

# Dr.-Ing. Shoya Ishimaru

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## Summary

Shoya Ishimaru is a Senior Researcher at the German Research Center for Artificial Intelligence (DFKI). His research interests are to invent new technologies augmenting abilities of human beings and investigating influences of the augmentations to human minds.

Shoya defended his PhD in Engineering at the University of Kaiserslautern in 2019 (Doktor der Ingenieurwissenschaften mit Auszeichnung *summa cum laude*). He has also been certificated as MITOU Super Creator by Ministry of Economy, Trade, and Industry in Japan.

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## Background

Human-Computer Interaction, Learning Analytics, Wearable Computing, and Pattern Recognition

## Scientific Career

Senior Researcher, German Research Center for Artificial Intelligence (DFKI)	2019 – current
Visiting Researcher, Osaka Prefecture University	2016 – current
Researcher, Keio Media Design Research Institute	2014 – current
Researcher, German Research Center for Artificial Intelligence (DFKI)	2016 – 2019
Research Associate, University of Kaiserslautern	2016 – 2019

## Engineering Career

Mentor (Project Manager), Mitou Junior	2020 – current
Engineering Mentor, Life is Tech, Inc.	2013 – 2015
Engineering Internship, Recruit Holdings Co.	2015
Engineering Internship, Livesense Inc.	2014
Engineering Internship, Cookpad Inc.	2014
Software Engineer, Campus. Inc.	2012 – 2013
Part-Time Software Engineer, Paperboy&co. Inc	2012
Engineering Internship, Hatena Co.	2012

## Education

PhD in Engineering, University of Kaiserslautern, Germany 2016 – 2019

### Meta-Augmented Human: From Physical to Cognitive Towards Affective State Recognition

Traditionally, human beings have obtained various skills by inventing technologies. Those who integrate technologies into daily life and enhance their capabilities are called Augmented Humans. While most existing augmenting human technologies focus on directly assisting specific skills, the objective of this thesis is to assist learning – the meta-skill to master new skills – with the aim of long-term augmentations. The proposed *Meta-Augmented Human Systems* quantify the cognitive/affective states of a learner by wearable/mobile sensors and give appropriate feedback on skill acquisition.

Master of Engineering, Graduate School of Engineering, Osaka Prefecture University, Japan 2014 – 2016

### Eyewear Computing for Cognitive Activity Recognition

As people are encouraged to be physically fit by monitoring step counts, counting the number of words they read is a potential approach to helping them increase their daily reading volume. This thesis proposed a system tracking the number of read words by analyzing electrooculography signals measured by JINS MEME. By detecting saccades from the signals, it estimated the number of read words with 11 % error rate.

Bachelor of Engineering, Osaka Prefecture University, Japan 2010 – 2014

### Activity Recognition with Google Glass: Combining Head Motion and Eye Blink Frequency

While many physical activities can be recognized by wearable motion sensors, recognizing cognitive activities such as reading is still challenging because body movements during the activities are not obvious. This thesis demonstrates how information about eye blink frequency and head motion patterns derived from Google Glass can distinguish different types of daily activities. The proposed method classified 5 activities with 67 % accuracy for eye blinking only and 82 % when extended with head movements.

## Grants

Key Researcher, DFG ANR JST International Call on Artificial Intelligence, 757 K EUR (93 M JPY) 2020-2022

### [Ongoing] Learning Cyclotron

The aim of this project is to augment and amplify human intelligence with artificial intelligence. We propose and develop Learning Cyclotron (LeCycl), a framework that monitors and actuates learning processes. In this framework, learners acquire knowledge with the following three steps: Perceive, Master, and Transfer. Behaviors of learners on each step are measured by sensors. From the sensor signals, we estimate cognitive and affective states, including attention, interest, concentration, mental workload, and self-confidence. The estimated states will be utilized to select how to nudge learners. As the same as a cyclotron accelerates charged particles by a magnetic field, LeCycl circulates knowledge between learners.

