The 1st Winter School on 3D Digitainability: Exploring the Combined Effects of Digitalization, Sustainability, Artificial Intelligence, and Additive Manufacturing

3D Digitainability Talvikoulu: Miten Digitalisaatio, Kestävä Kehitys, Tekoäly ja 3D-Tulostus Nivoutuvat Yhteen?

GUEST SPEAKERS

The Winter School includes speakers and instructors from diverse backgrounds – engineering, AI, environmental science, economics – to ensure a holistic understanding of the intersection between digital technologies and sustainability. Below, there are the invited speakers.

What if humans are NOT in the loop? Autonomous AI as a driver for sustainable future

Pekka Abrahamsson, **Professor of software engineering, Member of the Finnish Academy of Science and Letters, Head of the AI research Centre AI HUB and director of the GPT-labs, Faculty of Information Technology and Communications Sciences, Tampere University, Finland**

https://www.tuni.fi/en/pekka-abrahamsson

Bio: Pekka is a seasoned software engineering professor with several years of international experience. He is one of the leading figures in science focusing on the application of generative AI in software engineering and beyond. Pekka has received numerous awards and merits during his research career of 20+ years. He was recently rated in the all-time top-1% in the world in his field.

Abstract: A common claim is that AIs should not be allowed to perform tasks autonomously without human oversight, especially in areas that directly affect societal well-being, ethics, and safety. However, what if we challenge this assumption and explore scenarios where humans are not in the loop? This talk examines the potential of fully autonomous AI systems to act as catalysts for a sustainable future. By removing human intervention, we may be able to unlock the true efficiency and adaptability of AI systems, allowing for faster decision-making in complex environments such as climate response, renewable energy management, and resource allocation. The core question is: can autonomous AI outperform hybrid systems in addressing sustainability challenges, and if so, under what conditions?

The greatest opportunity in digital manufacturing

Pekka Ketola, 3DStep Oy, Chief innovation officer, founder
https://www.linkedin.com/in/pekkaketola/

Bio: Pekka is a professional innovator. He has worked with emerging technologies at Nokia corporation (17 years) and as entrepreneur (12 years). Pekka is a founder at 3D printing company 3DStep Oy, innovation company Ideascout Oy and vehicle manufacturing company Scouter Mobility Oy. He has PhD from Tampere university (user centred development).

Abstract: 3D printing has transitioned from the early adopter phase to the early majority phase across various industries. As this digital manufacturing technology continues to evolve, it is poised for a transformative shift known as de-coupling of technology and services. This shift offers unprecedented innovation opportunities by empowering service developers to create new solutions utilizing existing physical resources and infrastructure. Furthermore, it calls for the development of new competences and capabilities, particularly in integrating generative AI into these emerging services. In this talk we will explore the future directions of 3D printing and generative AI, and discover how these advancements are set to revolutionize digital manufacturing.

A life-long digital support for individuals with ADHD

Anneli Kylliäinen, Senior Research Fellow at the Tampere IAS and the Faculty of Social Sciences, Tampere University

Bio: Anneli Kylliäinen holds a title of docent in developmental neuropsychology with research interest in developmental neurodiversity including autism spectrum and ADHD. Her expertise lies in combining psychophysiological measures with clinical intervention studies.

Julia Kuosmanen, Senior Research Fellow at the Tampere IAS and the Faculty of Information Technology and Communication Sciences, Tampere University
https://www.tuni.fi/en/julia-kuosmanen

Bio: Julia obtained her PhD in Interactive Technology from the University of Tampere in 2009. Her research interests include vision-based perceptual user interfaces, human-computer interaction, child-computer interaction, computer vision, pattern recognition, signal processing, and eye tracking.

Abstract: In this shared talk, the nature of ADHD in children and how fidgeting movements can support their attention will be explained. This is followed by the exploration of the intersections between gaming, technology-based therapeutic interventions, and the additive manufacturing of 3D-printed fidgets as solutions for remote cognitive support, enhancing focus, impulse control, and behavioural and emotional regulation for individuals with ADHD. These emerging technologies not only empower individuals with ADHD but also address broader challenges of accessibility and inclusion in education and healthcare, contributing to long-term societal well-being and social sustainability.

Perspectives into the future of DigitAInability

Kirsikka Kaipainen, Project Manager, Digital and Sustainability Transitions in Society (DigiSus) research platform, Tampere University
https://www.tuni.fi/en/kirsikka-kaipainen

Bio: Kirsikka coordinates the Digital and Sustainability Transitions in Society (DigiSus) research platform that was launched in the beginning of 2024. Kirsikka also conducts research in sustainable urban mobility and has long experience in the field of digital mental health, having worked at VTT Technical Research Institute of Finland and as entrepreneur. She has a PhD on information technology.

Abstract: This session provides an introduction to the emerging field of 3D DigitAInability, a concept at the intersection of 3D digital technologies, artificial intelligence (AI), and sustainability. We take a look to the future, exploring and reflecting on potential advancements and challenges within the field of 3D DigitAInability. During the session, we will discuss emerging trends, technological innovations, responsible design approaches, and their broader implications for sustainability and sustainable development.

