (*Pongo pygmaeus*)**

Olvido Perea Garcia, J., Miani, A., Miani, A., Malmkvist, J., Hammer, T., Pertoldi, C., Pertoldi, C., Pertoldi, C., Kruse Nielsen, R., Hansen, D. W. & Bach, L. A., 31 Jan 2020, In: *Journal of Zoo and aquarium research*. 8, 1

### **Label Likelihood Maximisation: Adapting iris segmentation models using domain adaptation**

Eskildsen, A. M. & Hansen, D. W., 2020, *ETRA '20 Full Papers: ACM Symposium on Eye Tracking Research and Applications*. Association for Computing Machinery, p. 1-9 9 p. 5

### **Aiming for the quiet eye in biathlon**

Hansen, D. W., Heinrich, A. & Cañal-Bruland, R., 2019, *ETRA '19: Proceedings of the 11th ACM Symposium on Eye Tracking Research & Applications*. Association for Computing Machinery, p. 1-7 10

### **Eye movement recordings in natural settings**

Tatler, B., Hansen, D. W. & Pelz, J., 2019, *Eye Movement Research. Studies in Neuroscience, Psychology and Behavioral Economics: An introduction to the scientific foundations of eye movement research and its applications* Editors: Christoph Klein & Ulrich Ettinger. Martin Reuter & Christian Montag: Springer

### **Using Priors to Compensate Geometrical Problems in Head-Mounted Eye Trackers**

Batista Narcizo, F., Ahmed, Z. & Hansen, D. W., 23 Aug 2017.

### **Computer-implemented gaze interaction method and apparatus**

Hansen, D. W. & Mardanbegi, D., 4 May 2017, IPC No. G06F3/01; G06F3/0482, Patent No. PCT/EP2015/055435, Priority date 17 Mar 2014, Priority No. US 15/126,596

### **Variability through the Eyes of the Programmer**

Melo, J., Batista Narcizo, F., Hansen, D. W., Brabrand, C. & Wasowski, A., 1 May 2017, *2017 IEEE/ACM 25th International Conference on Program Comprehension (ICPC)*. IEEE, p. 34-44 11 p.

### **System and Method for Eye Tracking**

Pelz, J. & Hansen, D. W., 2017, IPC No. G06K 9/00 (2006.01), G06K 9/62 (2006.01), G06K 9/46 (2006.01), Patent No. 2017/034756, 26 May 2017, Priority date 27 May 2016, Priority No. 62/342,453 27.05.2016 US US201662342453P 20160527

### **A GAZE TRACKER AND A GAZE TRACKING METHOD**

Mardanbegi, D. & Hansen, D. W., 11 Aug 2016, IPC No. A61B3/113; G06F3/01, Priority date 4 Feb 2015, Priority No. DKPA201570064 20150204

### **Pupil Center as a Function of Pupil Diameter**

Ahmed, Z., Mardanbegi, D. & Hansen, D. W., 14 Mar 2016, *ETRA '16 Proceedings of the Ninth Biennial ACM Symposium on Eye Tracking Research & Applications*. Association for Computing Machinery, p. 283-286 4 p.

### **Depth Compensation Model for Gaze Estimation in Sport Analysis**

Batista Narcizo, F. & Hansen, D. W., 17 Dec 2015, *2015 IEEE International Conference on Computer Vision Workshop (ICCVW)*. IEEE Professional Communication Society, p. 788-795 8 p.

### **Why have microsaccades become larger? Investigating eye deformations and detection algorithms.**

Hansen, D. W., Nyström, M., Andersson, R. & Hooge, I., 3 Dec 2014, In: *Vision Research*.

### **Head and eye movement as pointing modalities for eyewear computers**

Jalaliniya, S., Mardanbeigi, D., Pederson, T. & Hansen, D. W., 19 Jun 2014, *Proceedings of the 2014 11th International Conference on Wearable and Implantable Body Sensor Networks Workshops*. IEEE Computer Society Press, 4 p.