Co-Investigator, JSPS Grant-in-Aid for Scientific Research (B), 142 K EUR (17.81 M JPY) 2020-2022

### [Ongoing] Sensing and Actuation to Accelerate Human Knowledge I/O

In this project, we propose a new theory of Learning Augmentation – utilizing sensors and actuators for accelerating the knowledge I/O without much effort by a learner –. The theory is based on the three axes: (1) knowledge input and output, (2) knowledge states and mental states, (3) sensing and actuation. We build a system based on this idea and demonstrate its effectiveness through large-scale experiments.

Co-Investigator, JSPS Grant-in-Aid for Scientific Research (C), 37 K EUR (4.68 M JPY) 2017-2019

### Generating Artificial Eye Movements on a Document for an Objective Readability Measurement

In this project, we aimed to assess the readability of a document on the basis of eye movements. Since it is not realistic to ask participants to read documents with eye tracking devices every time, we developed a system that synthesizes artificial eye movements on the document and utilizes them for the readability measurement. The relationship between cognitive load while reading and sensor signals (eye tracking, physiological sensing) was also investigated as basic research for the readability measurement.

Representative, JSPS Grant-in-Aid for Young Scientists (B), 31 K EUR (4.16 M JPY) 2017-2019

### Eyefact: Development of a Platform for Eyewear Data Conversion and Its Application to Activity Recognition in the Wild

The goal of this project was to develop a system that learns the relationship between data recorded by multiple sensors and converts data obtained from one sensor into the equivalent data obtained by another advanced sensor. We developed data collection software and evaluated its scalability. We also proposed a method for recognizing reading behavior in the real world by using electrooculography glasses and published the method with a dataset.

Creator, IPA MITOU Exploratory IT Human Resources Project, 18 K EUR (2.30 M JPY) 2015

### Shin' on kei: Development of a System for Visualizing the Mental State

Mental illness, especially depression is one of the most pressing concerns all over the world. In this project, we proposed a system estimating mental states of a user from an activity log derived from sensors. It uses the analogy of thermometer for the visualization since everyone is familiar with this format when they have gone through hardships with fever. From this outcome, Shoya received the title of MITOU Super Creator, which is given to outstanding young software developers around 10 people/year in Japan.

## Teaching

Collaborative Intelligence, University of Kaiserslautern (Co-lecturing with Prof. Dengel) SS 2019, SS 2020

## Supervision

8 Master Theses	<i>Hussain, Jacob, Brishtel, Santhosh, Holub, Baitemirov, Steinert, Sinha</i>
1 Bachelor Thesis	<i>Steinert</i>
9 Project/Seminar Students	<i>Roy, Herurkar, Liu, Ghosh, Gomez, Inal, Allison, Kumar, Garg</i>
4 Internship Students	<i>Yamanda, Ohbayashi, Watanabe, Maruichi</i>

## Conference Organization

Program Co-Chair for Augmented Humans 2020 International Conference	2020
Co-Organizer for EyeWild 2019 (UbiComp Satellite Tutorial)	2019
Program Committee for PerPersuasion 2019 (PerCom Satellite Workshop)	2019
Program Committee for READ 2018	2018
Co-Organizer for Application Developer Festival 2015	2015
Reviewer for IMWUT, IJDAR, ISWC '20, CHI '20, MobileHCI '20, PerPersuasion '19, READ '18, HDI '17	

## Selected Awards and Honorable Activities

Best Presentation Award at Asian CHI Symposium 2020	2020
PhD with an award <i>summa cum laude</i> (with highest praise)	2019
Poster Track Honorable Mention at UbiComp/ISWC 2018	2018
Gave an invited talk “Cognitive Cyborgs” at TEDxNagouaU	2017
Certificated as MITOU Super Creator by Ministry of Economy, Trade, and Industry in Japan	2016
President’s Honor in Osaka Prefecture University, Japan	2012, 2015

## Journal Papers

1. Iuliia Brishtel, Anam Ahmad Khan, Thomas Schmidt, Tilman Dingler, Shoya Ishimaru and Andreas Dengel. “Mind Wandering in Multimodal Reading Setting: Behavior Analysis & Automatic Detection using Eye-Tracking and EDA Sensor”. *Sensors*, 20 (9), p. 2546, 2020.
2. Oliver Amft, Florian Wahl, Shoya Ishimaru and Kai Kunze. “Making Regular Eyeglasses Smart”. *IEEE Pervasive Computing*, 14 (3), pp. 32–43, 2015.

