Eren Homburg

Curriculum Vitae

Personal information

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Date of Birth	12.09.2002

Education

Sep 2022 - Aug 2025 — **B.Sc Computer Science**,
ETH Zürich, Zürch, Switzerland

- Thesis: 'DBox Plus: An AI-Assisted Code Learning Tutor' supervised by Prof. Dr. April Wang
- Core Courses: Compiler Design, Human-Computer Interaction, Visual Computing, Introduction to Machine Learning, and Rigorous Software Engineering

Sep 2017- Jun 2021 — **High School**,
Liceo Cantonale di Mendrisio, Mendrisio, Switzerland
Physics and applied Mathematics

Projects

Feb 2025 – Jul 2025 — **DBox Plus – An AI-Assisted Code Learning Tutor**,
Bachelor Thesis supervised by Prof. April Wang, (ETH Zürich Switzerland),
dbox.com

- **Skills**: **React**, **TypeScript**, **Python**, **User-Centered Design**, **Git**, **LaTeX**, **Figma**, **Docker**
- Built the Decomposition Box (DBox) from scratch using **React**, including a complete frontend and a redesigned user interface
- Designed and implemented system extensions to teach abstraction by identifying and generalizing recurring programming patterns
- Integrated **large language models** to support learners through interactive step trees that foster co-decomposition and independent thinking
- Deployed backend on Cloudflare Workers using R2 and KV storage, with rate limiting, file streaming, and resource caching
- Applied a **user-centered design process**, conducted a **usability study** (N=7), and evaluated the system using SUS and likeliness scores; performed **quantitative and qualitative analysis**, including **visualization of user feedback and behavioral patterns**

Mar 2025 – Jun 2025 **Static Program Analyzer**,
Rigorous Software Engineering , (ETH Zürich Switzerland)

- **Skills**: **Abstract Interpretation, Static Analysis, APRON, Soot, Java Bytecode (Jimple), Program Verification, Numerical Domains**
- Developed a Java static analyzer using abstract interpretation techniques and numerical abstract domains (APRON)
- Integrated pointer analysis with numerical abstract interpretation using the Soot analysis framework
- Verified multiple properties (e.g., non-negativity, delay bounds accumulated delays) of Java programs involving complex control flows, loops, and heap objects
- Ensured soundness and maximized precision by correctly implementing widening and fixpoint computation for loop analysis

Nov 2024 – Dec 2024 **Urban AI – Scalable Web Application for Urban Insight**,
Fundamentals of Web Engineering, (ETH Zürich Switzerland),
github.com/repo

- **Skills**: **React**, **JavaScript**, **TypeScript**, **Cloudflare**, **OpenLayers**, **HTML**, **CSS**, **Google Maps API**, **Git**, **LaTeX**
- Built a **full-stack web application** to generate architectural and civil engineering insights from user-uploaded images
- Designed an interactive map (OpenLayers) to visualize geo-curated datasets from 6 major cities, including dynamic coloring and filtering
- Developed a responsive frontend (**React**) with image upload portal, token system, user authentication, and Stripe integration
- Deployed backend on **Cloudflare Workers** using R2 and KV storage, with rate limiting, file streaming, and resource caching
- Integrated Google Maps Street View API, Grounding DINO, and SAM for street-level insight extraction and segmentation
- Ensured security and scalability via CORS handling, **Cloudflare edge caching**, and secure email routing via contact form

Oct 2024 – Dec 2024 **Family FairShare: Balance the Invisible Work**,
Human Computer Interaction, (ETH Zürich Switzerland),
github.com/repo

- **Skills**: **Figma**, **Miro**, **PHP**, **Python**, **User Research**, **A/B Testing**, **Git**, **LaTeX**
- Designed and prototyped a mobile app to visualize and fairly redistribute household mental load using **user-centered design methods**
- Ideated with 6-3-5 Brainwriting and affinity diagrams; benchmarked apps like Trello for visualization inspiration
- Developed three prototype iterations (low-, mid-, and high-fidelity) using **Figma**; incorporated feedback from **usability tests and A/B testing**
- Engineered dynamic task visualization tools (e.g., heatmaps, radar charts, load timelines) to aid in workload awareness and planning
- Evaluated gamification's impact via user studies; removed features that increased mental load or reduced fairness in real-world group tests

Oct 2024 – Dec 2024 **X86lite Assembler & Simulator**,
Compiler Design, (ETH Zürich Switzerland)

- **Skills**: **OCaml, Numeric libraries, Parsing, Assembler construction**
- Developed a label-resolving assembler (including symbol tables) that serializes instruction/data sections into a binary memory image
- Built a full-featured simulator handling memory mapping, registers, flags, instruction decoding, and program execution (e.g., recursive factorial)
- Extended the compiler pipeline through LLVMlite and LLVM-to-Oat stages, including backend (LLVM→X86lite), frontend (Oat parsing, AST→LLVM IR), and dataflow/optimizations (liveness, constant propagation, dead code elimination, register allocation)

Mar 2024 – Apr 2024 **Reliable Transport Protocol**,
Computer Networks, (ETH Zürich Switzerland)
- **Skills**: **C, UDP, Sliding Window Protocol, Network Programming**
- Implemented a reliable sliding-window transport protocol on top of UDP, ensuring data integrity and order despite packet loss, corruption, and reordering
- Developed client and server components to reliably transfer data streams, handling acknowledgments, retransmissions, flow control, and EOF signaling
- Passed rigorous automated testing, demonstrating robustness with arbitrary window sizes and handling complex network conditions

Feb 2024 – Jul 2024 **Flight Jet Simulator, VR, Universal Render Pipeline (URP)**,
Visualization, Simulation and Interaction - Virtual Reality I, (ETH Zürich Switzerland)
- **Skills**: **Blender**, **Unity**, **C#**
- Designed a custom jet model in Blender and integrated it into Unity
- Developed immersive game mechanics and physics interactions for VR

Experience

Jan 2022 - Jun 2022 **Assistant Kitchen Chef**,
Casa Anziani Girotondo, Novazzano, Switzerland
- Demonstrated efficiency and reliability in meeting rigorous schedules
- Maintained high standards while working under pressure in a fast-paced environment
- Engaged in direct customer contact, ensuring service quality and satisfaction

Jul 2021 - Aug 2021 **Directional Beam Pioneer**,
Swiss Armed Forces, Kloten, Switzerland
- Set up communication systems in fast-paced and high-pressure environments
- Collaborated closely in team-based missions under extreme mental and physical stress
- Acted as multilingual interpreter (French–German–Italian) in operational settings

Skills

Programming Languages & Frameworks	Python (Pandas, NumPy, PyTorch), Java, C++, C#, C, Assembly, Haskell, OCaml, JavaScript/TypeScript (React, Node.js, Chart.js), PHP, HTML/CSS, MySQL
Tools & Platforms	Git, Docker (basic), LaTeX, Cloudflare, Blender, Unity, Miro, Figma, Canva, Microsoft Office
Hardware & Embedded	FPGAs (basic), Assembly
UX & HCI	User Research, Usability Testing (SUS, A/B Testing), Survey Design, Wireframing, Affinity Mapping, Task Flows, Statistical Analysis (Python)
Languages	German (Native), Italian (Native), English (Professional Proficiency), Turkish (Professional Proficiency), French (Limited Professional Proficiency)