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Reading Images, Writing Metadata –

Exploring AI Approaches on Image Data Mining in Collections of the Austrian National Library

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AI and Artworks: Object Detection, Image Classification and Iconographic Analysis, April 16th, 2026

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Project Outline (2025-2027)

Goals

- Generate new metadata concerning image content
- Provision of generated metadata via ÖNB LABS (Labs plattform of Austrian National Library)
- Increase visibility and searchability for our collections

Main topics

- Extraction of images from newspapers, journals and book collections
- Detection of objects on all images (including from our Picture Archives and Graphics Department)
- (possible extension: classification of images)

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Prerequisites and Challenges

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Data Diversity	How do we cope with variety? – E.g. newspaper page vs. Photograph

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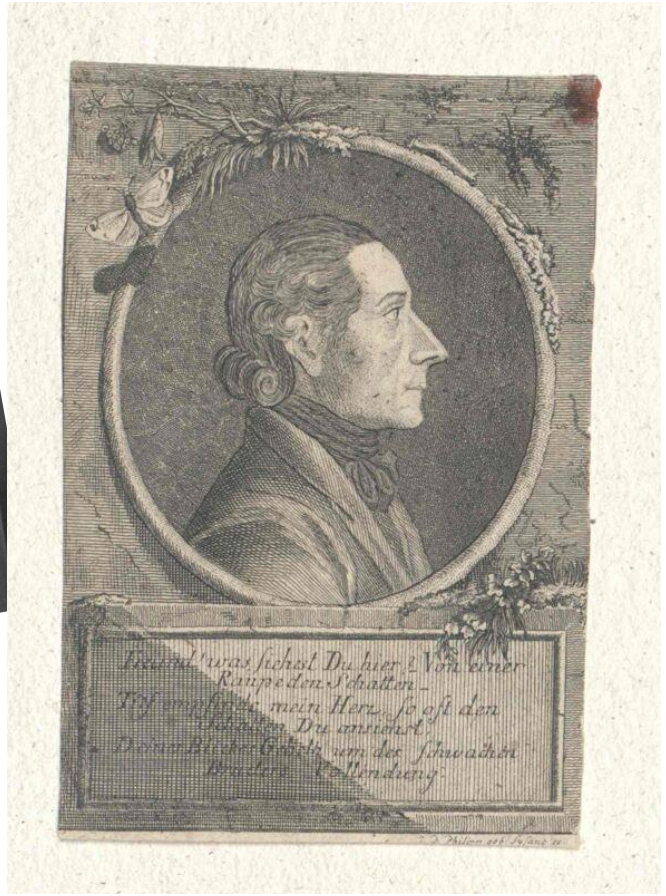
Our images look like…



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Data Diversity	How do we cope with variety? – E.g. newspaper page vs. Photograph
Technical ressources – GPU, CPU, storage capacity etc.	Cost-intensive – Tasks need to consider availability
Open Access Models and Tools	Transparency and Biases
Language and Translations	May cause additional costs (licences)

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Project Steps

Finished

1 Model prototyping & testing

Evaluate model sizes, compare architectures, establish performance baselines

2 Test dataset selection

Curate representative samples with the image & graphics department

3 Quality control & data analysis

Librarian review, annotation audit, and quantitative quality assessment

4 Workflow design & refinement

Define processing pipeline, apply model adjustments, document procedures

Current:

5 Full pipeline setup ★ In progress

Integrate all components end-to-end, configure infrastructure, run end-to-end validation tests

Next up

6 Mass image extraction

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What was tested?

- Different architectures and model sizes
  - YOLO11, YOLO12, YOLO26 (in different sizes) as well as CLIP
  - Time logging!
  - Considerations on open source, maintainability etc.