## Book Chapter

1. Shoya Ishimaru, Syed Saqib Bukhari, Carina Heisel, Nicolas Großmann, Pascal Klein, Jochen Kuhn and Andreas Dengel. “Augmented Learning on Anticipating Textbooks with Eye Tracking”. In *Positive Learning in the Age of Information (PLATO)*, pp. 387–398, 2018.

## Conference Papers

1. Shoya Ishimaru, Takanori Maruichi, Koichi Kise and Andreas Dengel. “Gaze-Based Self-Confidence Estimation on Multiple-Choice Questions and Its Feedback”. In *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems (Asian CHI Symposium ’20)*, 2020. *Best Presentation Award*
2. Jayasankar Santhosh, Shoya Ishimaru and Andreas Dengel. “Generating Heatmap for Unknown Documents Towards Readability Measurement”. In *Proceedings of the 25th International Conference on Intelligent User Interfaces Companion (IUI ’20)*, pp. 47–48, 2020.
3. Takanori Maruichi, Shoya Ishimaru and Koichi Kise. “Self-confidence Estimation on Vocabulary Tests with Stroke-level Handwriting Logs”. In *Proceedings of the 15th IAPR International Conference on Document Analysis and Recognition (ICDAR HDI ’19)*, pp. 18–22, 2019.
4. Shoya Ishimaru, Takanori Maruichi, Manuel Landsmann, Koichi Kise and Andreas Dengel. “Electrooculography Dataset for Reading Detection in the Wild”. In *Proceedings of the 2019 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp ’19 Adjunct)*, pp. 85–88, 2019.
5. Shoya Ishimaru, Ko Watanabe, Nicolas Großmann, Carina Heisel, Pascal Klein, Yutaka Arakawa, Jochen Kuhn and Andreas Dengel. “HyperMind Builder: Pervasive User Interface to Create Intelligent Interactive Documents”. In *Proceedings of the 2018 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp ’18 Adjunct)*, pp. 357–360, 2018.
6. Soumy Jacob, Shoya Ishimaru and Andreas Dengel. “Interest Detection While Reading Newspaper Articles by Utilizing a Physiological Sensing Wristband”. In *Proceedings of the 2018 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp ’18 Adjunct)*, pp. 78–81, 2018. *Poster Track Honorable Mention*
7. Dayananda Herurkar, Shoya Ishimaru and Andreas Dengel. “Combining Software-Based Eye Tracking and a Wide-Angle Lens for Sneaking Detection”. In *Proceedings of the 2018 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp ’18 Adjunct)*, pp. 54–57, 2018.
8. Yuya Ohbayashi, Shoya Ishimaru, Andreas Dengel and Koichi Kise. “Investigating Gaze and Physiological Features to Estimate Comprehension on E-learning Video Lectures”. In *Proceedings of the 1st international interdisciplinary Symposium on Reading Experience and Analysis of Documents (READ ’18)*, 2018.
9. Jayasankar Santhosh, Shoya Ishimaru and Andreas Dengel. “Estimating Fixation Durations for Each Word in Documents towards Readability Measurement”. In *Proceedings of the 1st international interdisciplinary Symposium on Reading Experience and Analysis of Documents (READ ’18)*, 2018.