### **Head mounted device for point-of-gaze estimation in three dimensions**

Hansen, D. W., Lidegaard, M. & Krüger, N., 1 May 2014, *ETRA '14 Proceedings of the Symposium on Eye Tracking Research and Applications*. Association for Computing Machinery, 4 p.

### **Robust glint detection through homography normalization**

Hansen, D. W., Roholm, L. & García Ferreiros, I., 1 May 2014, *ETRA '14 Proceedings of the Symposium on Eye Tracking Research and Applications*. Association for Computing Machinery, p. 91-94 4 p.

### **Method of Determining Reflections of Light**

Hansen, D. W., 1 Feb 2014, IPC No. G06F3/01, Priority date 29 Oct 2010, Priority No. WO2010EP66495 20101029

### **Proceedings of the Symposium on Eye Tracking Research and Applications 2014: Conference ETRA '14 Eye Tracking Research and Applications**

Hansen, D. W. & Qvarfordt, P. (ed.), 2014, *Conference ETRA '14 Eye Tracking Research and Applications*. Association for Computing Machinery

### **Synergies between head-mounted displays and head-mounted eye tracking: The trajectory of development and its social consequences**

Ling, R., Mardanbegi, D. & Witzner Hansen, D., 2014, *Living inside social mobile information*. 2251 Arbor Blvd. Dayton, OH 45439, USA: Greyden Press, LCC, p. 131-158

### **Eye-based head gestures for interaction in the car**

Mardanbeigi, D. & Witzner Hansen, D., 2013, *Proceedings of the 4th International Conference on Automotive User Interfaces and Interactive Vehicular Applications: AutomotiveUI '12*. Association for Computing Machinery, p. 39-42 4 p.

### **Gaze-Based Controlling a Vehicle**

Mardanbeigi, D. & Witzner Hansen, D., 2013. 6 p.

### **Time, Interaction, and Design in Support of a Good Life**

Froes, I. C. G., Laaksolahti, J. M., Witzner Hansen, D., Heyer, C., Kotamraju, N. P., Malmborg, L., Nielsen, L., Pedersen, J. & Shklovski, I., 2013. 7 p.

### **Towards Wearable Gaze Supported Augmented Cognition**

Toshiaki Kurauchi, A., Hitoshi Morimoto, C., Mardanbeigi, D. & Witzner Hansen, D., 2013.

### **Conclusion and Look to the Future**

Donegan, M., Majaranta, P., Hansen, J. P., Hyrskykari, A., Witzner Hansen, D. & Rähä, K-J., 2012, *Gaze Interaction and Applications of Eye Tracking: Advances in Assistive Technologies*. Idea Group Publishing, p. 365-376 12 p.

### **Eye-based head gestures**

Mardanbeigi, D., Witzner Hansen, D. & Pederson, T., 2012, *ETRA '12 Proceedings of the Symposium on Eye Tracking Research and Applications*. Association for Computing Machinery, p. 139-146 7 p.

### **Parallax error in the monocular head-mounted eye trackers**

Mardanbeigi, D. & Witzner Hansen, D., 2012, *UbiComp '12 Proceedings of the 2012 ACM Conference on Ubiquitous Computing*. p. 689-694 6 p.

### **EYE GAZE TRACKING**

Hansen, D. W., 28 Jul 2011, IPC No. G06K9/00, Priority date 8 Jul 2008, Priority No. WO2008DK00257 20080708

### **Discussion and Future Directions for Eye Tracker Development**

Hansen, D. W., Mulvey, F. & Mardanbeigi, D., 2011, *Discussion and Future Directions for Eye Tracker Development*. p. 359-363 5 p.

### **Methodology for designing, implementing and evaluating assistive mobility technology to enable the social inclusion and independence needs of an ageing population**

Morrison, A. J., Andersen, H. J., Malmberg, L., Witzner Hansen, D. & Knudsen, L., 2011. 7 p.

