PhD-Day at ATB Potsdam, Thursday, 19 June 2025, Hybrid-Conference; Room Z003 and Zoom

Time	Topic	Speaker	Supervisor ATB	Supervisor University
9:00	Welcome	Prof. Dr. Barbara Sturm Dr. Ulrike Praeger PhD representatives ATB		
9:15	Keynote: Mathematical models in AI and data science with a view toward agriculture and bioeconomy	Prof. Dr. Tim Römer	Institute of Mathematics, Uni Osnabrück Spokesperson of Joint Lab Artificial Intelligence & Data Science	
Diversified crop production				
10:00	Digital twin driven predictive maintenance for high-precision agricultural machinery	Verena Tessaro	Prof. Dr. Cornelia Weltzien	Prof. Dr. Mario Porrmann, Uni Osnabrück Prof. Dr. Heiko Tapken, Hochschule Osnabrück
10:20	Break			
10:50	An Integrated vision-based architecture for autonomous plant handling in agriculture	Mostafa Shokrian Zeini	Dr. Volker Dworak	Prof. Dr. Kolja Ernst Kühnlenz Hochschule Coburg
11:10	Effects of precision fertilization on soil-borne nitrous oxide emissions, the soil microbiome and net greenhouse gas emissions in a farm in Brandenburg/Germany	Eduardo Cerull	Dr. Werner Berg et al.	Prof. Dr. Annette Prochnow
11:30	Evaluating interpretable methods via geometric alignment of functional distortions	Anna Hedström	Prof Dr. Marina Höhne	Prof Dr. Marina Höhne TU Berlin
Healthy Foods				
11:50	Advancements in coffee authenticity: A spectroscopic feature compression approach using eXplainable AI and vision transformer	Shanghua Liu	Prof Dr. Marina Höhne	Prof Dr. Marina Höhne Uni Potsdam
12:10	Group photo			
12:15	Lunch Break			
13:15	Game	Doctoral researchers ATB		
14:00	Compositional changes and storage stability of brewer's spent grain: From production to preservation	Pramod Aradwad	Prof. Dr. Barbara Sturm	Prof. Dr. Cornelia Rauh TU Berlin
14:20	Digital assessment of physio-chemical changes during drying of purple carrots and golden kiwifruit	Muhammad Tayyab	Prof. Dr. Barbara Sturm	Prof. Dr. Barbara Sturm HU Berlin
Individualized Livestock production				
14:40	CFD simulation of the ventilation performance of a naturally ventilated pig barn with an outdoor exercise yard under different seasons	Xuefei Wu	Dr. Qianying Yi	Prof. Dr. Thomas Amon Prof. Dr. Jürgen Zentek
15:00	Break			
15:30	Working opportunities for scientists on the labor market in Brandenburg	Katharina Luther	Project manager, Department Labour – Skilled Workforce and Qualification; Economic Development Agency Brandenburg (WFBB)	
16:15	Discussion with an alumna about her career	Dr. Sofia Zanella Carra	Research lead at the Climate Finance Hub Brazil	
17:00	Get together			

Abstracts of presentations

Diversified crop production

Digital twin driven predictive maintenance for high-precision agricultural machinery

Verena Tessaro

Joint degradation is a key factor limiting the performance of parallel kinematic robots like the Jaetrobi, developed at ATB for automatic, herbicide-free weeding using a laser. This presentation focuses on a concept for evaluating the long-term precision of Jaetrobi's actuation system using a dedicated test rig with identical laser kinematics, which enables repeatable simulation of wear through defined motion patterns. Detailed analysis of joint fatigue and wear propagation will be applied toward a digital twin model that quantifies wear per movement and estimates component end-of-life. This predictive maintenance approach will support wear-optimized motion strategies, enabling synchronized joint replacement and thereby minimizing operational downtime and improving overall system reliability.

An integrated vision-based architecture for autonomous plant handling in agriculture

Mostafa Shokrian Zeini

This study presents an integrated vision-based robotic framework for precise plant handling in unstructured environments. A MECA500 robotic arm with an eye-in-hand RGB camera performs Image-Based Visual Servoing (IBVS) using deep learning-based detection, adaptive path planning, and 3D reconstruction. A faster R-CNN model ensures robust object detection, while an RRT-based planner computes collision-free paths. Structure from Motion estimates camera poses and reconstructs the plant's 3D structure, enabling sub-millimeter distance estimation. Experimental validation demonstrates the system's reliability under varying lighting and occlusions, showcasing its potential for agricultural automation.