10. Nicolas Großmann, Iuliia Brishtel, Shoya Ishimaru, Andreas Dengel, Carina Heisel, Pascal Klein and Jochen Kuhn. "iQL - Immersive Quantified Learning Lab". In Proceedings of the 1st international interdisciplinary Symposium on Reading Experience and Analysis of Documents (READ '18), 2018.
11. Soumy Jacob, Shoya Ishimaru, Syed Saqib Bukhari and Andreas Dengel. "Gaze-Based Interest Detection on Newspaper Articles". In Proceedings of the 7th Workshop on Pervasive Eye Tracking and Mobile Eye-Based Interaction (ETRA '18), p. 4, 2018.
12. Iuliia Brishtel, Shoya Ishimaru, Olivier Augereau, Koichi Kise and Andreas Dengel. "Assessing Cognitive Workload on Printed and Electronic Media using Eye-Tracker and EDA Wristband". In Proceedings of the 23rd International Conference on Intelligent User Interfaces Companion (IUI '18), p. 45, 2018.
13. Shoya Ishimaru, Soumy Jacob, Apurba Roy, Syed Saqib Bukhari, Carina Heisel, Nicolas Großmann, Michael Thees, Jochen Kuhn and Andreas Dengel. "Cognitive State Measurement on Learning Materials by Utilizing Eye Tracker and Thermal Camera". In Proceedings of the 14th IAPR International Conference on Document Analysis and Recognition (ICDAR HDI '17), pp. 32–36, 2017.
14. Shoya Ishimaru, Kensuke Hoshika, Kai Kunze, Koichi Kise and Andreas Dengel. "Towards Reading Trackers in the Wild: Detecting Reading Activities by EOG Glasses and Deep Neural Networks". In Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '17 Adjunct), pp. 704–711, 2017.
15. Koichi Kise, Olivier Augereau, Yuzuko Utsumi, Masakazu Iwamura, Kai Kunze, Shoya Ishimaru and Andreas Dengel. "Quantified Reading and Learning for Sharing Experiences". In Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '17 Adjunct), pp. 724–731, 2017.
16. Shoya Ishimaru and Andreas Dengel. "ARFLED: Ability Recognition Framework for Learning and Education". In Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '17 Adjunct), pp. 339–343, 2017.
17. Sabine Hoffmann, Helga Tauscher, Andreas Dengel, Shoya Ishimaru, Sheraz Ahmed, Jochen Kuhn, Carina Heisel and Yutaka Arakawa. "Sensing Thermal Stress at Office Workplaces". In Proceedings of the 5th International Conference on Human-Environment Systems (ICHES '16), 2016.
18. Shoya Ishimaru. "Cognitive State Recognition for Developing Anticipating Textbook". In Proceedings of the 9th International Conference on Mobile Computing and Ubiquitous Networking (ICMU '16), pp. 1–2, 2016.
19. Shoya Ishimaru, Syed Saqib Bukhari, Carina Heisel, Jochen Kuhn and Andreas Dengel. "Towards an Intelligent Textbook: Eye Gaze Based Attention Extraction on Materials for Learning and Instruction in Physics". In Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '16 Adjunct), pp. 1041–1045, 2016.
20. Shoya Ishimaru, Kai Kunze, Koichi Kise and Andreas Dengel. "The Wordometer 2.0: Estimating the Number of Words You Read in Real Life using Commercial EOG Glasses". In Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '16 Adjunct), pp. 293–296, 2016.
21. Shoya Ishimaru, Tilman Dingler, Kai Kunze, Koichi Kise and Andreas Dengel. "Reading Interventions: Tracking Reading State and Designing Interventions". In Proceedings of the 2016 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '16 Adjunct), pp. 1759–1764, 2016.
22. Christophe Rigaud, Thanh-Nam Le, J-C Burie, Jean-Marc Ogier, Shoya Ishimaru, Motoi Iwata and Koichi Kise. "Semi-Automatic Text and Graphics Extraction of Manga using Eye Tracking Information". In Proceedings of the 2016 12th IAPR Workshop on Document Analysis Systems (DAS '16), pp. 120–125, 2016.
23. Shoya Ishimaru and Koichi Kise. "Quantifying the Mental State on the Basis of Physical and Social Activities". In Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '15 Adjunct), pp. 1217–1220, 2015.
24. Kai Kunze, Katsuma Tanaka, Shoya Ishimaru, Yuji Uema, Koichi Kise and Masahiko Inami. "MEME: Eye Wear Computing to Explore Human Behavior". In Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '15 Adjunct), pp. 361–363, 2015.

