Computer Vision Models Life-Cycle Management

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Pain Points for Current Projects

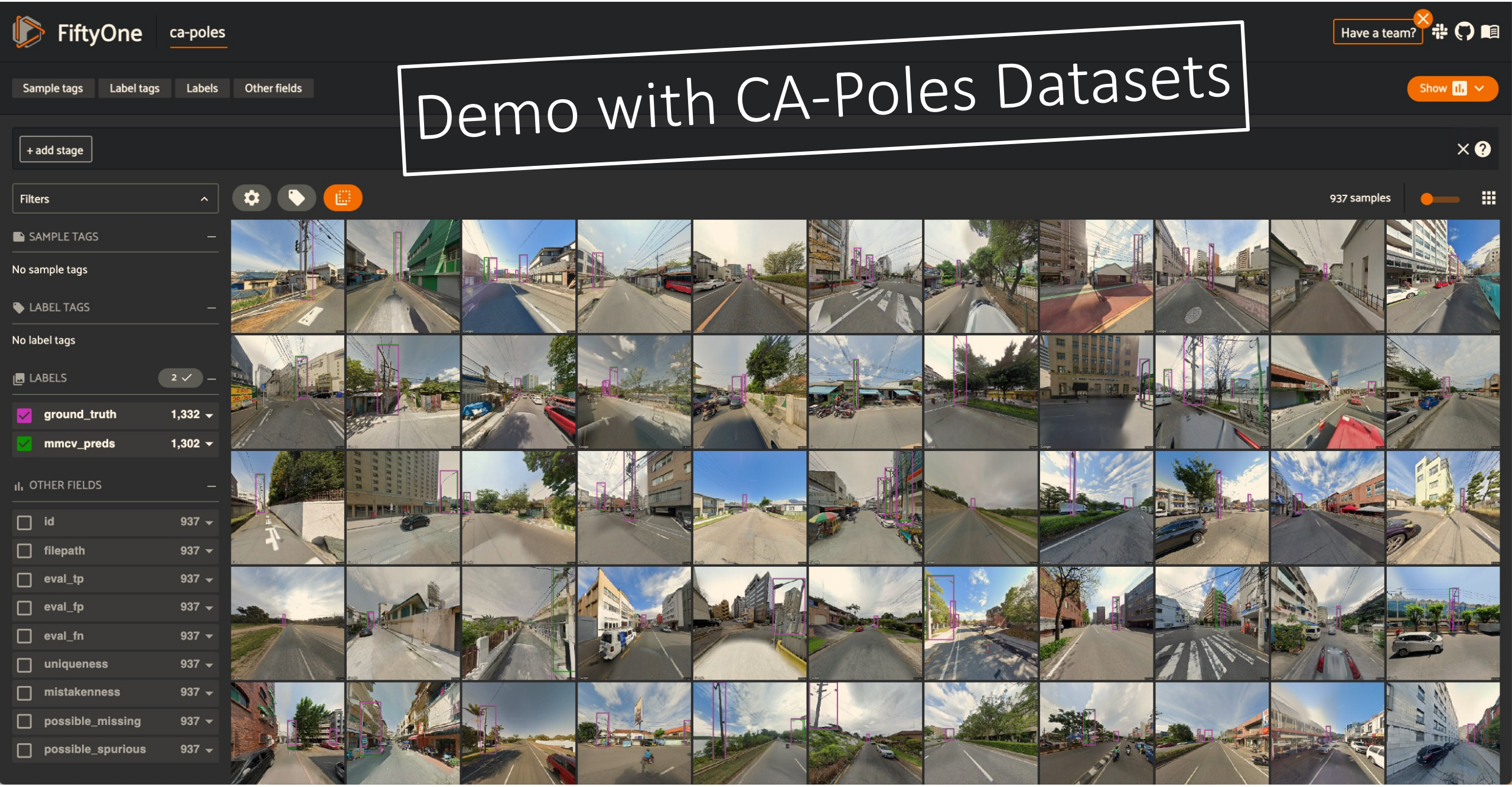
- Data Quality Issues:
  - Current Approach: manually check datasets through image by image.
  - Difficulty to find annotation mistakes or weaknesses.
  - Difficulty to identify failure modes (edge cases).
- Model Evaluation Issues:
  - Current Approach: compare different models based on aggregated performance measurements like mAP, rather than individual samples.
  - Difficulty to identify the strengths/weaknesses of different models.
- Dis-bridge between dataset review and model evaluation

