HOCHSCHULE
MAINZ

Gestaltung
Design

A Tale of Two Clusters
Approaching HPC in Arts, Humanities and Design Education

26/02/2025

University of
Applied Sciences

1.
#vortanz
Introducing machine-learning (AI) to university-level dance education.

Project: #vortanz
Supporting dance education with ML

Project details:

- Three-year project (2021-2024) funded by the Federal Ministry of Education and Research (BMBF).
- Project lead: Mainz University of Applied Sciences; Project partners: DSHS Cologne, HfMDK Frankfurt, HZT Berlin, wizAI solutions GmbH.
- Split into three phases: development, survey, and a final analysis and transfer phase.

Challenges:

- Small budget for compute resources and infrastructure (ca. €15k).
- Partnering institutions have vastly different requirements and didactic methods.

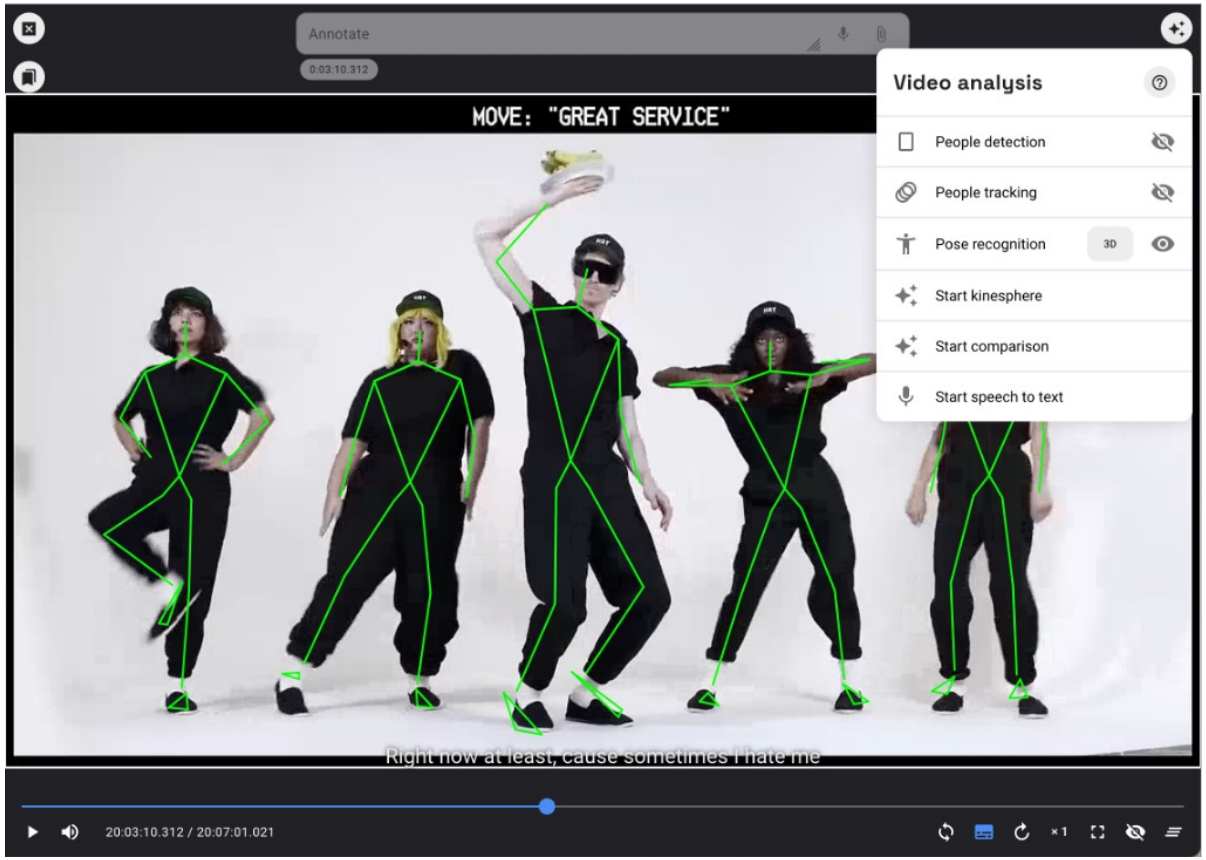
Concept: Automated pre-annotation
Supporting dance education with video annotation tools

Digital video is the primary medium of documentation in dance. Rehearsals and performances are often recorded in order to review, discuss and disseminate dance material.