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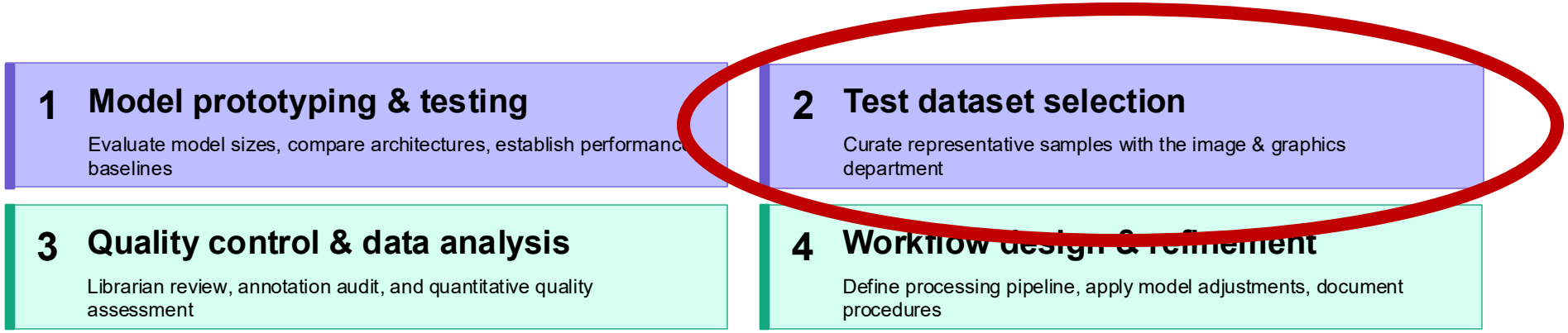
Project Steps



What data did we use?

Primary testing sets:

- Small sets taken from photography collections (Klaus Titzer, Heinz Stephan Tesarek or similar)
- sized 100-2000 images

Later:

- Extension to newspaper illustrations and graphics

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Project Steps

How did we verify results?

Statistics + Data Analysis

- Model metrics (including mAP50, mAP50-95, accuracy, prec, rec)
- Detections per image
- Results on different image types

Manual data quality control through librarian!

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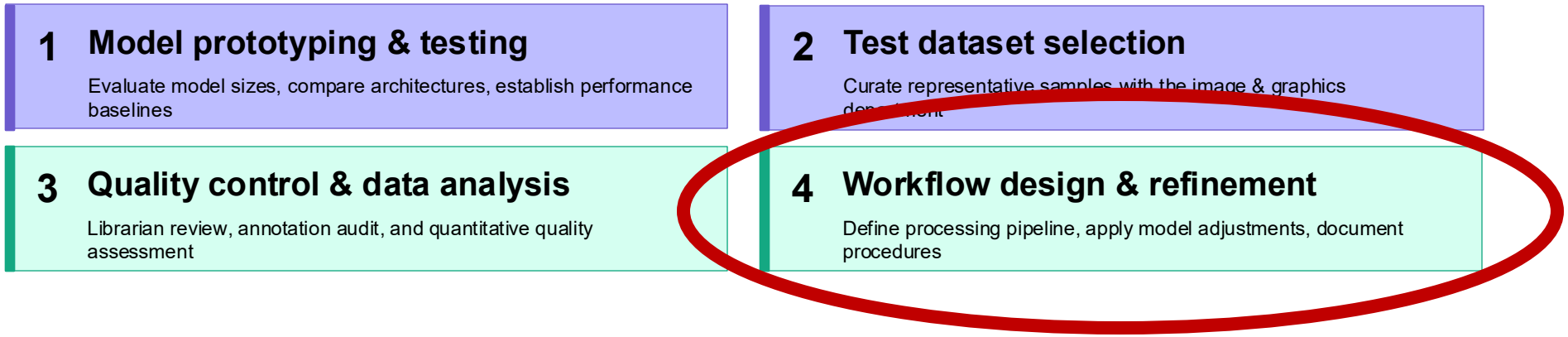
Project Steps



Adjusting our workflow

After results from data analysis and quality control:

- Refinement of processes
- Decision of which model to go forward with

Which models were most likely?