### **Mobile gaze-based screen interaction in 3D environments**

Mardanbeigi, D. & Witzner Hansen, D., 2011, *NGCA 2011. Proceedings of the 1st Conference on Novel Gaze-Controlled Applications*. Association for Computing Machinery, 2

### **Towards gaze-controlled platform games**

Muñoz, J., Yannakakis, G. N., Mulvey, F., Hansen, D. W., Gutierrez, G. & Sanchis, A., 2011, *Computational Intelligence and Games (CIG), 2011 IEEE Conference on*. p. 47-54 8 p.

### **Evaluation of a low-cost open-source gaze tracker**

San Agustin, J., Jensen, H. T. S. H., Møllenbach, E., Barret, M., Witzner Hansen, D. & Hansen, J. P., Mar 2010, *ETRA '10 Proceedings of the 2010 Symposium on Eye-Tracking Research & Applications*. Association for Computing Machinery, 4 p.

### **Homography Normalization for Robust Gaze Estimation in Uncalibrated Setups**

Witzner Hansen, D., San Agustin, J. & Villanueva, A., 2010, *ETRA '10 Proceedings of the 2010 Symposium on Eye-Tracking Research & Applications*. Association for Computing Machinery

### **In the Eye of the Beholder- A Survey of Models for Eyes and Gaze**

Witzner Hansen, D. & Ji, Q., 2010, In: *IEEE Transaction on Pattern Analysis and Machine Intelligence*. 32, 3, p. 478 - 500 23 p.

### **Reflections of Head Mounted systems for Domotic Control**

Mardanbeigi, D. & Witzner Hansen, D., 2010, *IT University of Copenhagen*.

### **Gaze-controlled driving**

Tall, M., Alapetite, A. P. B., San Agustin, J., Jensen, H. T. S. H., Hansen, J. P., Witzner Hansen, D. & Møllenbach, E., 2009, *Proceedings of the 27th international Conference Extended Abstracts on Human Factors in Computing Systems*. Association for Computing Machinery, p. 4387-4392 5 p.

#### **Location-based solutions in the experience center**

Witzner Hansen, D., Alapetite, A., Holdgaard, N., Simonsen, C. & Larsen Vilsholm, R., 2009, In: *Nordisk Museologi*. 1, p. 44-52 8 p.

#### **Location-based solutions in the experience centre**

Witzner Hansen, D., Alapetite, A., Holdgaard, N., Simonsen, C. & Larsen Vilsholm, R., 2009, In: *Nordisk Museologi*. 2009, 1, p. 44-52

#### **Low-cost gaze interaction: Ready to deliver the promises**

San Agustin, J., Jensen, H. T. S. H., Hansen, J. P. & Witzner Hansen, D., 2009, *Proceedings of the 27th international Conference Extended Abstracts on Human Factors in Computing Systems*. Association for Computing Machinery, p. 4453-4458 5 p.

#### **Low-cost gaze pointing and EMG clicking**

San Agustin, J., Hansen, J. P., Witzner Hansen, D. & Jensen, H. T. S. H., 2009, *Proceedings of the 27th international Conference Extended Abstracts on Human Factors in Computing Systems*. Association for Computing Machinery, p. 3247-3252 5 p.

#### **Eye Tracking**

Witzner Hansen, D., 2008, IPC No. INV.A61B3/113 G06F3/01, Patent No. PCT/DK2008/000257, 8 Jul 2008

#### **Location-based Services using Image Search**

Vertongen, P-P. & Hansen, D. W., 2008, *2008 IEEE Workshop on Applications of Computer Vision*. IEEE, p. 1-6 6 p. (IEEE Workshop on Applications of Computer Vision).

#### **Location-based solutions in the Experience centre**

Witzner Hansen, D., Alapetite, A. P. B., Holdgaard, N., Simonsen, C. & Vilsholm, R. L., 2008.