– Machine learning models can be used to **segment** large quantities of rehearsal material.

– Verbal commentary becomes **searchable** through automated transcription.

– Statistical analysis can provide **alternative perspectives** on the material.



Implementation: Motion Bank Systems
Video annotation tool with an open processing pipeline

The existing „Motion Bank System“ annotation tools were adapted for integration with a job-queue running custom built Docker containers within a small cluster infrastructure.

– **Software:** Kubernetes on bare-metal servers running Ubuntu Linux.

– **Cluster:** single control-plane node, one CPU-based worker node and two GPU-based worker nodes; all servers housed on-campus at Mainz University of Applied Sciences.

– **Hardware:** partly bought on project budget (mostly GPUs, cases and parts), otherwise extended using existing and discarded units within the design department (control-plane, CPU worker, additional GPU cards).

2.
KITeGG (Gestaltung.ai)
Making AI tangible and comprehensible: Connecting technology and society through design.

Project: KITeGG
Establishing an experimental teaching environment

Project details:

– Five-year project (2021-2025) funded by the Federal Ministry of Education and Research (BMBF).

– Project lead: Mainz University of Applied Sciences; Project partners: Offenbach University of Art and Design, Schwäbisch Gmünd University of Applied Design, Cologne International School of Design and Trier University of Applied Sciences.

– Split into an initial setup and establishing phase and three years of 40 classes and two symposia each year, as well as three publications dedicated to theory, experiences and practical guidelines.

Challenges:

– Partnering institutions have vastly different requirements and didactic methods.

– No preconceived concept of application requirements and implementation specifics.

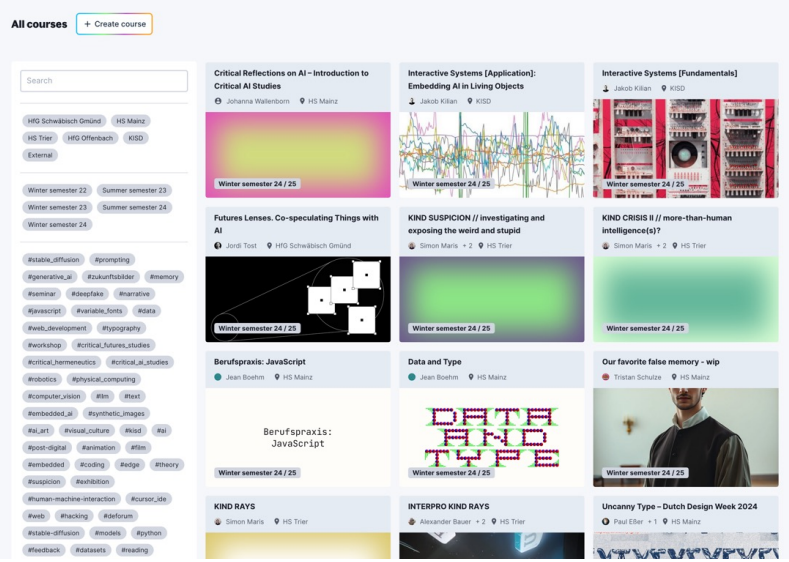
– Continuous iterative adjustment of platform design and software implementations.

