DEFENSIE
LA DÉFENSE

SALTO

Use of active learning for object detection task in satellite images

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OSCARS

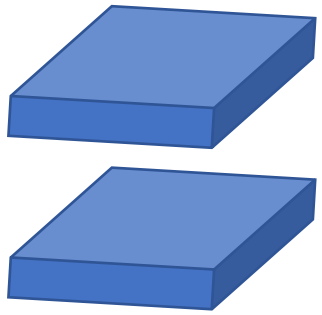
Context & objectives

Lots of satellite images → Impossible to analyse all images

=> Platform to automate task

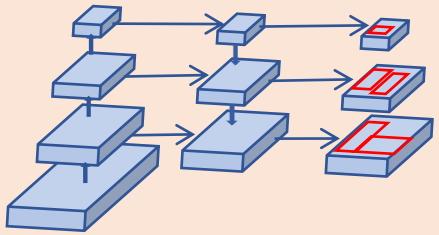
Satellite images

Synthetic images



OSCARS

Geo-intelligence platform



Annotation of images

- **Detection model**
- **Active Learning**

Change between two images

Automatic report

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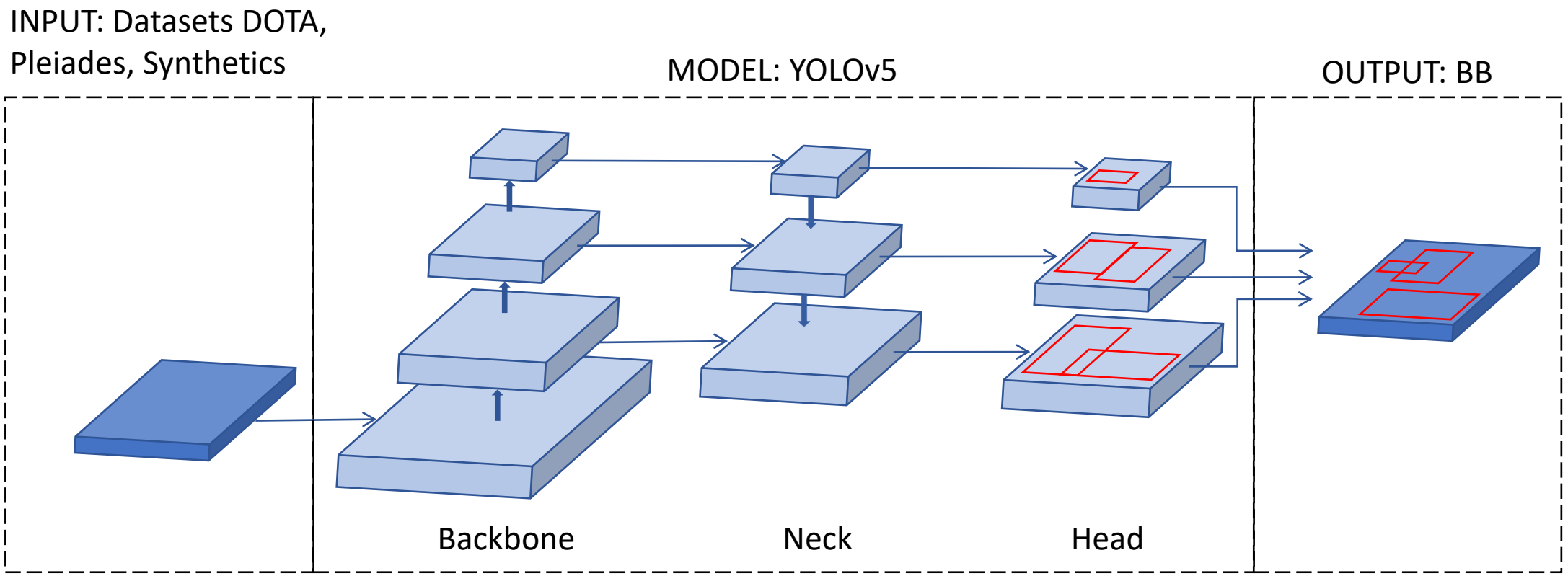
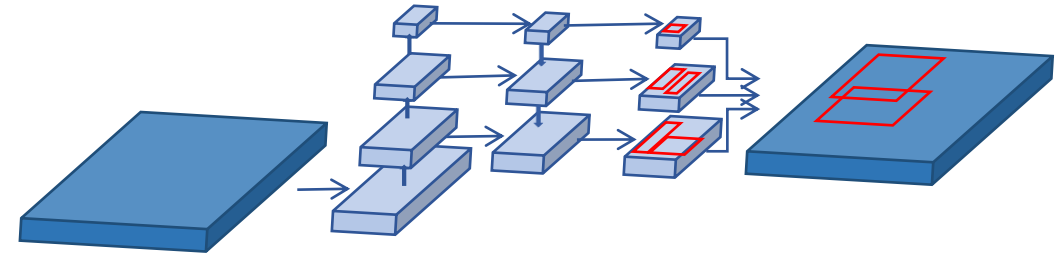
Detection model: Yolov5

