PhD seminar in Interdisciplinary Research in Human-Computer Interaction

23-24 May 2022
Chalmers University of Technology
Gothenburg, Sweden

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Welcome

The PhD seminar in Interdisciplinary Research in Human-Computer Interaction is held by the Interaction Design Unit at the Computer Science and Engineering department at Chalmers University of Technology in Gothenburg Sweden. This two-day event is taking place on May 23rd and 24th, 2022. This seminar provides a platform for sharing research ideas, questions and findings; while aiming to create an environment to foster knowledge exchange and collaborations between PhD students and researchers in Nordic countries.

This event is a gathering opportunity for PhD students and other researchers who are mainly from Nordic countries. The seminar hosts PhD student presentations with the attendance of other students, post-doctoral fellows, and professors. We encourage PhD students to gather and share their research plans, findings, experiences, and challenges that they encounter in their research activities. We are inviting regional and Nordic researchers to cultivate knowledge exchange through sharing research finding and to encourage PhD students to network with Nordic researchers; towards initiating collaborations between PhD students and researchers in Nordic countries.

Stay tuned for forthcoming workshops, which will take place at KTH Royal Institute of Technology in Stockholm Sweden in early Fall 2022, at University of Bergen in Norway in late Fall 2022.

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https://kivanctatar.com/phd-seminar-may-2022

Organizers and Sponsors

Chalmers University of Technology (Chalmers)
Gothenburg, Sweden
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Stockholm, Sweden
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The University of Bergen (UiB)
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WASP—HS

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wasp-hs.org

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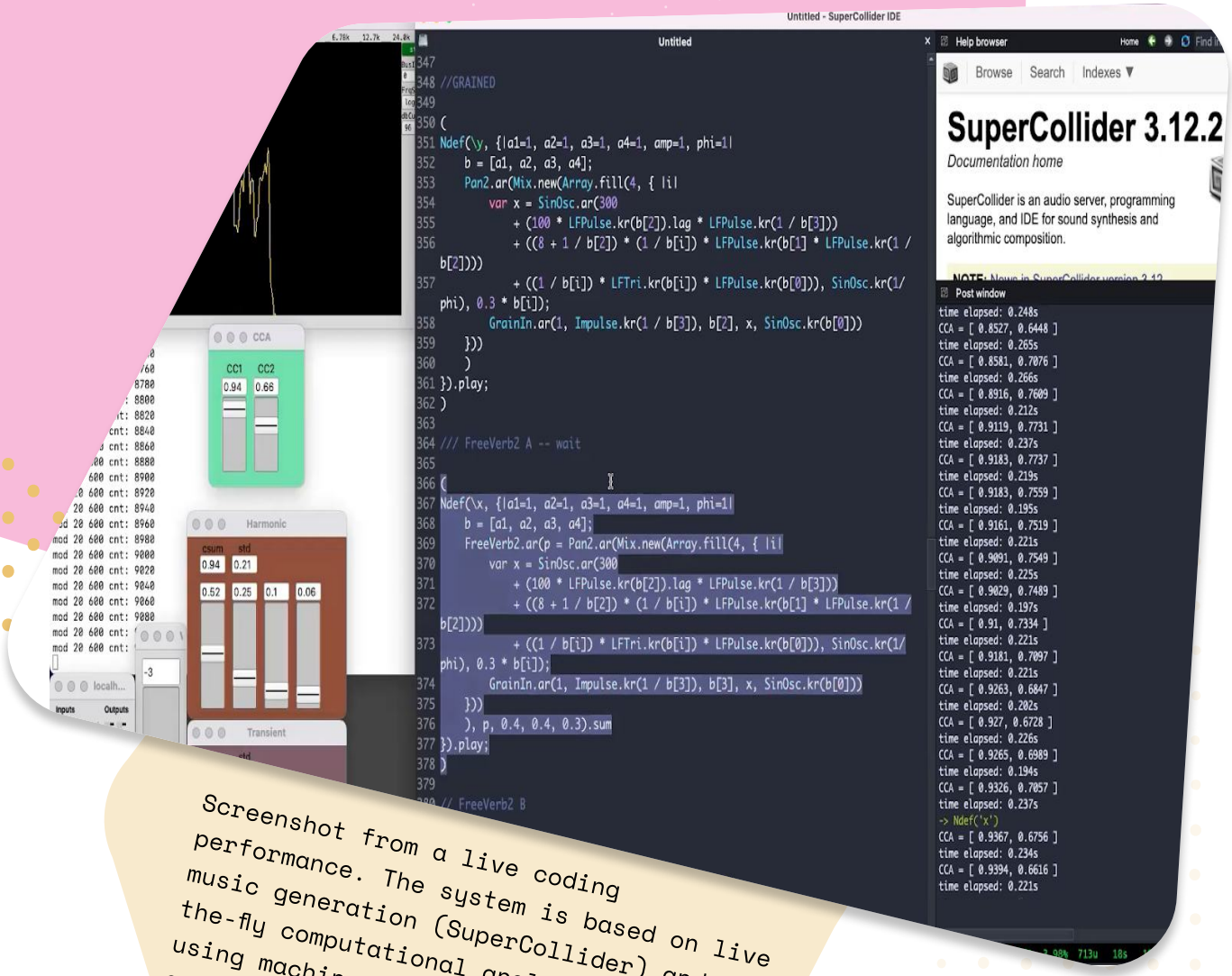
PhD student since: **48 months**
PhD defence planned in: **12 months**
Working title of thesis: **Liveness and interaction with generative algorithms for machine musicianship**
3-5 keywords: **live coding, music performance, musical gestures, music psychology & perception, machine listening & learning**