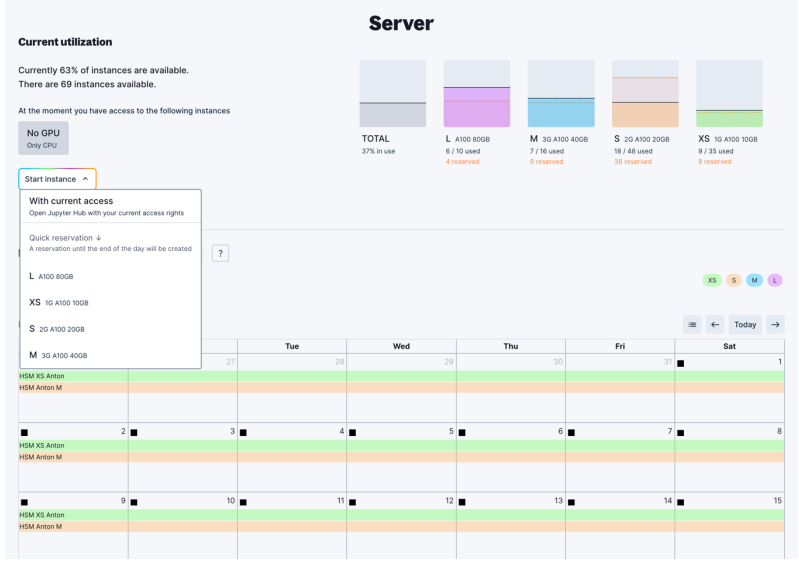
Concept: Experimental teaching and learning platform
Shared access to compute for students and teachers

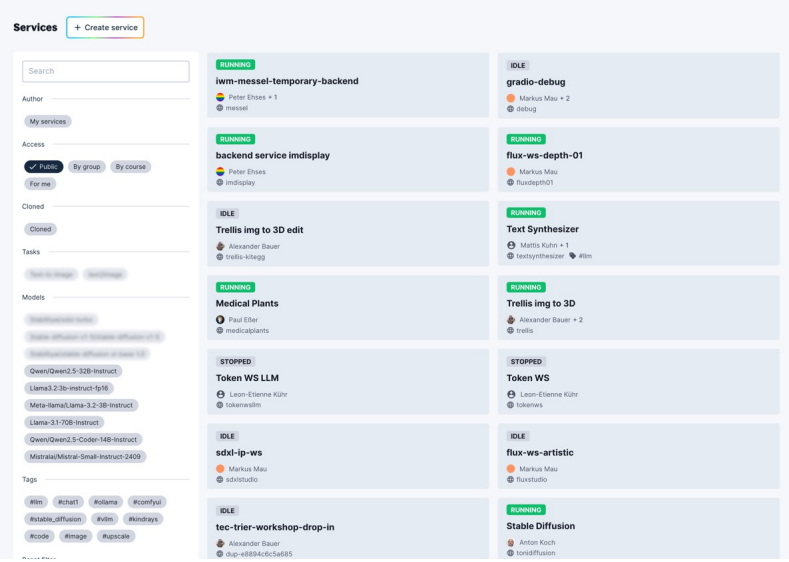
Courses: Teachers can create courses, share materials with and assign resources to students. Students can explore available courses and browse showcases of past course results.

GPU/CPU access: Predefined profiles allow users to start personal JupyterLab servers with and without access to dedicated GPU hardware reserved for a defined timespan.

Services: Teachers can deploy custom built web-services to be accessed on-premises in courses, as well as over the internet at home.