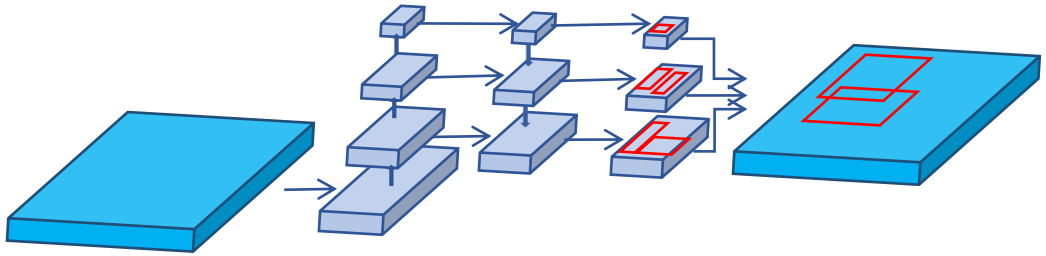


Training of the model

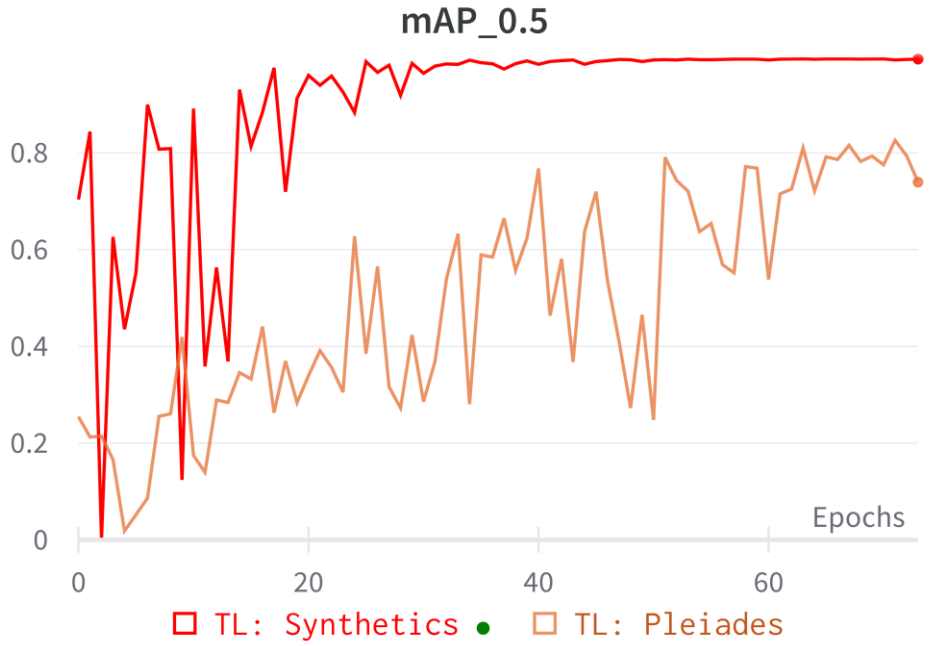


DOTA

weights *w*



Pleiades
Synthetics