25. Kai Kunze, Katsutoshi Masai, Masahiko Inami, Ömer Sacakli, Marcus Liwicki, Andreas Dengel, Shoya Ishimaru and Koichi Kise. "Quantifying Reading Habits: Counting How Many Words You Read". In Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp '15), pp. 87–96, 2015.
26. Kai Kunze, Kazutaka Inoue, Katsutoshi Masai, Yuji Uema, Sean Shao-An Tsai, Shoya Ishimaru, Katsuma Tanaka, Koichi Kise and Masahiko Inami. "MEME: Smart Glasses to Promote Healthy Habits for Knowledge Workers". In ACM SIGGRAPH 2015 Emerging Technologies (SIGGRAPH '15), p. 17, 2015.
27. Katsuma Tanaka, Shoya Ishimaru, Koichi Kise, Kai Kunze and Masahiko Inami. "Nekoze!: Monitoring and Detecting Head Posture while Working with Laptop and Mobile Phone". In Proceedings of the 9th International Conference on Pervasive Computing Technologies for Healthcare (Pervasive Health '15), pp. 237–240, 2015.
28. Shoya Ishimaru, Kai Kunze, Katsuma Tanaka, Yuji Uema, Koichi Kise and Masahiko Inami. "Smart Eyewear for Interaction and Activity Recognition". In Extended Abstracts of the 2015 CHI Conference on Human Factors in Computing Systems (CHI '15 EA), pp. 307–310, 2015.
29. Shoya Ishimaru, Kai Kunze, Koichi Kise and Masahiko Inami. "Position Paper: Brain Teasers - Toward Wearable Computing That Engages Our Mind". In Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '14 Adjunct), pp. 1405–1408, 2014.
30. Shoya Ishimaru, Kai Kunze, Yuji Uema, Koichi Kise, Masahiko Inami and Katsuma Tanaka. "Smarter Eyewear: Using Commercial EOG Glasses for Activity Recognition". In Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '14 Adjunct), pp. 239–242, 2014.
31. Shoya Ishimaru, Jens Weppner, Andreas Poxrucker, Paul Lukowicz, Kai Kunze and Koichi Kise. "Shiny: An Activity Logging Platform for Google Glass". In Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '14 Adjunct), pp. 283–286, 2014.
32. Shoya Ishimaru, Jens Weppner, Kai Kunze, Andreas Bulling, Koichi Kise, Andreas Dengel and Paul Lukowicz. "In the Blink of an Eye: Combining Head Motion and Eye Blink Frequency for Activity Recognition with Google Glass". In Proceedings of the 5th Augmented Human International Conference (AH '14), pp. 150–153, 2014. *Cited by 130 times*
33. Shoya Ishimaru, Kai Kunze, Yuzuko Utsumi, Masakazu Iwamura and Koichi Kise. "Where Are You Looking At? - Feature-Based Eye Tracking on Unmodified Tablets". In Proceedings of the 2013 2nd Asian Conference on Pattern Recognition (ACPR '13), pp. 738–739, 2013.
34. Kai Kunze, Shoya Ishimaru, Yuzuko Utsumi and Koichi Kise. "My Reading Life: Towards Utilizing Eyetracking on Unmodified Tablets and Phones". In Proceedings of the 2013 ACM International Joint Conference on Pervasive and Ubiquitous Computing: Adjunct Publication (UbiComp '13 Adjunct), pp. 283–286, 2013.
35. Kai Kunze, Yuki Shiga, Shoya Ishimaru and Koichi Kise. "Reading Activity Recognition Using an Off-the-Shelf EEG - Detecting Reading Activities and Distinguishing Genres of Documents". In Proceedings of the 2013 12th International Conference on Document Analysis and Recognition (ICDAR '13), pp. 96–100, 2013.

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