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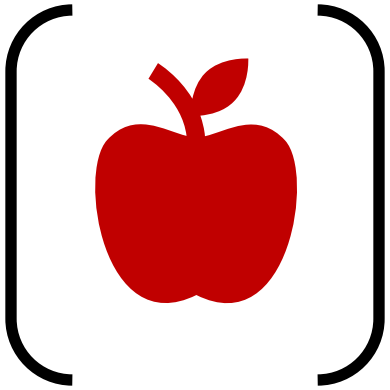

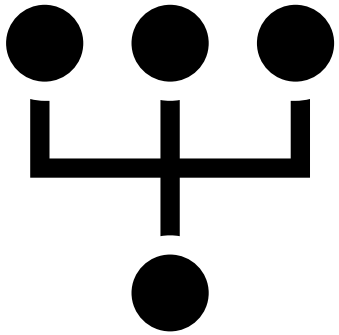

YOLO

What objects are on the images?

- Object detection
- Object/ Layout extraction

CLIP

Whats the topic of the image?

- Classification
- Additional description

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YOLO (Ultralytics)

= Model for image processing tasks

Outline

- Annotates images by saving boxes around detected objects
- Pre-trained versions available, but can be fine-tuned
- Can be used for layout extraction, object detection or classification

Why YOLO?

- Very fast -> established for real-time application
  - Important for our amount of data!
- Still in production and open access
  - Support should be available in the future
  - Can be used freely for research purposes
  - Easier adjustment for future versions of the model

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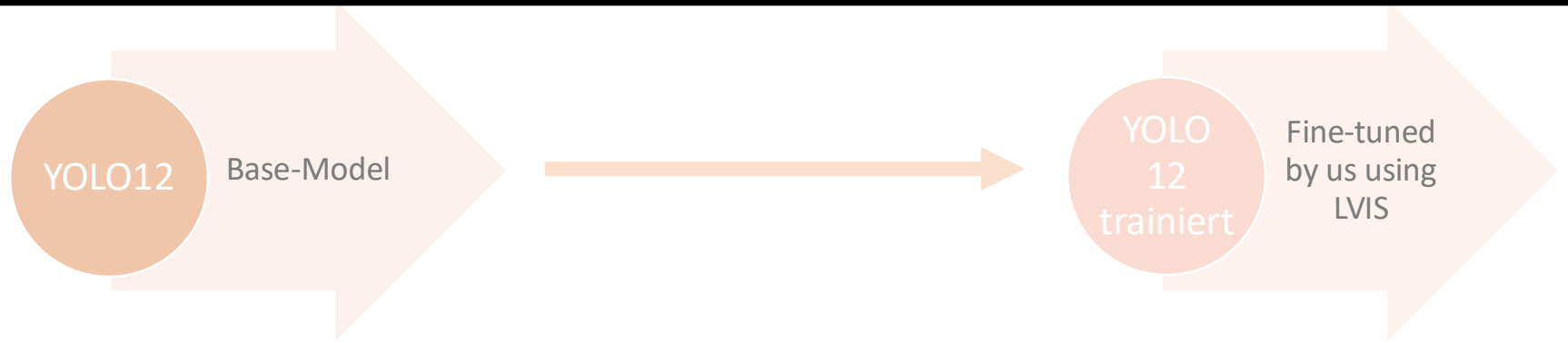
Why train or fine-tune?

Number of classes: 80 ---------- 365 ---------- more than 1000



Layout extraction

Identifying Images on digitized pages

Process:

- ~600 images manually annotated
- Classes represent visual cues, not arthistorical standards!
  - Picture
  - Illustration
  - Emblem
  - Pictogramme
  - Stamp
- Training of YOLO26x model using the annotated images (less than 10 hours)

