

PETMEI: 8th Workshop on Pervasive Eye Tracking and Mobile Eye-Based Interaction

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The first applications of eye tracking and eye-based human-computer interfaces mainly concentrated on making use of the eyes in traditional desktop settings. However, this changed in the last decade with a growth of interest in smart eyewear. With recent advances in low-cost mobile eye trackers, gaze-based techniques for mobile computing have become increasingly important. PETMEI 2023 focuses on the pervasive eye tracking paradigm as a trailblazer for mobile eye-based interaction and eye-based context-awareness. We want to stimulate and explore the creativity of these communities with respect to the implications, key research challenges, and new applications for pervasive eye tracking in ubiquitous computing. The long-term goal is to create a strong interdisciplinary research community linking these fields together and to establish the workshop as the premier forum for research on pervasive eye tracking.

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1 INTRODUCTION

Eye tracking technology has matured considerably in recent years, and eye-based interaction is gaining attention in various application areas. While early work focused on gaze as an input modality to interact with desktop computers, it is becoming increasingly important to take eye tracking into everyday life and mobile settings. This paradigm of continuous eye monitoring and eye-based interaction 24/7 was coined *pervasive eye tracking* [8]. The potential applications for the capability to track and analyse eye movements anywhere and any time call for new research to further develop and understand visual behaviour and eye-based interaction in mobile daily-life settings. Pervasive eye tracking is by nature inter-disciplinary and spans across a number of disciplines, including ubiquitous computing, human-robot, human-computer interaction, eye-tracking research, egocentric vision, cognitive psychology, design, and extended reality. Furthermore, virtual reality and augmented reality devices (VR/AR) are becoming more popular and have already entered people's everyday lives, further pushing eye tracking beyond the typical desktop setting. Most likely, the next generation of these devices will integrate eye tracking as an essential core technology to increase content presentation and enhance interaction.

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How and where we look in everyday life provides rich information for understanding human interactions with real-world environments. Our gaze behaviours are closely related to attention and are good indicators of objects of interest. Recently, these insights about users that can be gained through eye tracking are applied in a new out-of-the-lab context (as opposed to more traditional lab research) in real-world environments. The advent of mobile video-based eye-tracking technologies has paved the way for such new research in everyday environments and mobile settings [4]. A growing number of researchers study eye-based interaction in pervasive daily-life settings [2, 11, 16], thereby opening up new application areas and promising eye-based interaction to become mainstream. Mobile eye trackers can provide an indicator of user attention in daily environments [5, 20], and eye movements can be used as a new modality for activity and context recognition [3, 6, 18]. Eye tracking has the potential to become a key component in all interactions that users perform with computing systems in the real world. Successful examples thereof are mobile geospatial applications [14], multi-user gaze-based interactions [19, 22], pervasive display interactions [26, 27], privacy-aware eye tracking [25], gaze interaction with head-mounted VR/AR displays [12, 23] and adaptive user interfaces [10, 24].

2 OBJECTIVES

The main objective of the workshop is to bring together researchers and practitioners working from various disciplines in human-computer interaction, context-aware computing, computer vision, eye tracking, and related fields. The long-term goal of the workshop is to create a strong interdisciplinary research community linking the different research fields and to establish the workshop as the premier forum for these researchers to gather, present their ideas, and discuss techniques and applications for research on pervasive eye tracking in context-aware computing.

Most importantly, the workshop will provide the opportunity to re-establish and expand the research community around pervasive eye tracking, define novel challenges and opportunities, and establish guidelines to inform future research in this field. The first stepping stones towards this vision were established in the first iterations of this workshop from 2015 to 2018. However, in the last five years significant advancements in camera technologies, algorithms, and display devices, have been made, which call for a new perspective on these topics. Specifically, we want to encourage these communities to think about the implications of pervasive eye tracking for context-aware computing, that is, the ability to track eye movements not only for a couple of hours inside the laboratory but continuously for days, weeks, or even months in people's everyday life.

3 TOPICS OF INTEREST

PETMEI 2023 seeks to bring together researchers at different stages of the pipeline from developing algorithms and models to developing applications, and across industry and academia boundaries to discuss the opportunities and needs of future computational approaches for adaptive user interfaces. Submissions can reflect on past work, in-progress projects, present challenges and approaches, identified opportunities, or critical opinions and arguments covering but not limited to the following topics:

- Eye movement detection, tracking, and analysis
- Methods for ET on wearables and mobile devices
- Group interaction ET (beyond the individual)
- Pervasive ET data analysis
- Eye interaction with robots and virtual characters
- Error-aware ET systems
- Pervasive ET-based study of human factors
- Gaze-supported multimodal interaction
- Integration of pervasive ET and context-aware computing
- Robust ET (in the wild)
- Pervasive ET interfaces in VR/AR
- Eye-based activity and context recognition
- Pervasive attentive user interfaces
- ET and gaze interaction in healthcare

4 PAST WORKSHOPS AND ORGANIZERS

4.1 The PETMEI workshop series

The PETMEI workshop was first held in conjunction with UbiComp 2011 [9]. Following the success of this first edition, PETMEI was held at different venues over the years: UbiComp 2012 [7], ECEM 2013 [13], UbiComp 2014-2016 [15, 17, 21], and ETRA 2018 [1]. PETMEI has a long history of constantly attracting numerous participants (typically 30-60) working at the intersection of pervasive eye tracking with other fields, such as cognitive psychology and computer science. Now, after a 4-year break, we believe is the perfect time to reinstate the workshop, given that technological advancements have created new challenges in the area that need to be addressed, and that pervasive eye tracking is at the edge of becoming everyday end-user technology (e.g., through VR headsets like the Meta Quest 2).