Effects of precision fertilization on soil-borne nitrous oxide emissions, the soil microbiome and net greenhouse gas emissions in a farm in Brandenburg/Germany

Eduardo Cerull

This PhD project investigates the climate efficiency of precision fertilization, focusing on soil-borne nitrous oxide emissions, net greenhouse gas fluxes, and soil microbial communities. Five fertilization strategies, including control, standard, sensor-based, and two data fusion approaches (Kings and Robin Hood), are compared in an on-farm field experiment. Nitrous oxide emissions are measured using a variable-frequency closed-chamber method, and soil microbial communities are characterized through Nanopore sequencing. This project seeks to optimize nutrient management by correlating soil properties, fertilizer application, and yield data, ultimately revealing greenhouse gas reduction potentials for sustainable, high-yield agriculture. The expected outcomes will further advance sustainable practices.

Evaluating interpretable methods via geometric alignment of functional distortions

Anna Hedström

The responsible deployment of AI models requires them to be both interpretable and aligned with human values; however, achieving these goals remains an open research challenge. In this presentation, I will present my recent work on evaluating explanation quality by analysing the geometric alignment of functional distortions. I will discuss how interpretability methods, such as local linear approximators, global feature visualisation, sparse autoencoders, and LLMs-as-explainers, can be systematically evaluated to assess their faithfulness. These efforts address the long-standing issue of unreliable and inconsistent evaluation in interpretability research.

Healthy Foods

Advancements in coffee authenticity: A spectroscopic feature compression approach using eXplainable AI and vision transformer

Shanghua Liu

Verifying coffee authenticity is vital for fair trade. We employed near-infrared spectroscopy and advanced machine learning to identify Arabica coffee's origin from three regions across multiple roasting levels. Combining eXplainable AI (XAI) with Vision Transformer (ViT) yielded 99.8% accuracy on 1823 samples (10-fold cross-validation). GradCAM++ guided feature reduction to 1.1% of the wavelengths with minimal accuracy drop. The approach outperformed SVM and LDA, highlighting the potential of deep learning for coffee origin authentication. By clarifying spectral redundancy, our findings offer a cost-effective, practical solution for real-time monitoring, supporting fair trade and product integrity.

Digital assessment of physio-chemical changes during drying of purple carrots and golden kiwifruit

Muhammad Tayyab

Food quality and safety are of high concerns during processing operations and digital monitoring has emerged as an efficient and non-invasive tool for quality assessment. This study explores the use of visible-near-infrared hyperspectral imaging (Vis-NIR-HSI) to monitor key quality parameters (moisture content and carotenoids) during the drying of purple carrots and golden kiwifruit. Samples were dried at different temperatures (60°C, 70°C, and 80°C) and HSI images were analyzed alongside chemical data. Pre-processing methods like Savitzky-Golay filtering, Gaussian filter, SNV, and derivatives enhanced prediction accuracy. Different prediction models showed high accuracy in predicting moisture content and carotenoid contents, offering a non-invasive, real-time solution for monitoring food quality during processing and optimizing drying processes.

Compositional changes and storage stability of Brewer's Spent Grain: From production to preservation

Pramod Aradwad

The beer industry produces 38 million tons of Brewer's Spent Grain (BSG) annually. Traditionally used as animal feed, BSG is now being explored as a sustainable food ingredient. However, post-production heat retention in bulk storage can cause spoilage, fermentation, and microbial growth. Temperature and humidity fluctuations further

impact its shelf life and quality. Understanding how environmental conditions affect BSG storage is crucial. These insights help to assess its physical, biochemical, and sensory properties, as well as microbial diversity. Proper handling strategies, especially for breweries in diverse climates, can support waste management and unlock new opportunities for sustainable BSG utilization.

Individualized livestock production

CFD simulation of the ventilation performance of a naturally ventilated pig barn with an outdoor exercise yard under different seasons

Xuefei Wu

Naturally ventilated pig barns with an outdoor exercise yard (NVPBOYs) provide areas for pigs to excrete and sleep in separate areas, thereby improving animal welfare and enhancing environmental sustainability. However, research on NVPBOYs remains insufficient, and their indoor environment is not yet well understood. Therefore, this study employs Computational Fluid Dynamics (CFD) simulations to analyse the indoor climate of NVPBOYs across different seasons—summer, winter, and spring (transitional season). The airflow patterns, temperature distribution, and ventilation rates are evaluated to assess the ventilation performance of NVPBOYs across one year concerning pig welfare.