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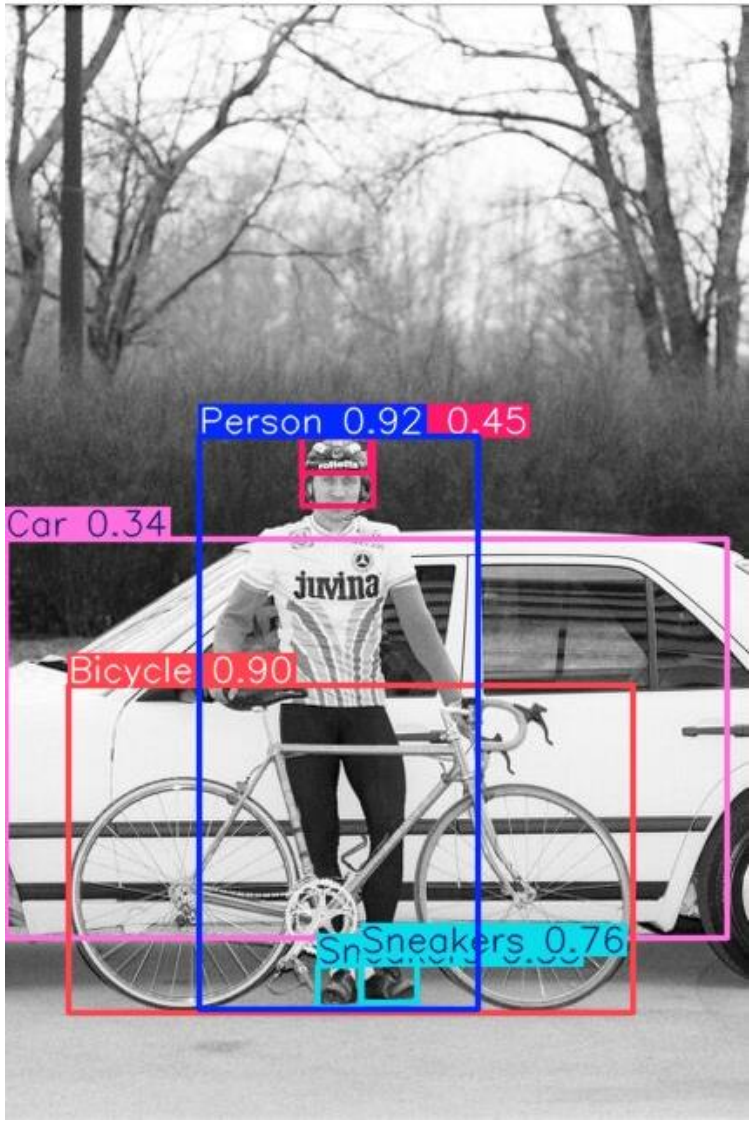
Object Detection

Identifying objects on images

Process:

- 8 different prototypes by fine-tuning different architectures of models with different datasets
- Models included: YOLO11, YOLO12 and trained YOLO variants downloaded from Huggingface
- Evident differences from model to model
  - Decision, what focus?



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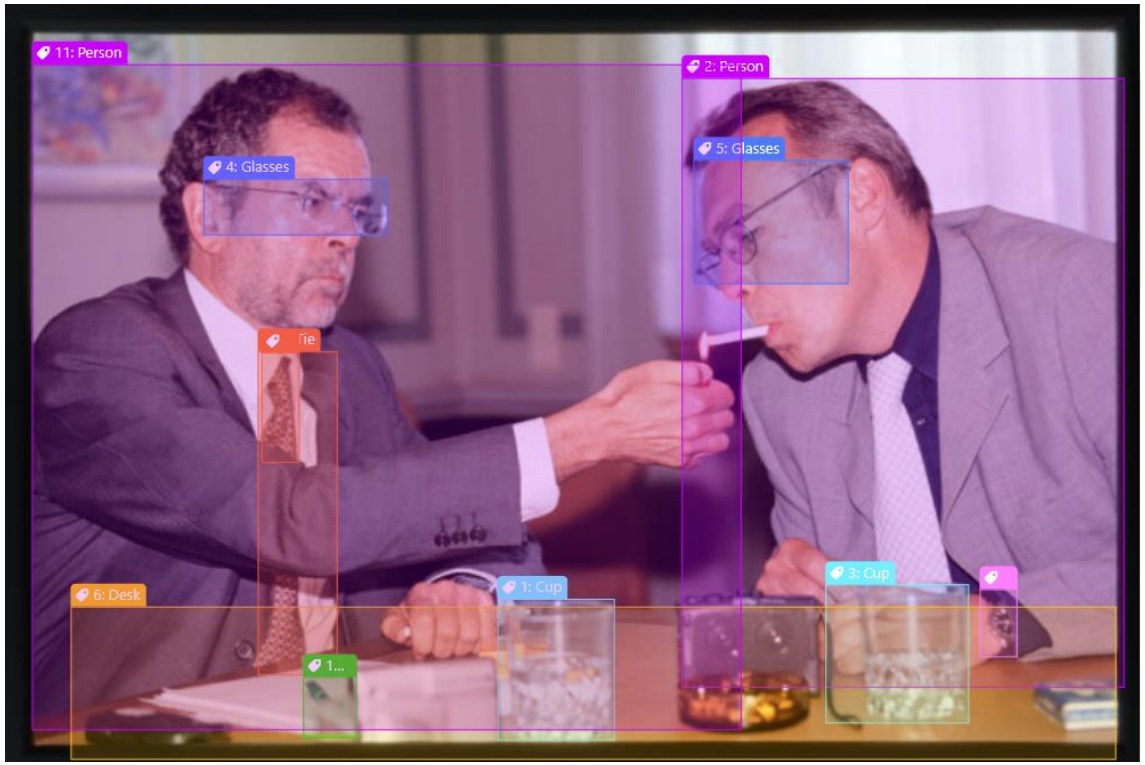
Object detection example