Abstract

Live coding is a performance practice which shows increasing trends among computer musicians, dancers and visual artists. In the context of music performance, the composer-programmer is typically typing on a keyboard and sharing her screen with the audience to generate musical sounds and make the performance experience transparent. Besides this standard form of performance, there is a broad variety of live coding music systems which sometimes alternate the performance practices. Live coding practitioners have been developing music systems which are based on traditional musical instruments, like the piano, to sophisticated and even obscured electronic interfaces. This spectrum of interface designs may afford different gestural interactions than typing on a keyboard. For instance, a pianist is producing an expressive repertoire of musical gestures during performance, which transforms the very meaning of non-significant gestural interactions, like typing on a keyboard.

Our approach is to examine how gestural interactions may vary between different practitioners, even when using potentially equivalent live coding systems. We conducted an observational study based on videos of live coding performances available online, and we developed an analytical framework for describing live coding systems. Our next steps are to expand this framework to a typology of live coding systems and practices. For example, live coding practice may also be a collaborative or even networked performance practice.



Screenshot from a live coding performance. The system is based on live music generation (SuperCollider) and on-the-fly computational analysis (Python) using machine listening on spectral acoustical characteristics.

Furthermore, given the technological advances of machine learning technologies it is possible to incorporate machine listening components in live coding performances. This is shifting the boundaries of human-machine musicianship as the human agent cannot be certain about her own contributions to the musical composition. To this end, we are developing machine listening and machine learning components which may be used for interactive AI systems.

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Working title of thesis: **Sustainable Human-Robot Interaction (HRI)**
3-5 keywords: **HRI, novel robotic applications, human perceptions, sustainability**

Abstract

With technology advances, artificial intelligence and autonomous systems seem to have a blowout in our society, embracing both opportunities and challenges. The following questions arise: What demands will society have for developing better robots? How will humans perceive robots in the near future? Could we better understand human mind and behaviors via studying and developing artificial intelligence and robotics? What ways are sustainable for the interaction between humans and robots? I have been trying to narrow down these broad questions into concrete research ideas via developing novel robotic applications and utilizing them to run psychological experiments on human participants. I have been taking and going to take a mixture of both quantitative and qualitative approaches, as I believe such a way can help us better understand the research subjects including both humans and robots.