FIFTYONE

- FiftyOne is an open-source dataset curation and model analysis tool for visualizing, exploring, and improving computer vision datasets and models.
- Core capabilities other than curating datasets:
  - Finding annotation mistakes (features from Fiftyone.Brain: mistakenness, possible_missing, possible_spurious)
  - Removing redundant images (features from Fiftyone.Brain: uniqueness)
  - Evaluating models (features: eval_tp, eval_fp, eval_fn), as easy-to-use as sklearn and pandas
  - Visualizing embeddings (methods from Fiftyone.Brain: UMAP, t-SNE, PCA)
  - Working with geolocation (only supports simple [longitude, latitude] coordinate points)

https://voxel51.com/docs/fiftyone/ (open-source)

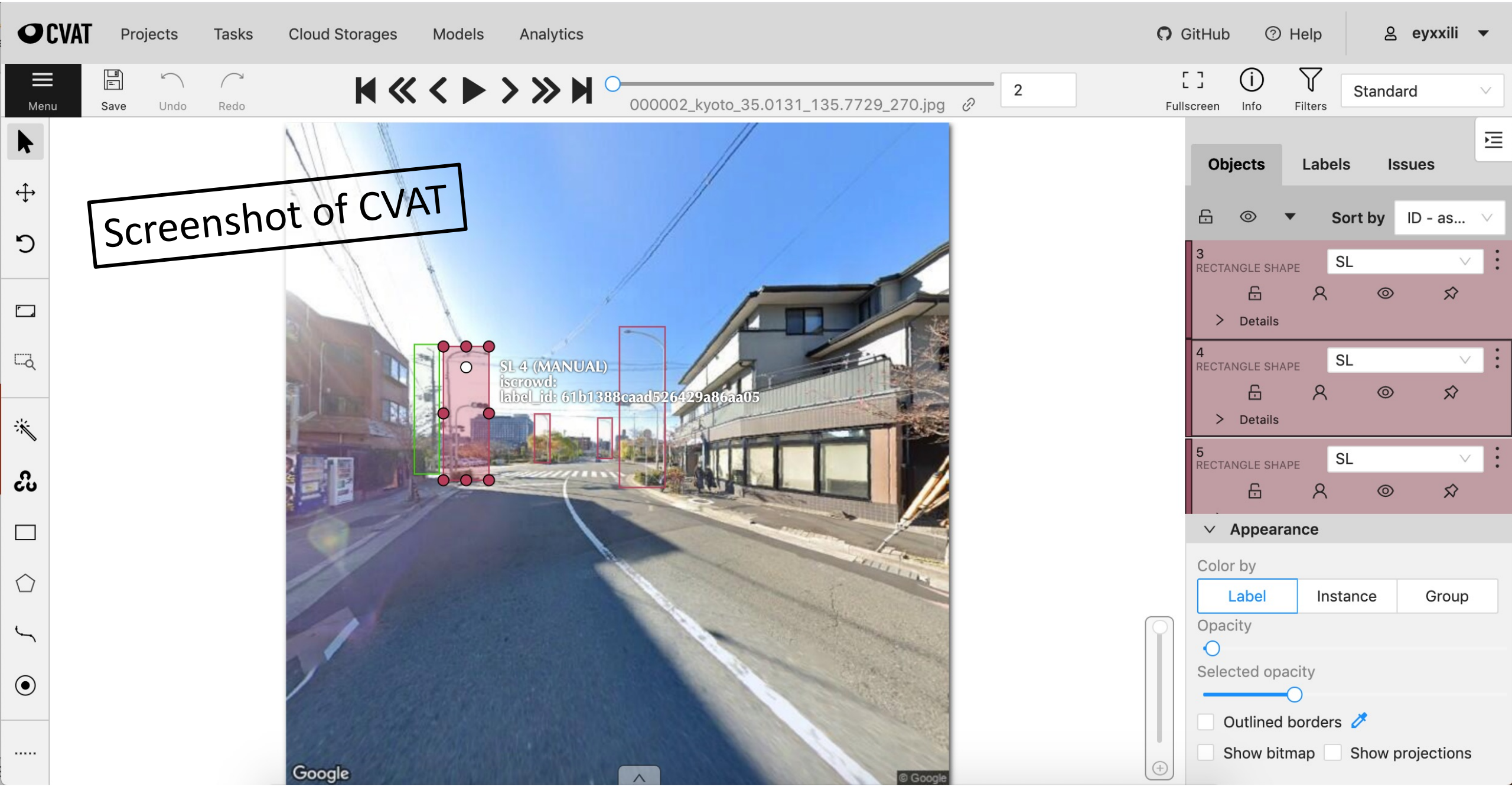
https://pypi.org/project/fiftyone-brain (closed-source)