All models have weaknesses…

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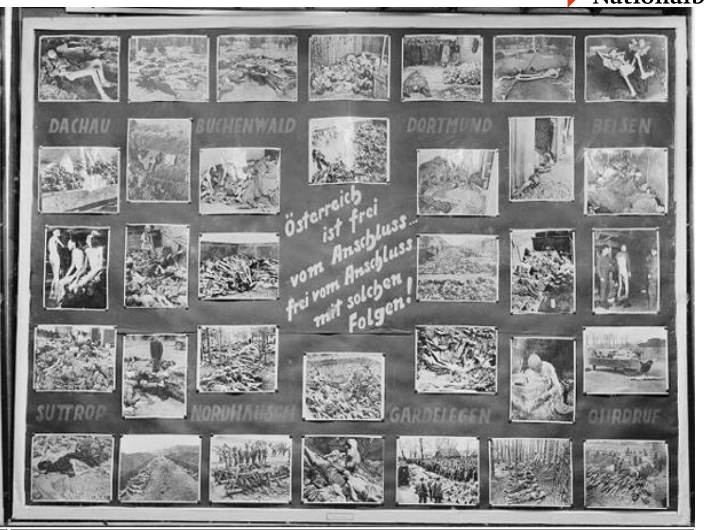
model_x