I recently finished a research study on how humans(N=56) perceive a small noisy flying robot under various conditions in terms of sound scenarios and proxemics, and currently I am still writing the research paper about the study. Next steps will be to finish writing this paper and get it published in some suitable venue, prepare for the next research study, and so forth.

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PhD defense planned in: **10 months**
Working title of thesis: **(not fixed) Augment the Vision: To Help Users Understand the XYZ**
3-5 keywords: **interactive visualization, augmented/mixed reality, human-centered design**

Abstract

One of the cutting-edge techniques—augmented reality (AR) (a variation of virtual reality (VR)), in which virtual objects are superimposed in the real world—has been demonstrated and applied in numerous fields due to its capability of providing interactive interfaces of visualized digital content. Moreover, AR can provide functional tools that support users undertaking domain-related tasks, especially facilitating them in data visualization and interaction because of its ability to jointly augment the physical space and the user's perception. How to fully use the advantages of AR technique, especially the items which augment human vision to help users with different domain tasks' perform is the central part of my PhD research.

Project: using AR to support industrial process tomography users for visualization-based analysis.
Industrial process tomography (IPT), as a non-intrusive and commonly-used imaging technique, has been effectively harnessed in many manufacturing components for inspections, monitoring, product quality control, and safety issues. IPT underpins and facilitates the extraction of qualitative and quantitative data regarding the related industrial processes, which is usually visualized in various ways for people to understand its nature, measure the critical process characteristics, and implement process control in a complete feedback network. The adoption of AR in benefiting IPT and its related fields is currently still scarce, resulting in a gap between AR developers and industrial applications. What I have done was filling this gap and creating the bridge between the AR developers and IPT users. The conceptualized AR framework was proposed, together with the implemented mobile application. The immersive interaction between users and the tomographic visualizations was also created through our AR system.

In this work, we propose a gaze-assisted AR system that provides visual and audio hints, along with gaze playback giving instant post-task feedback to enhance performance in search tasks. The target case in our study was a book searching task. The most prominent highlight of our proposed solution compared to conventional AR systems is that we bring the visual/audio hints and the instant post-task feedback together. We aim to explore the effect of the hints and the feedback in our proposed system with two hypotheses. H1: Both visual and audio hints can ameliorate AR search task performance whilst the combination of them transcends the individual ones. H2: Instant post-task feedback can lead to better performance in AR search tasks.

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PhD defence planned in: **Somewhere in 2027.**
Working title of thesis: **still too early to say**
3-5 keywords: **interactive tables; accessibility; interaction design; embodied interaction; digital fabrication**

Abstract

I have a mixed background in interaction (MSc) and industrial design (BSc), currently in the early stages of my PhD which is on the topic of interactive tables with a focus on accessibility aspects. I am currently working on a literature review on interactive tables with the ability to physically actuate (movement, change-shape, etc.) applied in an everyday context. My previous and current design research interests include: designing with biosensors, tangible interaction, IoT, somaesthetics, makerspace community, digital fabrication, craftsmanship.

Recent work paper abstract
We introduce Azalea: a design to enrich remote dialog by diminishing externalities, created through a process informed by somaesthetics. Azalea is a tactile cushion that envelops a smartphone running a bespoke app. A pair of Azaleas mediate an embodied co-experience between remote interlocutors via a motion-driven soundscape and audio-driven visuals. While most designs for enriching remote communication increase dimensionality and fidelity of modalities, Azalea diminishes distractions and serves as an abstract medium for co-experiencing embodied information. We present the theoretical foundations and design tactics of Azalea, and characterize the experience through a qualitative empirical study. Our findings culminated in 12 qualities, supporting 5 themes with design implications that contribute to (1) a design ethos of diminished reality and (2) an expansion of somaesthetic HCI towards expression and communication.

