



HEIDELBERG
FACULTY OF
MEDICINE

Multi-instrument detection for stereo-endoscopy in heart surgeries

Summer term 2022

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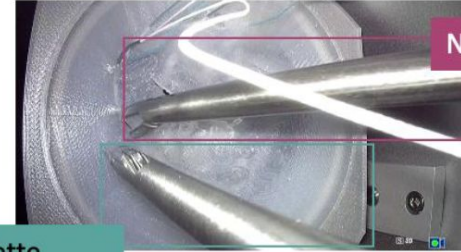
Aim

Multi-instance detection
(How many instruments?)



instrument 1

instrument 2



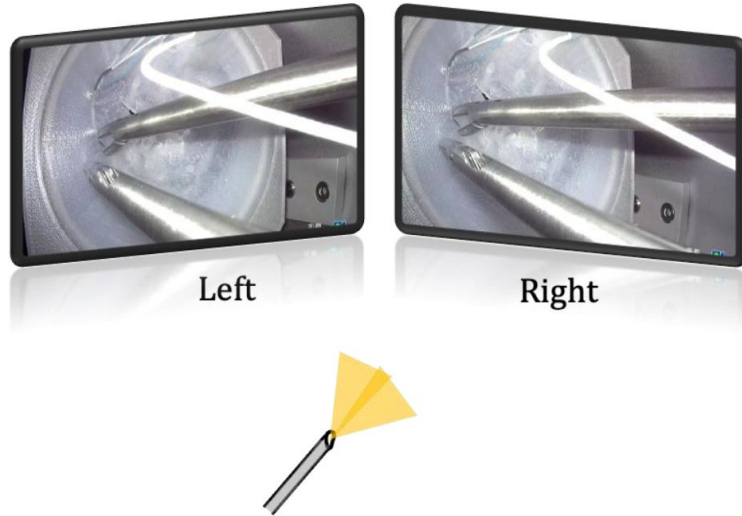
Nadelhalter

Pinzette

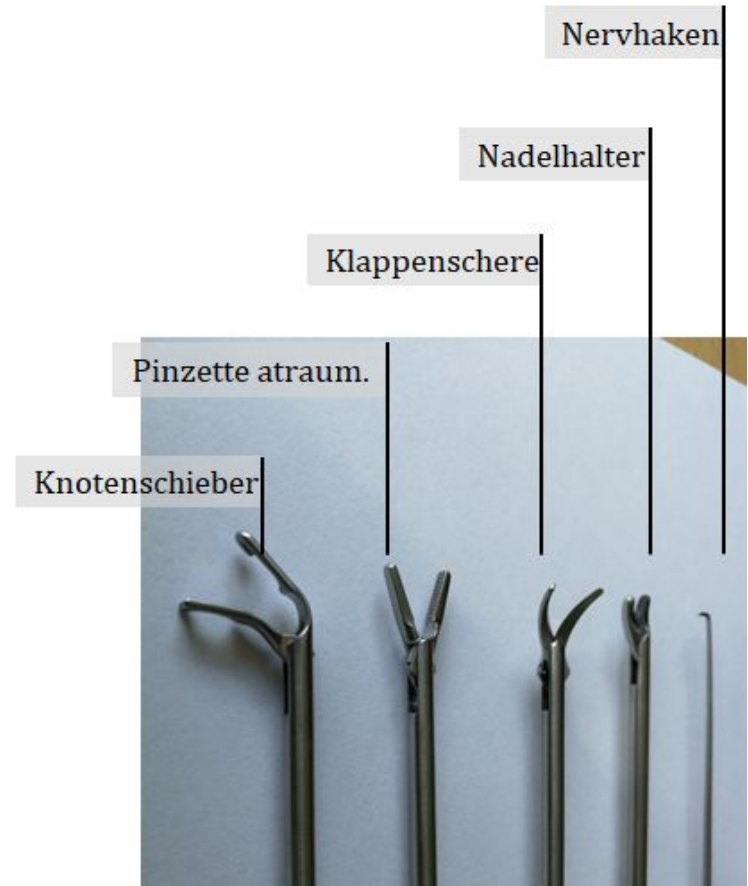
Multi-class detection
(Which instruments?)

