Tim J. Schoonbeek

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Seeking to participate in the MaVi Summer of Research 2024

As a PhD student in computer vision for egocentric activity recognition, I am excited at the opportunity to participate in the MaVi Summer of Research 2024. Specifically, with professor Dima Damen, a leading expert on video understanding. Her impressive track record, publications by students under her supervision, as well as the inspiring keynote at WACV this year, motivate me to apply for a research visit to her group.

My PhD research focuses on recognizing procedure actions from egocentric video, and providing a measure of completion as well as correctness for these actions. I find this research meaningful and highly interesting, since I strive to use computer vision to enable people, rather than replace or frustrate them. To this end, the work of professor Damen is highly relevant for my project. In particular, I find the recent works *generating actions and state transformations from instructional videos* and *action recognition generalisation over scenarios and locations* very relevant for my project. Expanding on such work, perhaps by recognizing the completion and correctness of actions or applying it to industrial-like settings, appears valuable and captivating to me.

Seizing the opportunity for a research internship with professor Damen at UoB would significantly contribute to my academic and personal growth. Simultaneously, I can bring enthusiasm, motivation, and an open mindset to the group.

Summary

PhD candidate at ASML Research and Eindhoven University of Technology, currently in third year of a four-year PhD program. In my research, I develop neural networks with Pytorch, to be deployed on head-mounted augmented reality devices with the objective to automatically recognize steps (and potential errors) during maintenance on lithography equipment. More information may be found on my website:

https://timschoonbeek.github.io

In my leisure time, I am deeply engaged in cultivating my passions, which include riding and maintaining motorcycles, swimming, studying Portuguese, and traveling the world as much as possible.

Research Interests

Egocentric video understanding, augmented reality, sim-to-real data generalization, recognition of procedure activities

Experience

ASML Research & Eindhoven University of Technology — *Eindhoven, the Netherlands*

PhD Candidate: Advanced Augmented Reality Solutions for AI-based Servitization — *Sept. 2021 - Oct. 2025*

- This PhD project aims at automatically extracting relevant and meaningful information from (egocentric) procedural actions within an industrial setting. These industrial settings contain a wide variety of procedural actions and a significant cost associated with mistakes. A solution requires scalable and robust algorithms, which we intend to deploy on augmented reality devices (e.g. HoloLens 2) to provide advanced support.
- Filed a patent and obtained two peer-reviewed contributions at the ASML Technology Conference, the largest developer event worldwide.
- Teaching obligations include giving a lecture on efficient video neural networks to graduate students.

International Summer School — *Matera, Italy*

eXtended Reality and Artificial Intelligence — *July. 2023*

- Summer school on the intersection of AI & extended reality (XR), including lectures from prof. Rita Cucchiara and prof. Joaquim Jorge.
- Pro-actively took up the role as a link between the programmers and designers in a multidisciplinary project, besides my technical roles.
- Our team worked on an XR app for engagement with cultural heritage and *won the best project award*.

Eindhoven University of Technology — *Eindhoven, the Netherlands*

Master thesis: Learning to Predict Collision Risk from Simulated Optical Flow — *Sept. 2020 - May. 2021*

- Master thesis on generalization from synthetic to real-world videos in the automotive domain. Domain generalization was achieved by design, rather than explicit training techniques.
- Awarded a 9.0/10.0, granting the *Cum Laude* honours distinction.
- Paper accepted as *oral presentation* on the single-track 2022 IEEE Intelligent Vehicles Symposium (top 10% of accepted papers).

Honda Research Insititute Europe GmbH — *Frankfurt, Germany*

Master internship: Interaction-Aware Trajectory Prediction using Graph Neural Networks — *Mar. 2020 - Jul. 2020*

- Worked on spatio-temporal graph neural network on trajectory prediction of surrounding vehicles for highway driving scenarios.

Automotive Technology InMotion (Student Team) — *Helmond, the Netherlands*

Race Engineer - part-time — *Sept. 2018 - Sept. 2019*

- Performed and optimized drive cycle simulations for an electric endurance racing car.