Sjoerd Hendriks, Simon Mare, Mafalda Samuelsson-Gamboa, & Mehmet Aydın Baytaş (2021). Azalea: Co-experience in Remote Dialog through Diminished Reality and Somaesthetic Interaction Design. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (CHI '21) https://doi.org/10.1145/3411764.3445052
http://sjoerdhendriks.com/project/azalea

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PhD defence planned in: **Future**
Working title of thesis: **To be determined**
3-5 keywords: **AI; music; ethics; aesthetics; interaction**

Abstract

I come from a musical background (BMusHon and MA Arts), with a focus on contemporary and experimental performance and composition. My artistic practice and research interests lie at the junction of art and technology, probing the possibilities of intersomatic experiences of music, movement and wearable interfaces. I have recently started my PhD, which is centered on exploring interactive music systems and AI. My previous research work has probed biodata and biosensor interactions, the design of musical interfaces, and experiential transfer of bodily knowledge through haptics.

Recent work paper abstract

In this paper we present our late-breaking work in leveraging a soft robotic fiber-based wearable system for the transposition of somatic knowledge and experience within the context of singing. We examine how the transposition of the physical nuances of singing from one body to another, or multiple other bodies, is possible by engaging with a soma design process. We share our findings in the context of experience transposition, resulting in a preliminary prototype: a pneumatically controlled soft robotic garment—called ADA (short for air-driven actuator) for re-enacting felt experiences of singing onto the human body. We contribute with 1) our initial findings in transposing singing experiences between and across bodies, and 2) a preliminary wearable robotic garment to mediate intersomatic experiences of singing.

Kelsey Cotton, Ozgun Kilic Afsar, Yoav Luft, Priyanka Syal, and Fehmi Ben Abdesslem. 2021. SymbioSinging: Robotically transposing singing experience across singing and non-singing bodies. In Creativity and Cognition (C&C '21). Association for Computing Machinery, New York, NY, USA, Article 52, 1–5. https://doi.org/10.1145/3450741.3466718

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Working title of thesis: **To be determined**
3-5 keywords: **robotics, model-driven engineering, mission assurance**

Abstract

I have a mixed background of data science and computer engineering and the goal of my research is to establish novel methods and tools for model-and-field-data-based safety assurance for robots.

Robots are increasingly used to perform tasks ranging from simple pick-and-place to performing complex behavior. They combine different skills that need to be coordinated to form complex behaviors, known as missions. Typically, those skills are programmed at a relatively low-level of abstraction, such as controllers for sensors and actuators, while the coordination of them to form missions might be represented on a higher level using behavior models.

With the rising complexity of robotic missions and their integration in human life, more research is needed to ensure the safety of mission execution. Identifying potential consequences of robot actions that might lead to accidents, such as collisions or failures to achieve mission goals, is a core research challenge. Having a high-level representation of robotic missions through behavior models is an important step towards better understanding of missions and early identification of problematic scenarios.

So far I have been focusing on an emerging behavior model called Behavior Trees that were originally invented for computer games. I have been researching the available languages and their use in real-world robotics projects.

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PhD defence planned in: **Sometime in 2026**
Working title of thesis: **Drones, Design, and Dasein: Designerly Ways of Knowing in Human-Drone Interaction**
3-5 keywords: **human-drone interaction; design epistemology; phenomenology; research through design**

Abstract

My research is framed by the WASP-HS grant on Social Drones led by Morten Fjeld and Sara Ljungblad. The project is funded through the Wallenberg Foundation within WASP-HS as an initiative for humanistic and social scientific research in AI and autonomous systems.

Through a critical design approach, my PhD proposes new perspectives on social drones, and particularly companion drones, drawing on notions of care. I intend to research how we can design for complex experiences, through engaging technology in practice. This process is supported by fringe design philosophies such as slow technology and soma design. I dwell on the notion of companion drones and how design knowledge is essential to their development. I intend to fill some of the methodological gaps identified in human-drone interaction, such as longitudinal studies in drone user experience through auto-ethnography, design for neglected more than human agents, but also reflective contexts such as the showroom.