Haptic Mediation through Artificial Intelligence: Using Magnetorheological Fluid, Electro-tactile Surfaces and Dynamic 3D printed Overlays to Mediator tactile feedback

Ahmed Farooq, Project Lead, Intelligent Haptic Mediation in Mobile Devices (IHM) Tampere Unit of Computer Human Interaction, Tampere University
https://www.tuni.fi/en/ahmed-farooq

Bio: Ahmed has been developing various research projects at the TAUCHI Research Center, since 2011. He has a Master's in CS (TAU), a Ph.D. in Interactive Technologies (TAU) and a Postdoc in EE / CE (from PURDUE, USA). He is currently working on multiple internation research projects with some of the leading research centers / universities in the world including Google CA, Facebook Reality Lab, Nokia Research Labs, CIM at McGill, HIRL at Purdue, ReTouch at UCSB and Haptosphere at Bentley. Ahmed also has a background in Artificial Intelligence and ML and has developed foundational models to further enhance academic research.

Abstract: This talk will introduce research into Intelligent Haptic Mediation, specifically how the emerging field of Haptic Mediation. 3D DigitAInability, and AI can be used to design tools and experiences, replicating a holistic multimodal experience on mobile and handheld devices. We will also discuss the main goals of this Google funded project, and how the new holistic approach of creating and delivering tactile feedback can mediate signals reliably within various mobile and hand-held devices to optimize MM Experiences.

The Elements of a Regenerative Smart City

Aleksi Kopponen, Director of Digital Transformation, City of Tampere
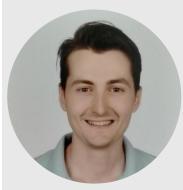https://www.linkedin.com/in/kopponen/

Bio: Aleksi Kopponen is the Director of Digital Transformation at the City of Tampere. With a background in public sector ICT and a focus on empowering people with data, Aleksi has been instrumental in driving digital transformation initiatives. Aleksi is also a PhD student at Aalto University School of Business, specializing in Citizen Digital Twins in Information and Service Management.

Abstract: The concept of a regenerative smart city is rooted in the integration of advanced technologies and sustainable practices to create urban environments that are not only efficient but also resilient and inclusive. This presentation explores the key elements that contribute to the development of regenerative smart cities, emphasizing the importance of a holistic approach that encompasses social, economic, and environmental dimensions.

A regenerative smart city prioritizes human-centricity, ecological sustainability, and economic vitality. By fostering a culture of continuous learning and innovation, cities can enhance the quality of life for their residents while promoting social equity and environmental stewardship. The City of Tampere's commitment to digital transformation and sustainable urban development serves as a model for how cities can navigate the complexities of modern urban life.

The presentation will delve into the transformative potential of various strategies and initiatives, such as enhancing public services, promoting green infrastructure, and supporting community engagement. It will highlight Tampere's efforts in areas like welfare economics management, which seeks to balance social, economic, and ecological sustainability, and the city's focus on empowering its personnel through continuous learning and development.

By examining the intersection of technology, sustainability, and human-centricity, this presentation aims to provide insights into how cities can evolve into regenerative smart cities that prioritize the well-being of their residents while fostering innovation and growth.

AI Agents in Smart Spaces

Aygün Varol, Doctoral Researcher, Tampere University
https://www.linkedin.com/in/aygunvarol/

Bio: Aygün holds both a BSc and MSc in Electrical and Electronics Engineering. He has four years of experience as a research assistant at Isparta University of Applied Sciences. Currently, he is a doctoral researcher in Electronics at Tampere University and a member of the Augmentative Technology group. His research focuses on IoT systems, particularly their applications in indoor environments.

Abstract: Smart spaces are indoor environments equipped with computational capabilities that have transformed the way we live and work, offering improved convenience to users. These spaces leverage machine learning models to interpret sensory data, enabling a wide range of applications namely rule-based automation, activity recognition, fall detection. However, with the emergence of transformer networks and large language models (LLMs), the scope of traditional ML-based applications in smart spaces is evolving. These state-of-the-art models outperform previous systems while simultaneously unlocking new possibilities. In this talk, we will survey the vision of smart spaces enhanced by AI agents empowered with the capabilities of these cutting-edge models and discuss the latest advancements.

Embedding Sustainability in Engineering Design and Manufacturing

Iñigo Flores Ituarte, Associate Professor in Digital Manufacturing, Tampere University
https://www.linkedin.com/in/i%C3%B1igo-flores-ituarte-00282430/

Bio: With a Ph.D. in Mechanical Engineering from Aalto University (2017), he has held several academic positions, including assistant professor at Aalborg University, Denmark, and post-doctoral researcher at the Singapore University of Technology and Design. His multidisciplinary approach, international research collaborations, and academic and industrial contributions make him a well-established figure in digital manufacturing.

Abstract: This talk explores how digital manufacturing technologies and AI are advancing sustainable design and production paradigms. Through convergence between humans and machines, data and model-driven methods, and AI companions, engineers can identify ripple effect of their engineering choices across disciplines, to optimize performance, and forecast environmental impacts. We also examine the challenges and opportunities of additive manufacturing (AM) in promoting material efficiency, circularity, and localized production. Highlighting RDI efforts and research examples, this talk will demonstrate how the next generation of engineering design and manufacturing systems will complement humans with a conscious intellectual activity involving prior knowledge, reasoning, and assisting as companions in exploring and exploiting optimal engineering solutions. As manufacturing accounts for over half of global energy use and 20% of global CO_2 emissions, digital manufacturing technologies play a vital role in minimizing waste, energy, and emissions. The question is "How can we engineer digital design to manufacturing systems to integrate materials with manufacturing, and product design processes, while optimizing for maximum quality and performance, minimizing costs, energy consumption, and raw material usage, and achieve a neutral or reduced environmental impact?"