model_obj



model_12x

model_trained_11

model_trained_12

Current stand: combination of models

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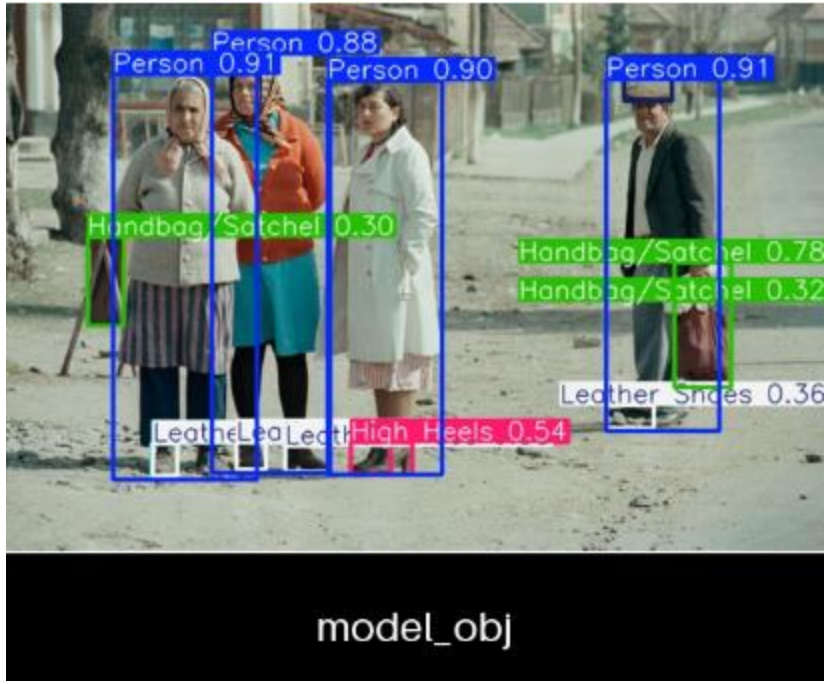
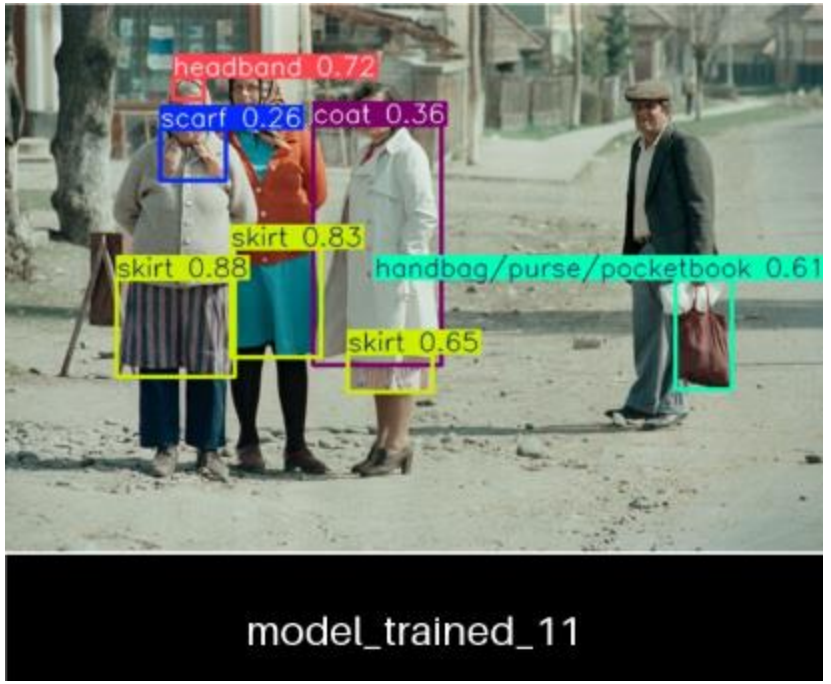


YOLO11n trained on Objects 365

- Best object detection
- Low confidences
- Low diversity (only 365 classes)

+



YOLO11x trained on LVIS

- No detection of persons
- High confidences
- High diversity (~ 1200 classes)

Results and issues

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- **Influence of Image Properties**
  - Brightness, contrast and color affect results
  - Good object detection especially with „modern photographs“
- **Strengths and Weaknesses of YOLO**
  - Objects vary greatly depending on training and model -> trade-offs necessary
  - Layout extraction for older documents requires a dedicated model
    - Training for this quickly possible
  - Difficulty to assess „errors“: When is an object class incorrect?
    - Model-inherent statistics do not always reflect well on historical data
- **(Additional) Classification Systems**
  - Difficult to find applicable class system
    - Too few classes (e.g. COCO) vs. Too many (e.g. Getty Thesaurus)
    - Too granular or not applicable to everything (e.g. ICONCLASS)

Challenges tackled vs. remaining

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Large amounts of data + cost efficiency

- YOLO processing very fast, other parts parallelized and efficient (enough)

✗ Diversity issue: not fully conquered

- Trials with image enhancement did not lead to better OD results
- Unclear, how well it will work with graphics etc.

Transparency and bias

- Multiple rounds of quality control
- Open communication about tools and models used
- ✗ Inherent biases remain

Translations

- Only list of terms -> can be translated easily through DeepL (best results without context)

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Resources

Models:

- YOLO11 / YOLO26 - Ultralytics Github Page https://github.com/ultralytics/ultralytics
- YOLO11 trained on Objects365 – Huggingface Page: https://huggingface.co/NRtred/yolo11n_object365
- CLIP – Github Page https://github.com/openai/CLIP

Tools:

- Labelstudio Guide: https://labelstud.io/guide/get_started

Trainingdata:

- LVIS: https://www.lvisdataset.org/
- COCO: https://cocodataset.org/#home
- Objects365: https://www.objects365.org/overview.html

Any questions / comments?

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Thank you for your attention!

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