#### **Noise tolerant selection by gaze-controlled pan and zoom in 3D: Proceedings of the 2008 symposium on Eye tracking research & applications**

Hansen, D. W., Jensen, H. S., Hansen, J. P. & Møllenbach, E., 2008, *Proceedings of the 2008 symposium on Eye tracking research & applications*. Räihä, K-J. & Duchowski, A. (eds.). Association for Computing Machinery, p. 205-212

#### **Robust registration for change detection**

Darkner, S., Witzner Hansen, D., Paulsen, R. R. & Larsen, R., 2008.

#### **Tracking the gaze of birds**

Kjærsgaard, A., Pertoldi, C., Loeschcke, V. & Hansen, D. W., 2008, *Tracking the gaze of birds*. p. 466-469 4 p.

#### **An improved likelihood model for eye tracking**

Hammoud, R. I. & Hansen, D. W., 2007, *An improved likelihood model for eye tracking*. p. 220-230 11 p.

#### **Improving face detection with TOF cameras**

Larsen, R., Lauze, F. & Hansen, D. W., 2007, *Improving face detection with TOF cameras*. p. 225-228 4 p.

#### **Robustifying eye interaction**

Hansen, D. W. & Hansen, J. P., 2006, *Robustifying eye interaction*.

#### **Boosting particle filter-based eye tracker performance through adapted likelihood function to reflexions and light changes**

Hammoud, R. & Hansen, D. W., 2005, *Boosting particle filter-based eye tracker performance through adapted likelihood function to reflexions and light changes*. p. 111-116 6 p.

#### **Eye tracking in the wild**

Pece, A. E. C. & Hansen, D. W., 2005, *Eye tracking in the wild*. p. 155-181 27 p.

### **Improved Likelihood Function in Particle-based IR Eye Tracking**

Satria, R., Sorensen, J., Hammoud, R. & Hansen, D. W., 2005, *Improved Likelihood Function in Particle-based IR Eye Tracking*.

### **Command Without a Click : Dwell Time Typing by Mouse and Gaze Selections**

Rauterberg, M. (ed.), Menozzi, M. (ed.), Wesson, J. (ed.), Hansen, J. P., Johansen, A. S., Hansen, D. W., Itoh, K. & Mashino, S., 2003, *Command Without a Click : Dwell Time Typing by Mouse and Gaze Selections*. Rauterberg, M., Menozzi, M. & Wesson, J. (eds.). IOS Press, p. 121-128 8 p.

## **Press clippings**

### **Bedre eyetracking-algoritmer fra ITU kan give flere guldmedaljer**

Dan Witzner Hansen & Fabricio Batista Narcizo

22/08/2016

1 item of Media coverage

### **Bornholmsk professor vil sikre øjets informationer**

Dan Witzner Hansen

15/11/2021

1 Media contribution

### **Debat: Danmark har fordele i kampen om at blive international AI-frontløber**

Dan Witzner Hansen

26/04/2021

1 Media contribution

### **Forskning baner vejen for sportsmedaljer**

Dan Witzner Hansen

14/12/2022

1 Media contribution

### **Forskning i øjets bevægelse hjælper elitesporten frem i feltet**

Dan Witzner Hansen

13/09/2016

1 item of Media coverage

### **Hvem kigger med**

Dan Witzner Hansen & Jari Kickbusch

09/05/2014

1 item of Media coverage

### **Hvem kigger med?**

Dan Witzner Hansen

09/05/2014

1 item of Media coverage

### **Ingen fælles standard for datasikkerhed i Danmark**

Dan Witzner Hansen

30/04/2014

1 item of Media coverage

### **Kan virtual reality komme til at ligne virkeligheden så meget, at vi ikke kan se forskel?**

Dan Witzner Hansen

24/07/2021

1 Media contribution

**Læk sætter fokus på datasikkerhed**

Dan Witzner Hansen

30/04/2014

1 item of Media coverage

**Ny ITU-professor forsker i øjets informationer**

Dan Witzner Hansen

16/12/2021

1 Media contribution

**SJÆLENS SPEJL: Afsørende blikke**

Dan Witzner Hansen

18/02/2022

1 Media contribution

**Projects**