4.2 Organizers

PETMEI 2023 will be organized by five researchers who have joint experience with the broad areas of eye-based human-computer interaction, eye tracking, extended reality, computer vision, and adaptive user interfaces. As for all previous workshops, they are joined by one member of the PETMEI Steering Committee. With their complementary backgrounds, they each bring unique expertise to the topic. Furthermore, being located in four countries, the five organizers have access to different local communities that they will engage to participate in the workshop.

Yao Wang is a Ph.D. student in Visualization and Interactive Systems at the University of Stuttgart, Germany. His research interests include computer vision and eye tracking, focusing on visual attention modelling on visualizations.

Ludwig Sidenmark is a postdoctoral researcher in Human-Computer Interaction (HCI) at Lancaster University, UK. His research interests lie within HCI, VR/AR, eye tracking and adaptive interfaces with a focus on gaze-based interaction in AR/VR. Ludwig was a Virtualization chair for ETRA 2021 and 2022, and Short paper chair for ETRA 2023.

Teresa Hirzle is a postdoctoral researcher in the Human-Centred Computing Section at the University of Copenhagen. Her primary research interest is in extended reality and eye tracking. She co-organized the workshop on Eyewear Computing at UbiComp 2021, was Short Paper co-chair of ETRA 2021, and co-organized the first edition of the EduEye workshop in 2022.

Yue Jiang is a Ph.D. student in Intelligent Systems with Prof. Antti Oulasvirta at Aalto University, Finland. Her main research interests include adaptive user interfaces and eye tracking. She co-organized the workshop on Adaptive User Interfaces at CHI2022. She is a Workshop Jury and Accessibility Co-Chair at CHI2023.

Andreas Bulling is Full Professor of Computer Science at the University of Stuttgart and Director of the research group Human-Computer Interaction and Cognitive Systems. Andreas has had various conference organisation roles over the years, most relevant in the context of this proposal as general chair for ETRA 2020 and 2021. He founded the PETMEI workshop series and organised its first edition in 2011 together with Andrew Duchowski and Päivi Majaranta.

5 WORKSHOP FORMAT

PETMEI 2023 is planned as a half-day workshop as part of the ETRA 2023 workshop program. We expect approximately 30 participants with a background in context-aware computing, human-computer interaction, computer vision, and eye tracking. As the workshop covers an interdisciplinary research area at the crossroads of these fields, we not only aim to

09:00 – 9:10	Opening	Introduction of the workshop program and goals
09:10 – 9:20	Introductions	30-second introduction of all participants with single slide bio.
09:20 – 9:50	Keynote Speaker	Aude Oliva (TBD)
09:50 – 10:00	Coffee Break	
10:00 – 10:40	Paper Presentation	Approx. 6-8 short paper presentations
10:40 – 11:40	Discussion in Breakout Groups	Common keywords among the submissions as a basis for the discussion group topics
11:40 – 12:00	Wrap-up	Report of discussion results, end of workshop

Table 1. Tentative workshop schedule

attract domain experts but also newcomers with an interest in potential applications of pervasive eye tracking in their respective fields.

5.1 Pre-Workshop Plans

We have set up a webpage¹ and will distribute the Call for Participation through multiple research communities, including those of ubiquitous and pervasive computing, eye tracking, computer vision, and HCI. We will also advertise the workshop at upcoming HCI conferences (e.g. CHI 2023), among research groups, on social media, and through our professional networks.

5.2 Workshop Schedule and Asynchronous Engagement

The workshop will consist of one keynote talk, workshop paper presentations, and topic discussions. All submissions will be peer-reviewed via an international program committee. Demos of the latest development of pervasive eye tracking will be encouraged to all participants. We will select participants based on the quality and novelty of the insights presented in their submissions. We will also try to balance different workshop topics and criteria to ensure a diverse group of workshop participants. We expect the workshop to be *hybrid* with most participants attending in person. Synchronous remote participation will be available for those unable to join us in person. We will stream all talks at the workshop and will create virtual discussion “breakout rooms” for remote attendees. We will release the workshop website upon the acceptance of the workshop. It will list the call for papers of the workshop, the program information, the list of organizers and speakers, and the pre-prints of accepted workshop position papers. The tentative workshop schedule is as shown in Table 1.

Backup Plan: In cases of a low number of submissions, we will invite one more keynote speaker to replace a portion of the paper presentation section and increase the time for discussion.

5.3 Post-Workshop Plan

Papers accepted for oral presentations will be included in the ACM Digital Library. Submissions accepted as a poster, presentation slides, and demo-related material will be made available on the workshop website. After the workshop, we plan to create a platform for community members to continue the discussion and share resources. Potential options may include a periodical email newsletter, a public GitHub repository, or a Slack/Discord channel. Participants and organizers will discuss the next steps at the workshop.

¹<https://www.petmei.org>

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