Source: wft_ss2022_session1_overview.pptx | Lalith Sharan

Dataset: Mitral valve repair

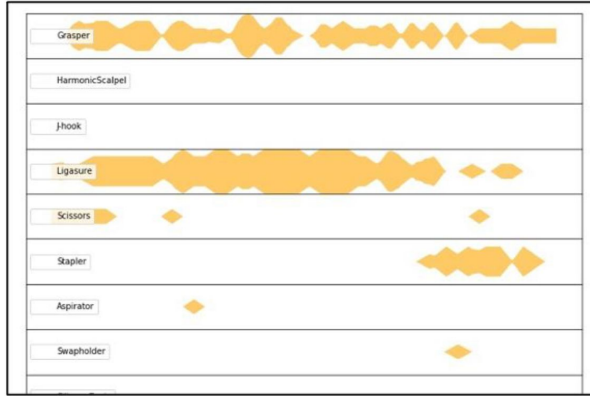


Source: wft_ss2022_session1_overview.pptx | Lalith Sharan

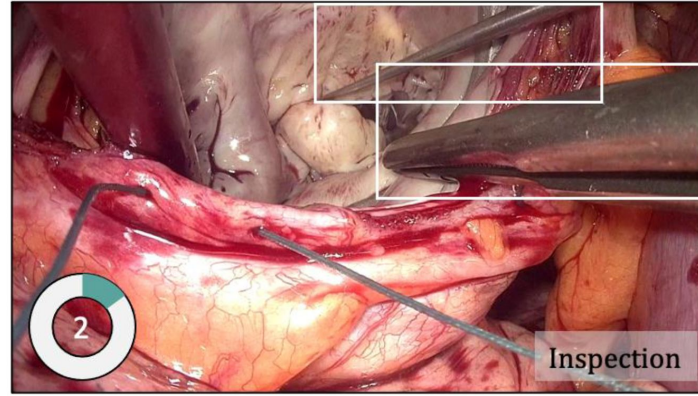


Source: wft_ss2022_session2_data_preparation.pptx | Lalith Sharan

Motivation



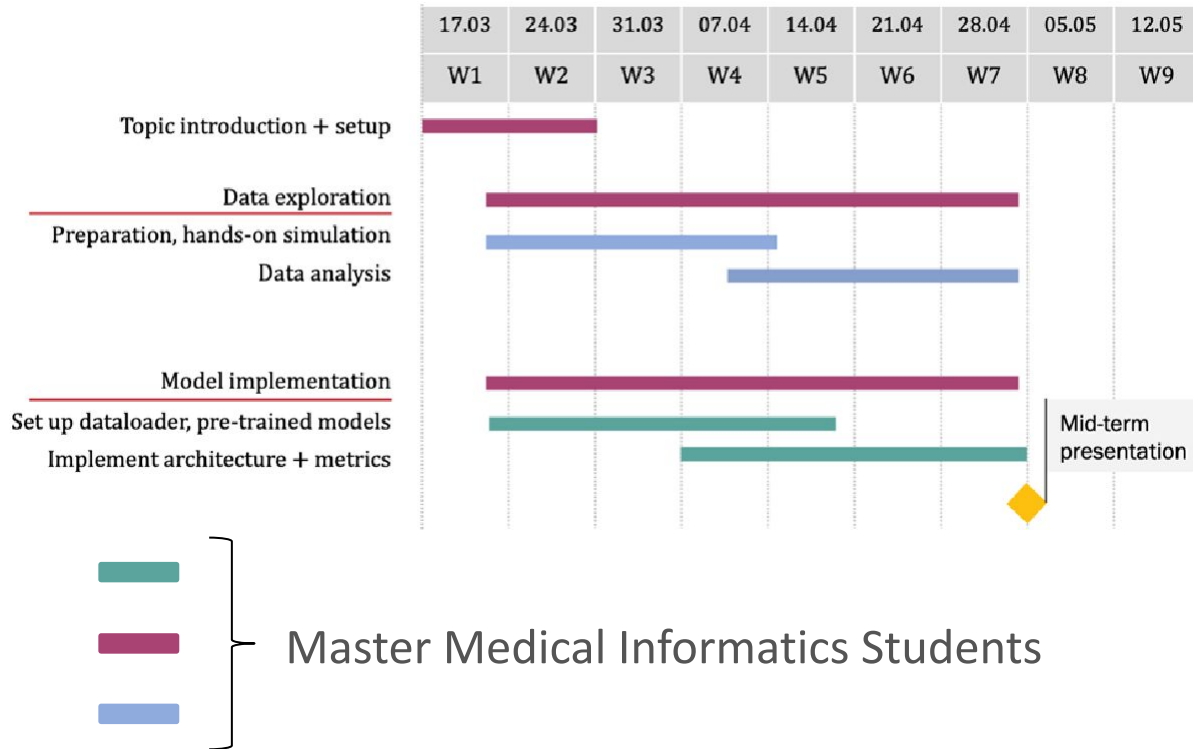
* Courtesy: Benedikt Mayer, OVGU Magdeburg