Therefore, the general issue for my research is summarized as such:

What design knowledge and methodology is critical for designing and studying social drones?

In the context of my PhD which will primarily focus on companion drones as a sub-set of social drones:

R1: What interaction design factors and philosophies are relevant when designing personal companion drones?
R2: What methods within critical design and ethnography are best suited to support a research through design approach to human-drone interaction, particularly child-drone interaction?

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Working title of thesis: **Reflection by Interaction - How technology can support users with self-reflection**
3-5 keywords: **self-reflection, personal informatics systems, interaction design, well-being**

Abstract

My PhD project focuses on technology-supported self-reflection. Self-reflection is a commonly addressed design goal in commercial systems and in Human-Computer Interaction (HCI) research. Yet, it is still unclear what tools are at the disposal of designers who want to build systems that support reflection. Understanding the design space of reflection support systems and the interaction techniques that can foster reflection is necessary to enable building technologies that contribute to the users' well-being.

In my work I therefore try to come to an understanding of the design space of reflection-support systems and how we can design interactions that enhance users' self-reflection. My PhD started off with three projects, resulting in three publications:

- In order to gain additional insight into how interactive artefacts foster reflection, we investigated past research prototypes and reflection-supporting smartphone applications (apps). Through a structured literature review and an analysis of app reviews, we constructed a taxonomy of design resources and patterns, which is intended to inspire future technologies that better support reflection [1].
- Current personal informatics models consider reflection as an important stage in users' journeys with trackers. However, these models describe reflection from a meta perspective and it remained unclear what this stage entails. To design interactive technologies that support reflection, we need a more thorough understanding of how people reflect on their personal data in practice. To that end, we conducted semi-structured interviews with users of fitness trackers and an online survey to study practices in reflecting on fitness data. Based on our results, we introduced the Technology-Mediated Reflection Model, which describes conditions and barriers for reflection on personal data [2].

- Evaluating if and how an interactive technology helps a user reflect is still complex. This makes it difficult to compare artefacts (or prototypes) for reflection, impeding future design efforts. To address this issue, we developed the Technology-Supported Reflection Inventory (TSRI), which is a scale that evaluates how effectively a system supports reflection. The TSRI enables researchers and practitioners to compare prototypes designed to support reflection [3].

My current projects focus on:

- The design of metrics (e.g. stress scores and body battery scores) and studying how these effect a user's understanding of, and reflection on their health and well-being
- The use of tangible tokens and artefacts to study if a physical representation of personal data enhances self-reflection

[1]https://doi.org/10.1145/3517233
[2]https://doi.org/10.1145/3411764.3445505
[3]https://doi.org/10.1145/3411764.3445673

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PhD defence planned in: **Late fall, 2023**
Working title of thesis: **The Robot Design Canvas**
3-5 keywords: **Human-Robot Interaction; service robots; user research integration; organizational change; robot design canvas**

Abstract

This PhD project is about designing and developing value-generating and need-fulfilling service robots for people. The robotics industry increasingly prioritizes design frameworks that integrate user research practices in effort to develop commercially viable robots that generate value and fulfill end-users' needs, yet we lack information about how commercial robots are currently being developed. Having this information will make it easier to integrate and fuse user research practices and competencies into work-practices of multidisciplinary teams working within robotics. Combining research from the fields of Human-Robot Interaction (HRI), HCI, and innovation management provide a solid foundation and the backbone for creating the Robot Design Canvas (RODECA). What makes RODECA unique is that it is informed by the needs, skills, challenges, and strategy of robotics companies as they design and develop robotics solutions. To achieve this, the plan is to incrementally develop, implement, and evaluate user research methods and techniques to be included in RODECA through repeated cycles together with industry practitioners, and the philosophy is that learning comes from both the development and use of the framework within industry contexts.