Academic Output

WACV 2024	Tim J. Schoonbeek *et al.*, IndustReal: A Dataset for Procedure Step Recognition Handling Execution Errors in Egocentric Videos in an Industrial-Like Setting
IEEE VR-Abs 2023	Tim J. Schoonbeek *et al.*, Beyond Action Recognition: Extracting Meaningful Information from Procedure Recordings
IS&T LIM 2022	Tim J. Schoonbeek *et al.*, Augmented Reality for Automatically Generating Robust Manufacturing and Maintenance Logs
IEEE IV 2022	Tim J. Schoonbeek *et al.*, Learning to Predict Collision Risk from Simulated Video Data

Industry Contributions

Patent (*filed*)	Tim J. Schoonbeek *et al.*, Contrastive Deep Learning for Scanning Electron Microscope Defect Inspection
ASML TC 2024	Tim J. Schoonbeek *et al.*, Verifying Procedure States of Manual Assemblies using Contrastive Learning and Synthetic Data
ASML TC 2023	Tim J. Schoonbeek *et al.*, Automated Recognition of Procedural Actions for Real-Time Understanding of Service Tasks

Education

Eindhoven University of Technology *Eindhoven, Netherlands*

M.Sc. in Automotive Engineering (Specialization: Mobile Perception Systems) *Feb. 2019 - May. 2021*

- Obtained the *cum laude* honours distinction for a 4.0 GPA (8.5/10).

Eindhoven University of Technology *Eindhoven, Netherlands*

B.Sc. in Electrical Engineering (Automotive track) *Sept. 2015 - Feb. 2019*

- Bachelor thesis on depth estimation from disparity and segmented images awarded a 8.5/10.

Recommendations

Dr. Hans Onvlee (*hans.onvlee@asml.com*), senior researcher at ASML and daily supervisor for PhD:
"From the start of his PhD project at ASML, Tim has always been someone who talked about complex challenges with genuine enthusiasm, followed by getting things in place to work on these challenges with the same enthusiasm. Tim is self-propelling, gets things done, has a nice style of presenting his results and a very nice colleague to work with. Half way his project we are already beyond what I dared to believe to be possible at the time we defined it, which is completely due to his practical, 'can do' mentality."

Dr.Ir. Fons van der Sommen (*fvdsommen@tue.nl*), associate prof. at Eindhoven University of Technology and daily supervisor for PhD:
"Tim is a very talented, enthusiastic and motivated student. As a MSc student, Tim was always sitting in the front row in my class on neural networks for computer vision and brought a very positive energy to the educational setting. It was no wonder that he completed my class with the highest possible mark (10/10), which only a handful of the most talented students do. After obtaining his MSc degree cum laude, he started as a PHD student under my supervision, on a very challenging project at the intersection of academia and an industry research department (ASML). For us this was pioneering work in a very important collaboration, hence, the position came with a considerable responsibility. Tim is handling this extremely well and does not need external motivation to raise the bar for himself. This is highlighted by one of his recent publication at the IEEE/CVF Workshop on Applications of Computer Vision, for which he created a publicly available data set (`https://timschoonbeek.github.io/industreal.html`) for a newly defined task, that was not yet well described in literature. This demonstrates Tim's ambition to have broader scientific impact at the highest level. I know Tim as an open person that is very eager to learn and I would highly recommend him for a research position in the field of computer vision (both in industry and academia)."

Dr.Ir. Tim Puphal (*tim.puphal@honda-ri.de*), my internship supervisor at Honda Research Institute Europe:
"During his internship Tim Schoonbeek completed all his research tasks motivated and diligently, while being friendly and supportive to his supervisors. His line of action was very systematic, and he could solve complex problems thoroughly in a fast manner. In the end of his stay, he wrote his report comprehensible and detailed at the same time. We highly recommend him without any reservation as a PhD student in the university or as a scientist in the industry."