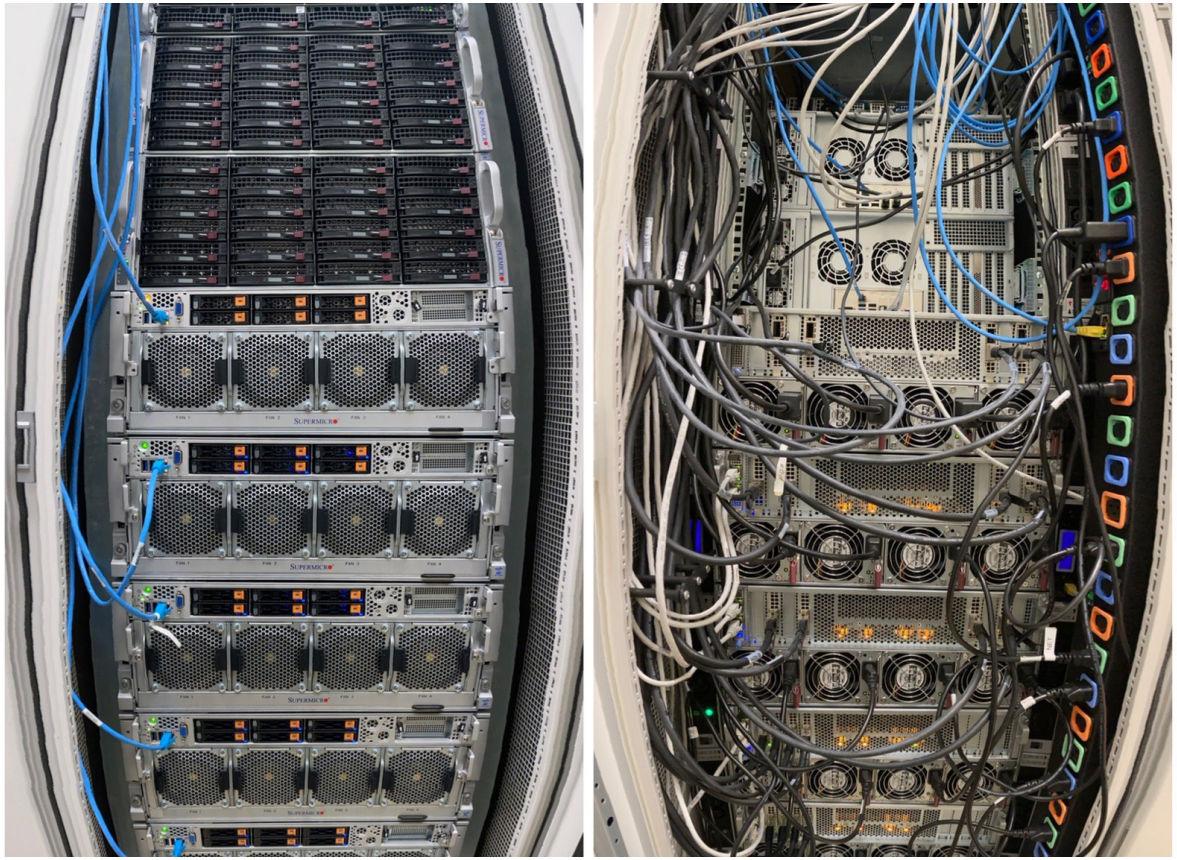
Implementation: KITeGG LLP (Lehr-Lernplattform)
An experimental cluster infrastructure for gen.-AI.

A bespoke software solution that aims to support dynamically developing teaching methods and independent software development for partners.

– **Software:** Kubernetes on bare-metal servers running Ubuntu Linux.

– **Cluster:** Two control-plane nodes, two dedicated storage nodes and five NVIDIA HGX worker nodes; all servers housed on-campus at the HPC department of Johannes Gutenberg University Mainz.

– **Hardware:** Dedicated budget of ca. €750k, planned for ca. 150-200 students using 40x A100 80GB GPUs, 640 physical CPU cores, 10TB RAM, ca. 350TB net SSD and ca. 400TB net HDD storage.



3.
Reflection
Lessons learned, perspectives

Benefits of owning infrastructure
Relevant aspects in general and for the projects.

As a university of applied sciences conducting multi-year, publicly funded research projects, multiple factors are of interest:

- **Cost:** both for a three-year and especially five-year project, the cost of owning and operating hardware on campus is substantially lower than commercial hosting.
- **Dependency:** tying mission-critical applications with fixed funding to commercial products with dynamic availability, design and pricing relinquishes long-term planning control.
- **Sustainability:** commercial hosting providers allocate more resources than possibly needed for project operations.
- **Politics:** using a cloud service funnels public money into private corporations instead of building out capabilities.

Aspects specific to each project:

- **#vortanz:** niche research working with both in-house equipment budgets and third-party funding can rarely fully budget the necessary equipment, thus benefitting from **reusing existing equipment and investing in shared infrastructure**.
- **KITeGG:** experimental and reflective engagement with emergent technologies benefits from building out **local expertise in full-stack appropriation instead of relying only on superficial usage experience**.

Kontakt

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