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Report for “Computer Vision in Archaeology” training school of ATRIUM project (14-18 September 2026)

I’m so grateful to ATRIUM for funding my trip to the summer school from September 14-18, 2026, and to the fantastic team at the Institute of Archaeology, Czech Academy of Sciences, Brno, for making it such a welcoming and valuable experience.

As a a new Master's student of Archeology and a long time software and computer vision engineer I didn’t really come with the intention to learn anything new in the computer vision domain, rather I was mostly interested in learning about how people are actually utilizing computer vision and other digital methods in the archeology field.

I was thoroughly impressed by the innovative work shared by fellow participants and the practical relevance of the curriculum. The presentations expertly balanced cutting-edge computer vision fundamentals with actionable solutions to common research obstacles.

The first day started with lectures by Petr Pajdla, doing an introduction to CV and how to use OpenAI’s CLIP model. We evaluated zero-shot vision-language alignment on macro-photographs of archaeological artifacts from the AMČR-PAS repository. The evaluation demonstrated how natural language prompts effectively classified distinct artifact categories without prior fine-tuning.

In the afternoon we had a practical session on agentic software development by Ronald Harasim, we configured Zed or Visual Studio Code with LLM agents using openrouter to automatically validate, reproject, and standardize using the `AGENTS.md` configurations and specialized skills. It was rather heavy and I wish we had more time to spend on this topic.

We finished the day off with an introduction to Python with NumPy, Matplotlib, and OpenCV by Filip Hájek. We built a baseline computer vision pipeline to isolate the Paleolithic Venus of Dolní Věstonice figurine from its background. The workflow processed the image as a multidimensional array through BGR-to-RGB color alignment, Gaussian noise reduction, inverse binary thresholding, and contour extraction to derive spatial measurements from the largest detected boundary.

Following the technical sessions, we had a terrace welcome gathering featuring vegan cuisine and beers which was a lot of fun. I was able to speak to many of the researchers, learn about what they are doing and learn about their research which was very insightful in my case as I am new to this field.

On day two we had a hands-on training with the Computer Vision Annotation Tool (CVAT) and Segment Anything Models (SAM 2/3) by Petr Pajdla, he demonstrated how class-agnostic foundation models accelerate dataset creation across COCO, YOLO, and Pascal VOC formats, though manual adjustments are still needed for edge artifacts.

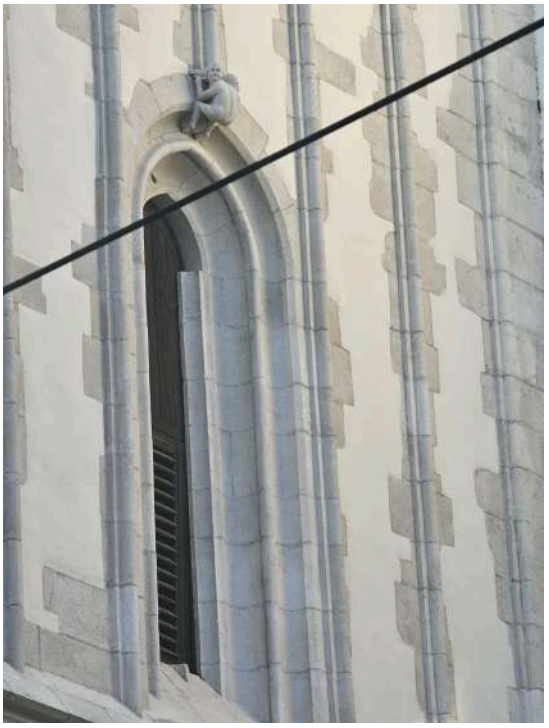
Using the 1,500-image AMČR-PAS benchmark dataset, we addressed key legacy data bottlenecks such as class imbalance, ambiguous terminology requiring SKOS mappings, and unrecorded photographic metadata, before evaluating annotator agreement through the ArchaeoTag game.

In the afternoon session some of the participants showcased diverse applications of machine learning, spatial analysis, and 3D digitization in cultural heritage. Participants delivered targeted presentations on technical methodologies tailored to specific archaeological and historical challenges.

Key topics included environmental reconstruction, hyperspectral imaging spectral recovery via CNNs, thermal drone mapping for clandestine grave detection, and monocular depth estimation for 3D modeling. Additional presentations explored geometric morphometrics and deep learning for analyzing stone carvings, lithic technologies, petroglyphs, and human toolmaking motor behaviors.

The academic session concluded with a historical walking tour of central Brno led by Eva, followed by an informal evening networking event in a local bar which was a lot of fun after a long tiring day.





On day three we had a session by Dr. Anastasia Eleftheriadou where she showed us how to create a computer vision pipeline on high-magnification optical microscopy of experimental flint lithics to detect and segment micro-topographical polish caused by organic contact. To overcome shallow depth-of-field, the workflow calculated Sobel gradient magnitudes to isolate sharp focus areas via watershed segmentation, followed by binarization to measure polish coverage percentages. The pipeline concluded with TensorFlow data augmentation, such as random rotations, zooms, and contrast shifts, to expand the dataset and prevent overfitting.

Before lunch we toured the Department of Analytical Conservation lab to inspect specialized archaeometric facilities for analyzing, stabilizing, and preserving metallic and organic artifacts. The inspection showcased advanced microscopy for surface trace analysis, static and portable X-ray systems for internal structural imaging, and portable and desktop XRF devices for non-destructive elemental profiling.

Conservators also demonstrated artifact stabilization alongside additive 3D printing techniques used to manufacture custom support jigs and handling tools. The day wrapped up with an evening social event on the department terrace featuring music, games, and informal networking.



On day four we explored macro-scale spatial analysis by using 10-meter spatial resolution Sentinel-2 multispectral satellite imagery to detect cropmarks delivered by Filip Hájek. Subsurface features like ditches, pits, and stone foundations alter soil moisture and root depth, resulting in localized growth variations across crop canopies.

We had to calculate multi-temporal Normalized Difference Vegetation Index (NDVI) stacks by combining Near-Infrared and Red spectral bands. Applying Principal Component Analysis (PCA) and spatial anomaly filtering to these spectral stacks successfully isolated subtle vegetation stress patterns, revealing hidden prehistoric enclosures and historic field systems.

After lunch Dr. Ashley Green presented a case study on using YOLO instance segmentation to detect Nordic Bronze Age rock art amidst challenges like tiny cupmarks, weathered substrates, and overlapping motifs. To overcome lighting and color variations, 3D point clouds and photogrammetric meshes were converted into Local Relief Models and processed into uniform, normalized spatial tiles. The trained models successfully detected fine-grained motifs and exported predicted polygons back into GIS frameworks as georeferenced vectors.

We also had a tour of the ARÚB Central Archive, we learned about a specialized digitization pipeline designed to process over 170,000 historical excavation records and field plans. The workflow uses binarization and deskewing alongside tailored OCR and HTR models to extract text from historical Czech and German documents. Finally, these text outputs are vectorized into a high-dimensional embedding space, enabling semantic natural-language search that connects archival reports directly to spatial database records.



The final day synthesized the week's core concepts through practical work with coin photography, vision-language models, and hybrid analytical approaches. A key takeaway was that older or adapted algorithms often perform just as effectively as cutting-edge AI models when applied thoughtfully to specific archaeological questions.

Beyond technical skills, the training school underscored the necessity of high-quality dataset curation, standardized annotations, and reproducible workflows for managing digitized collections. These methodologies offer actionable pathways for enhancing image classification, metadata enrichment, and searchability in institutional research datasets.