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PhD defence planned in: **2026**
Working title of thesis: **Sustainability and Ethics of Creative-Ai**
3-5 keywords: **Creative-AI, Sustainable AI**

Abstract

This PhD project is exploring sustainability and ethics in the context of Creative-Ai. Having started last September (2021), I have firstly focused on understanding the materiality of Creative-Ai (ontologies of various tools) and existing sustainability assessment methods that could be applied in the analysis of Creative-Ai (LCA, energy assessment, etc.). I have written a paper called "On the environmental impact of Ai Art(s)", where we introduce the topic and argue that sustainability of Creative-Ai systems is of interest to study. We also situate the sustainability of Creative-Ai in the context of wider sustainability research, particularly in the computing within limits community and perspective (that is rooted in planetary limits and explores concepts and strategies for this, such as de-growth). In this paper, we have also looked into a few cases in which contemporary artists use Ai in their artworks.

Another direction that I've so far pursued in my research is ethics perspectives from feminist environmental posthumanities - by exploring the values and practices historically embedded in Creative-Ai phenomena (artifacts, agents) through the critical lense of feminist care ethics using speculative design. With the latter exploratory study, I've aimed to start taking steps towards understanding how ethics are enacted in practice and aim to gain some ethically informed perspectives on practicing sustainability in the context of Creative-Ai. My aim is to work with the concept of sustainability in various dimensions, such as material, sociocultural, ethical - as they are interconnected.

Fig 1. Exploitative practices in use and design of technologies. 1: an iPone factory in which the employees have committed suicide [12]. 2: low-wage workes extracting rare earth minerals in China [31]. 3: mountains of e-waste [24]

Fig 2. Materials and outcomes of the care workshop

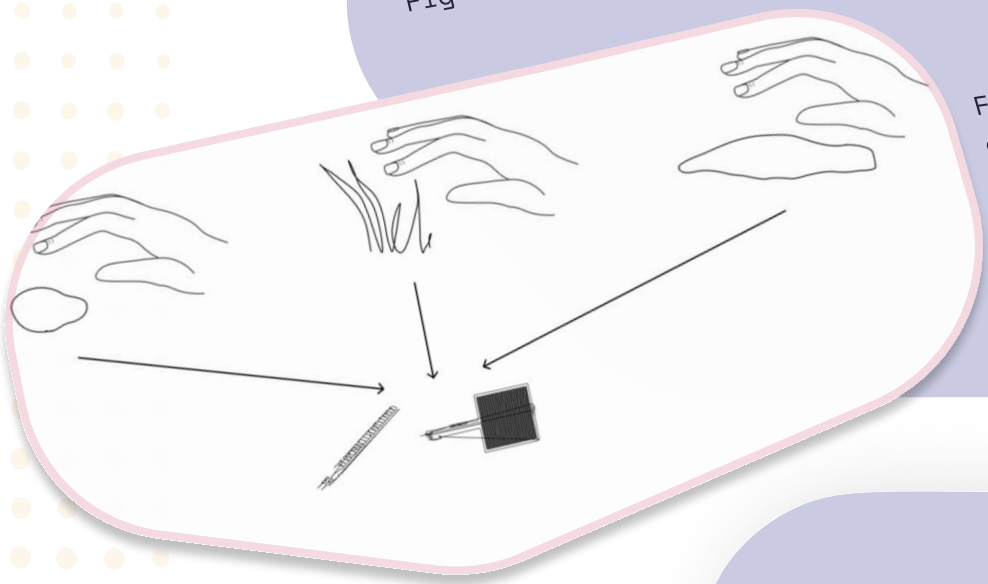

Fig 4. Detecting caring or violent touch of artifacts using a sensor

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Working title of thesis: **Ethical and legal implications of creative Ai**
3-5 keywords: **creative Ai, arts, ethics, law, social studies**

Abstract

My PhD project explores the socio-cultural implications of creative-Ai technologies by drawing from the experiences of Nordic Ai-artists and developers. In particular, the focus will be on the frameworks of ethical and legitimate practices of creative-Ai technology: how are they (re)constructed in the current forms of artistic creation and application development, and how this understanding could inform the the development of ethical guidelines and intellectual property regimes in the field. We are currently testing an applied ethical analysis tool that encourages Ai developers to explore the ethical and societal implications of their work from the perspective of stakeholder mapping, and will soon pursue interviews with Ai-artists from various Nordic countries.