FiftyOne
ca-poles
Have a team?
Demo with CA-Poles Datasets
Sample tags
Label tags
Labels
Other fields
Show
+ add stage
Filters
937 samples
SAMPLE TAGS
No sample tags
LABEL TAGS
No label tags
LABELS
2
ground_truth 1,332
mmcv_preds 1,302
OTHER FIELDS
id 937
filepath 937
eval_tp 937
eval_fp 937
eval_fn 937
uniqueness 937
mistakenness 937
possible_missing 937
possible_spurious 937

CVAT (Computer Vision Annotation Tool)

- CVAT is free, online, interactive video and image annotation tool for computer vision.
- Tight integration between FiftyOne and CVAT
  - curate and explore datasets in FiftyOne and then send off samples or existing labels for annotation in CVAT with just one line of code.
  - annotate unlabeled datasets.
  - correct existing label deficiencies which have been identified.

https://github.com/openvinotoolkit/cvat

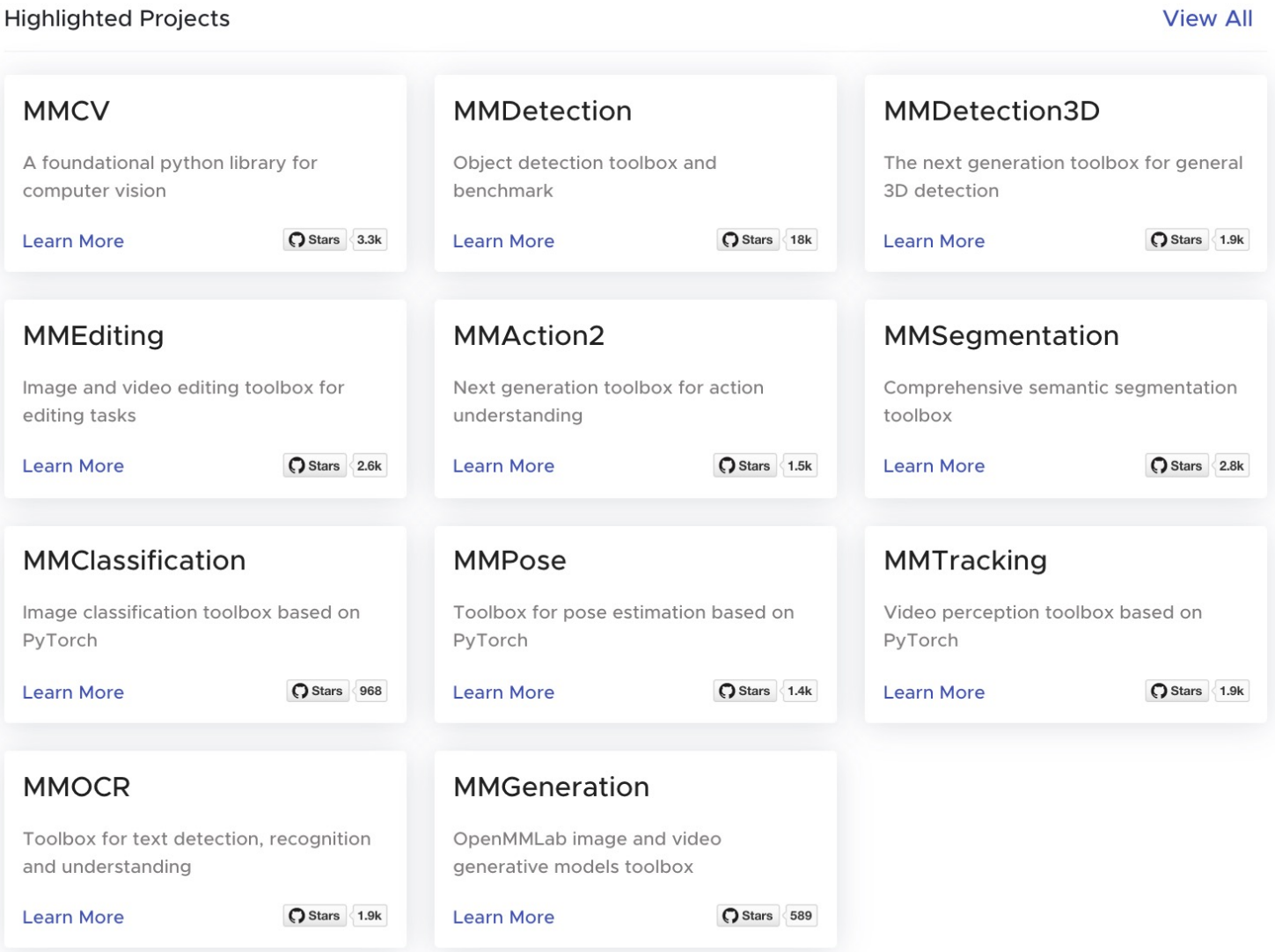

CVAT
Projects
Tasks
Cloud Storages
Models
Analytics
GitHub
Help
eyxxili
Menu
Save
Undo
Redo
000002_kyoto_35.0131_135.7729_270.jpg
2
Fullscreen
Info
Filters
Standard
Screenshot of CVAT
SL 4 (MANUAL)
iscrowd:
label_id: 61b1388caad526429a86aa05
Google
© Google
Objects
Labels
Issues
Sort by
ID - as...
3
RECTANGLE SHAPE
SL
Details
4
RECTANGLE SHAPE
SL
Details
5
RECTANGLE SHAPE
SL
Appearance
Color by
Label
Instance
Group
Opacity
Selected opacity
Outlined borders
Show bitmap
Show projections

OpenMMLab

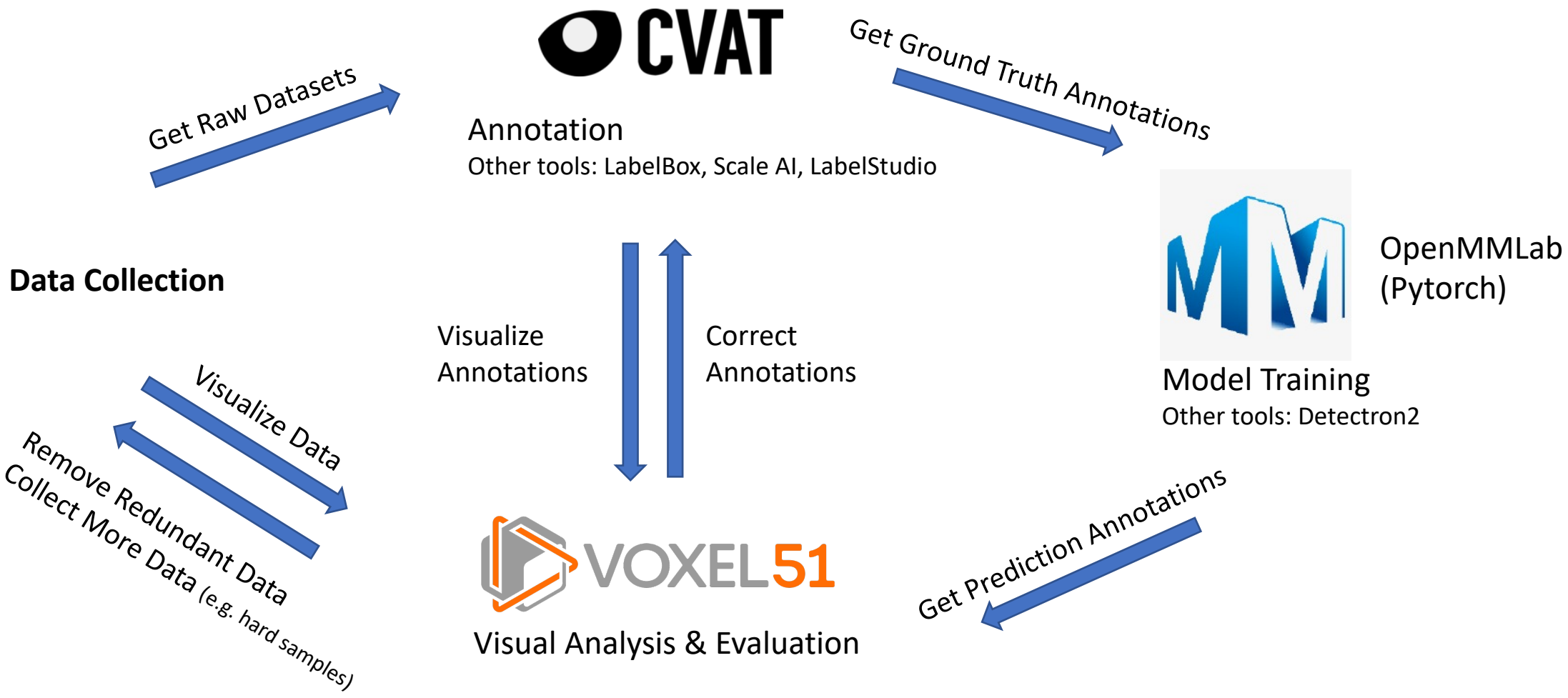
OpenMMLab covers a wide range of research topics of computer vision:

- classification,
- detection,
- segmentation,
- super-resolution,
- tracking,
- OCR,
- etc.

https://openmmlab.com/

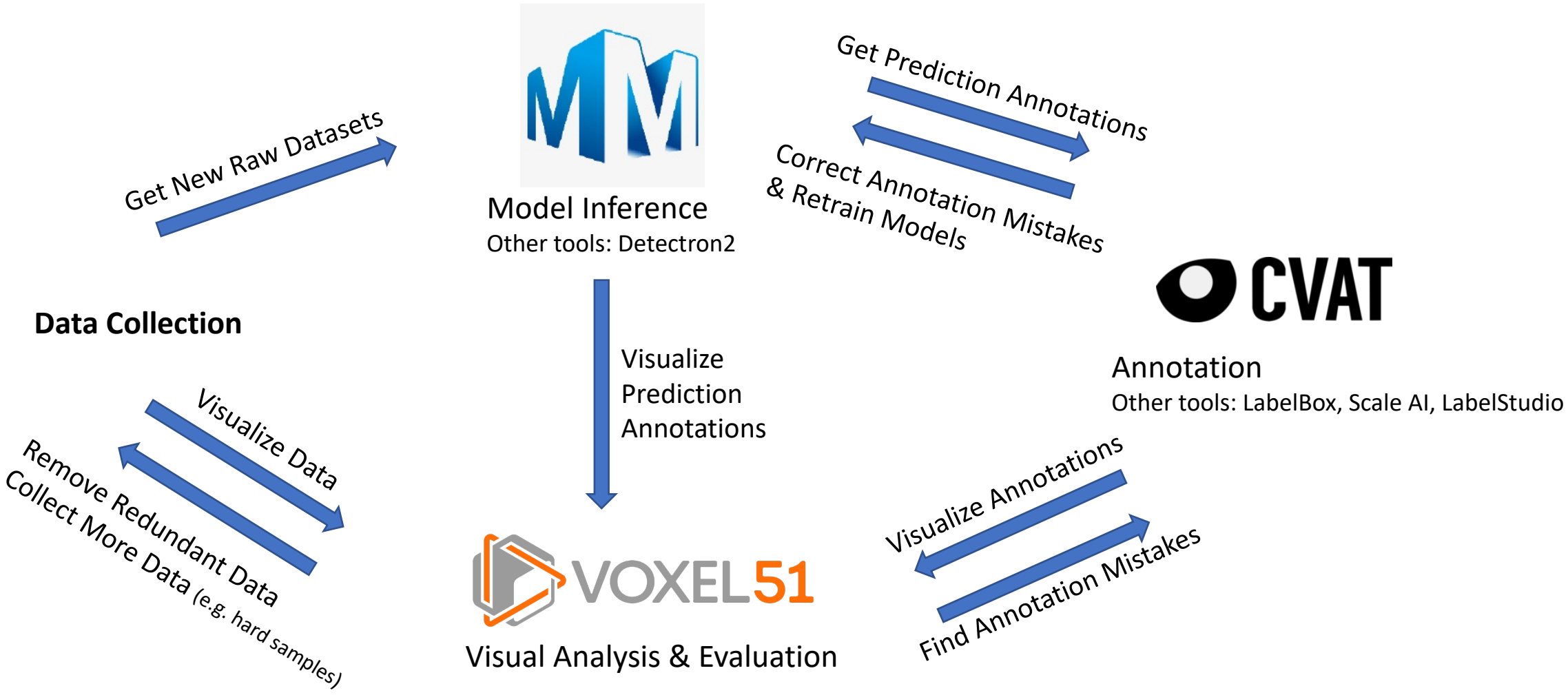


Lifecycle Workflow (First Time)



Lifecycle Workflow (Re-Apply)

Data drift may happen when applying current models to new datasets.



Future Steps for Argo-CD / Workbench Integration

- Deploy CVAT to our k8s cluster with Helm
  - Tutorial: https://github.com/openvinotoolkit/cvat/tree/develop/helm-chart
- Enable Fiftyone Connection for Related Projects
  - Enable port: 5151
- Integrate CVAT into Fiftyone:
  - `export FIFTYONE_CVAT_URL=<Deployed_CVAT_URL>`

Takeaways

- It’s critical to study the failure modes of a model so one can take the right actions to improve them.
- Finding potential annotation mistakes and exporting the problem samples for review/reannotation.
- Identifying scenarios that require additional training samples.
- Inspecting the hardest samples in datasets to diagnose the underlying issue, whether it be the models or the ground truth annotations.
- We can borrow ideas from closed-source Fiftyone-Brain and create our own assets which can be applied to other AI projects.

Q&A