* Representation

- Analysis of instrument occurrence patterns
- Presence and use of instruments
- Assessment of surgical skills
- Surgical video annotation and tagging
- What information should be displayed at the right time?
- Prediction of the remaining operating time

Milestone planning



Approach

- Data exploration -

1. Relabel existing dataset
2. final data format: COCO format

The “COCO format” is a specific JSON structure dictating how labels and metadata are saved for an image dataset.

Approach

- Data exploration -



advantages over labelme

Semi-automatic labeling

Integrated OpenCV tools

User-friendly interface

Local installation via docker

easier and faster labeling

rotated bounding boxes

Marking for objects that are hidden

Effective data visualization

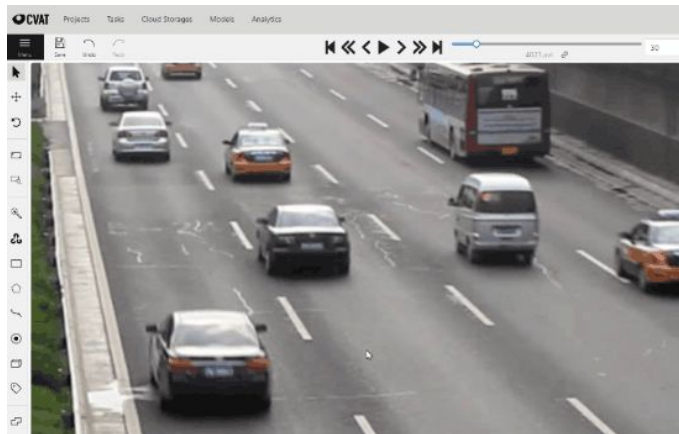
Approach

- Data exploration -

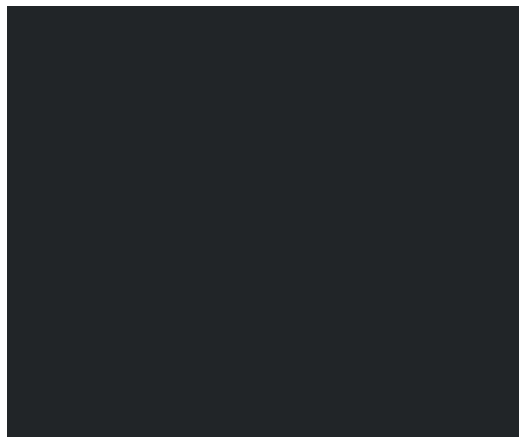
CVAT

+

VOXEL51



Source: <https://www.v7labs.com/blog/cvat-guide#cvat-pros-cons>

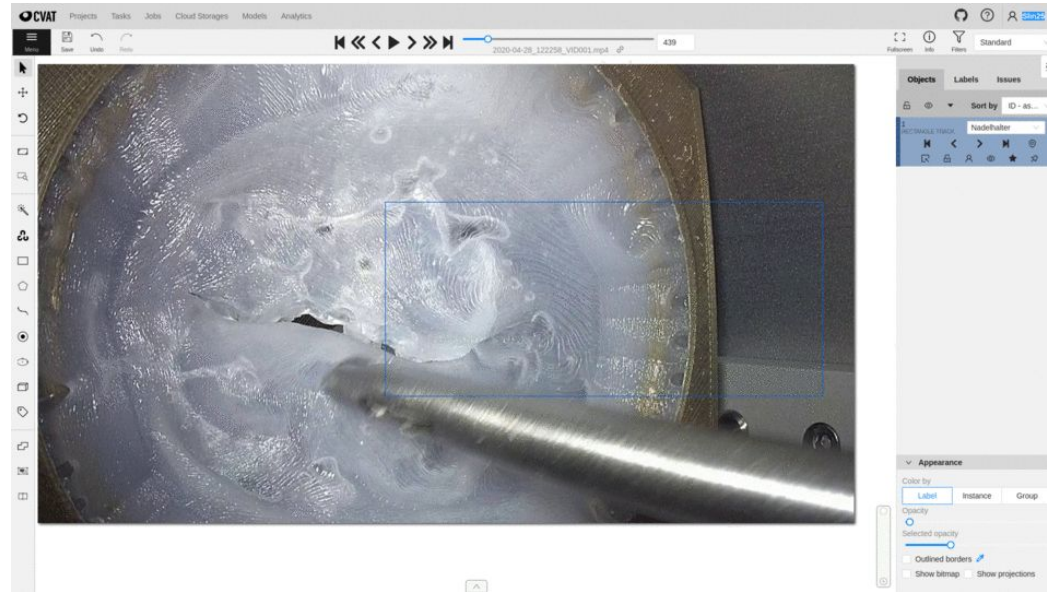


Source: <https://voxel51.com/docs/fiftyone/>

Approach

- Data exploration -