My background is in Musicology, with a later specialisation in Intellectual Property Law (copyright), but I'm cross-disciplinarily curious and look forward to expanding the project from music and sonic arts to various other art disciplines and creative domains.
My work is funded by the WASP-HS initiative under the project "AI and the Artistic Imaginary".

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Working title of thesis:
3-5 keywords:

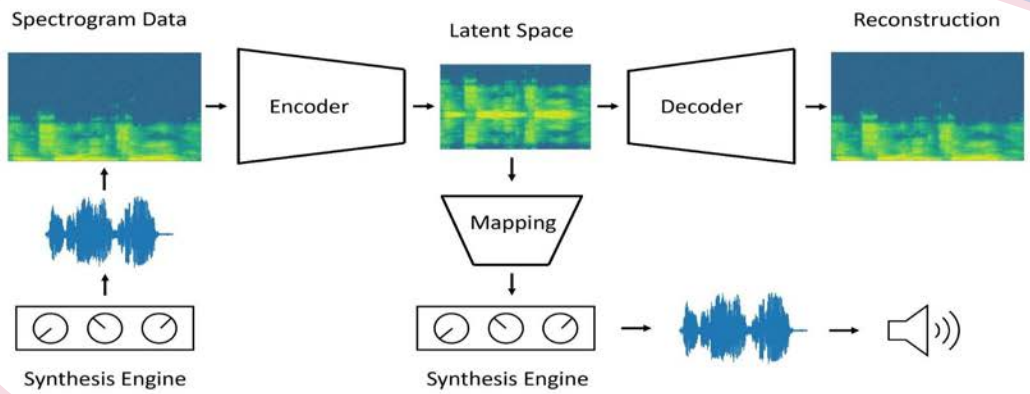
Abstract

Timbre Space Exploration using Variational Autoencoders

Modern control interfaces for digital sound synthesis typically include an intricate set of control parameters that influence the sound output in sometimes nonlinear and un-intuitive ways. The high dimensionality and combinatorial complexity of the control parameter space may therefore effectively limit the expressive potential of electronic instruments and confine the user to explore only a limited region of the sonic search space. The problem faced by the electronic sound designer or performer is therefore not a lack of possibilities, but rather a lack of tools and creative constraints that can aid navigation of complex parameter spaces for musical exploration.

Recent developments in machine learning (ML) and deep learning (DL) provide promis ing tools for addressing these problems by ways of reorganising the search space of a synthesis engine, using audio data from the synthesizer, in order to better reflect changes in the timbral qualities of the sounds (rather than simply changes in their correspond ing control parameters). This project in a general sense addresses the opportunities and limitations of incorporating machine learning algorithms in the context of digital sound synthesis, in both its technical and artistic implications, with a specific applica tion of variational autoencoders (see figure) in order to support exploration of the sonic potentials of a given synthesis engine.

Figure 1: A variational autoencoder can be trained on audio data from a synthesis engine in order to learn an organised latent representation of sounds. The latent space is then navigable through a mapping back to the parameter space of the synthesis in order to generate sound



Thank You

We would like to thank the institutions, sponsors, and researchers who have supported the planning, the carrying out, and the financing of this workshop. The event is kindly hosted by Chalmers University of Technology. This seminar is partially supported by the Wallenberg AI, Autonomous Systems and Software Program – Humanities and Society (WASP-HS) funded by the Marianne and Marcus Wallenberg Foundation and the Marcus and Amalia Wallenberg Foundation. Lastly, we would like to thank Kelsey Cotton for designing this booklet.

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THANK YOU