Tracking of BB for Videos



Approach

- Model implementation -



Source: <https://github.com/open-mmlab/mmdetection>

- Open-Source-Toolbox for object recognition
- Based on PyTorch

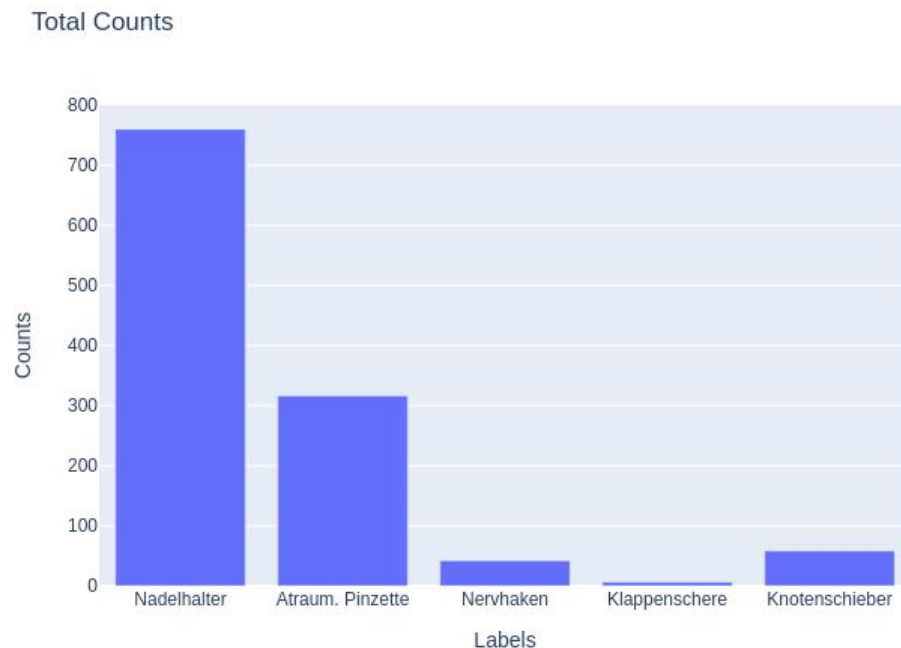
First results

mAP: 0.442



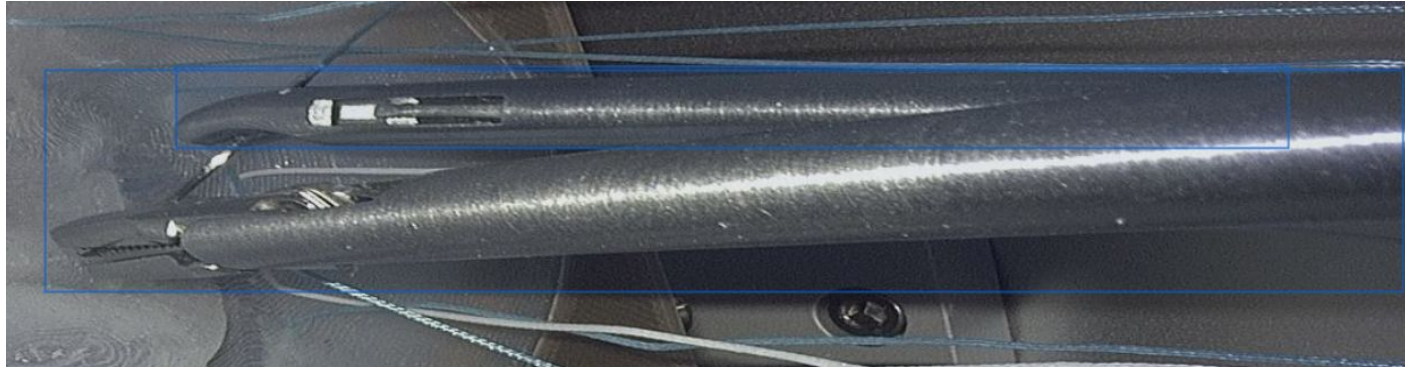
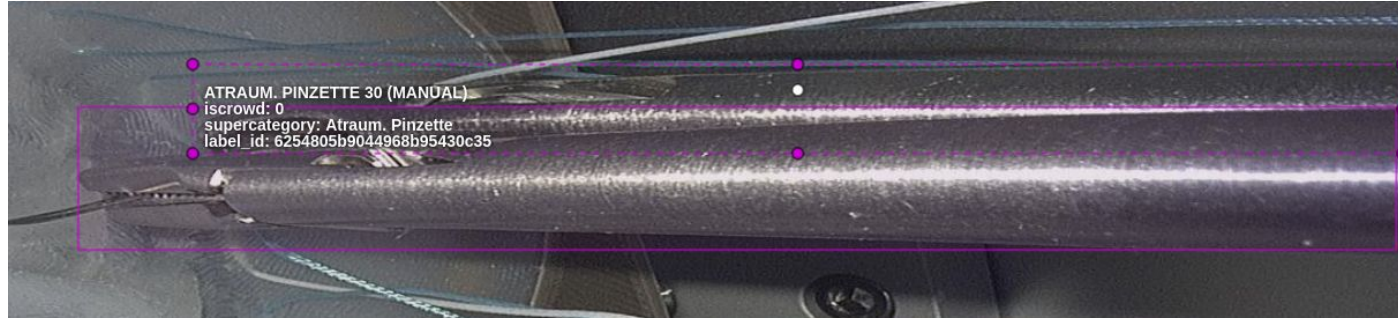
Problems and challenges

- What are the limitations?
 - Fixed number of images
 - Selection not validated
- Where were the biggest difficulties?
 - Inaccurately labeled
 - Incorrectly labeled
 - Blurred images



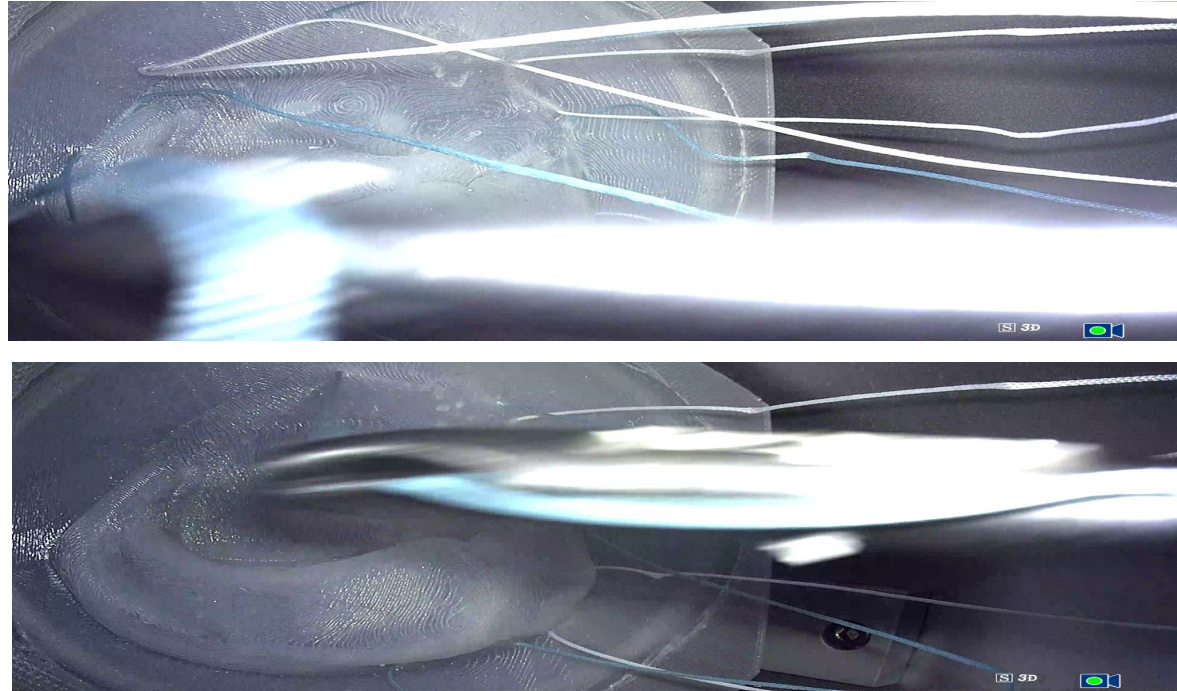
Problems and challenges

Wrong labeling



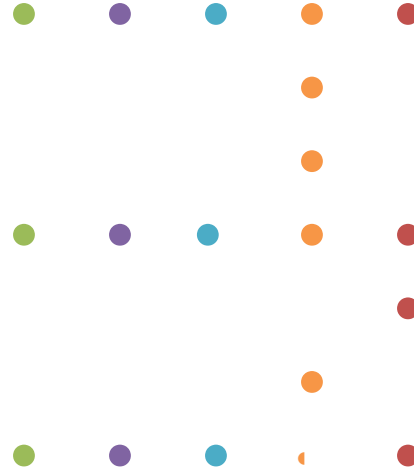
Problems and challenges

Blurry images



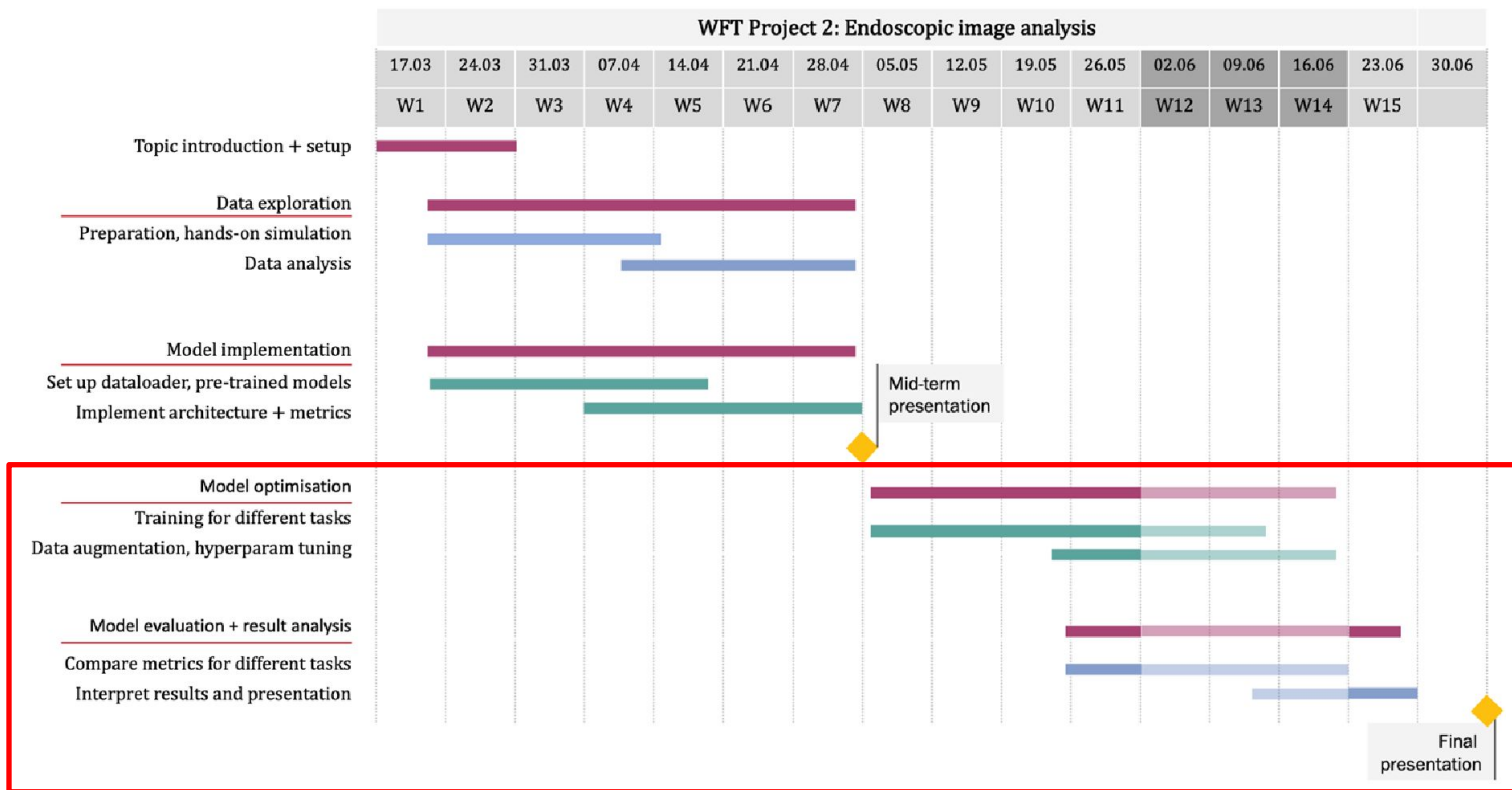
Distribution of tasks

- Data analysis
- Annotation-tool and model selection
- COCO to Labelme conversion
- Data annotation in CVAT
- Data annotation review in FiftyOne
- Basic model implementation
- Mid-Term presentation



● Wimmer ● Stegmayer ● Westerheide ● Iseke ● Bednorz

Next milestones



Next milestones

- Stereo Model
- Data Augmentation
- Hyperparameter tuning
- Metric comparison
- Result interpretation
- Final presentation