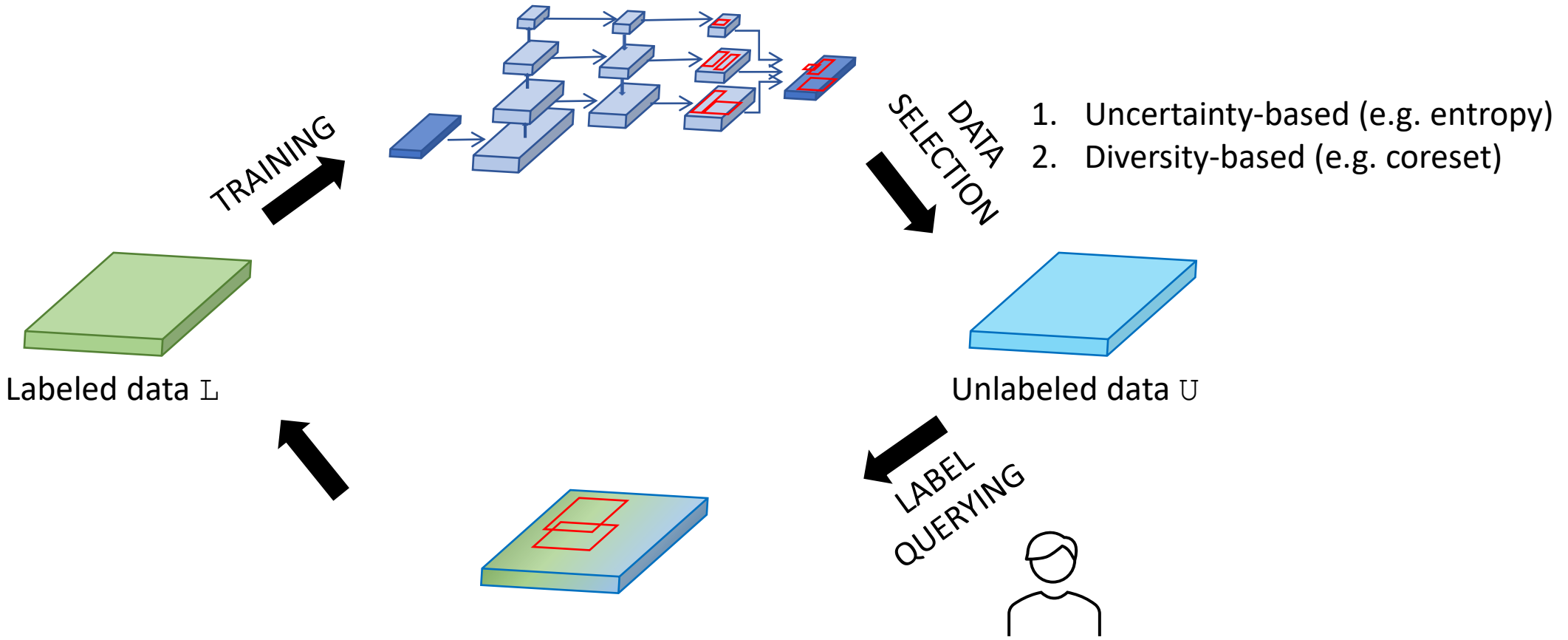


0.994 > 0.81

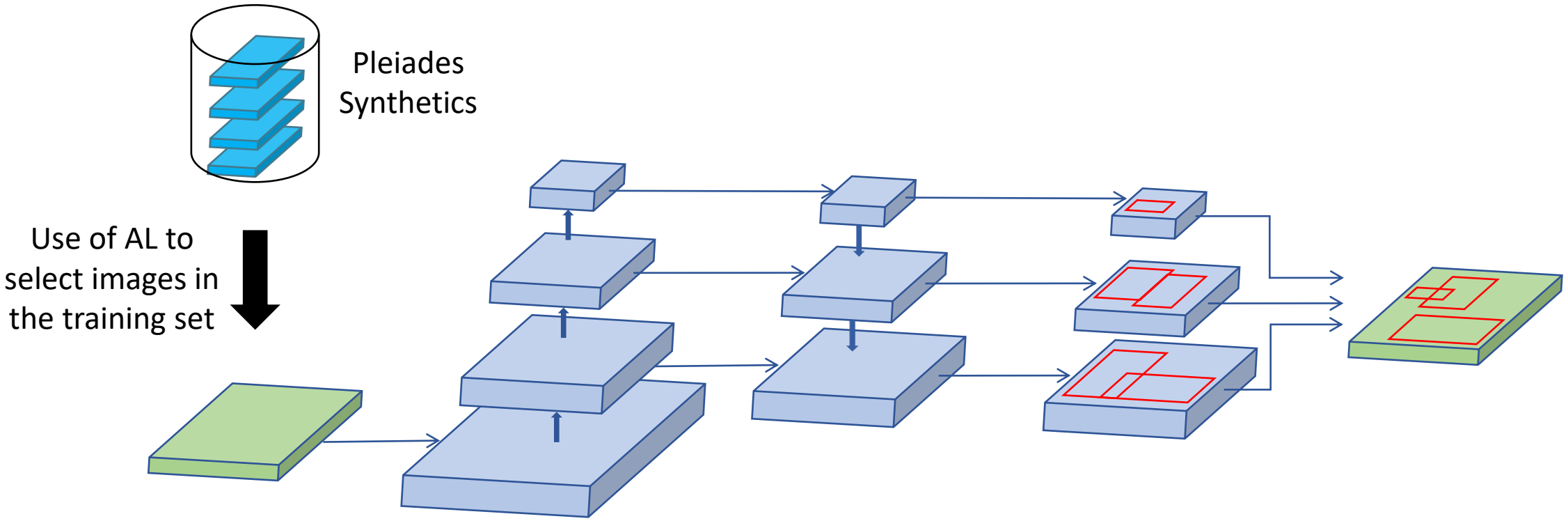
→ Gain of using synthetic images

Active Learning (AL)

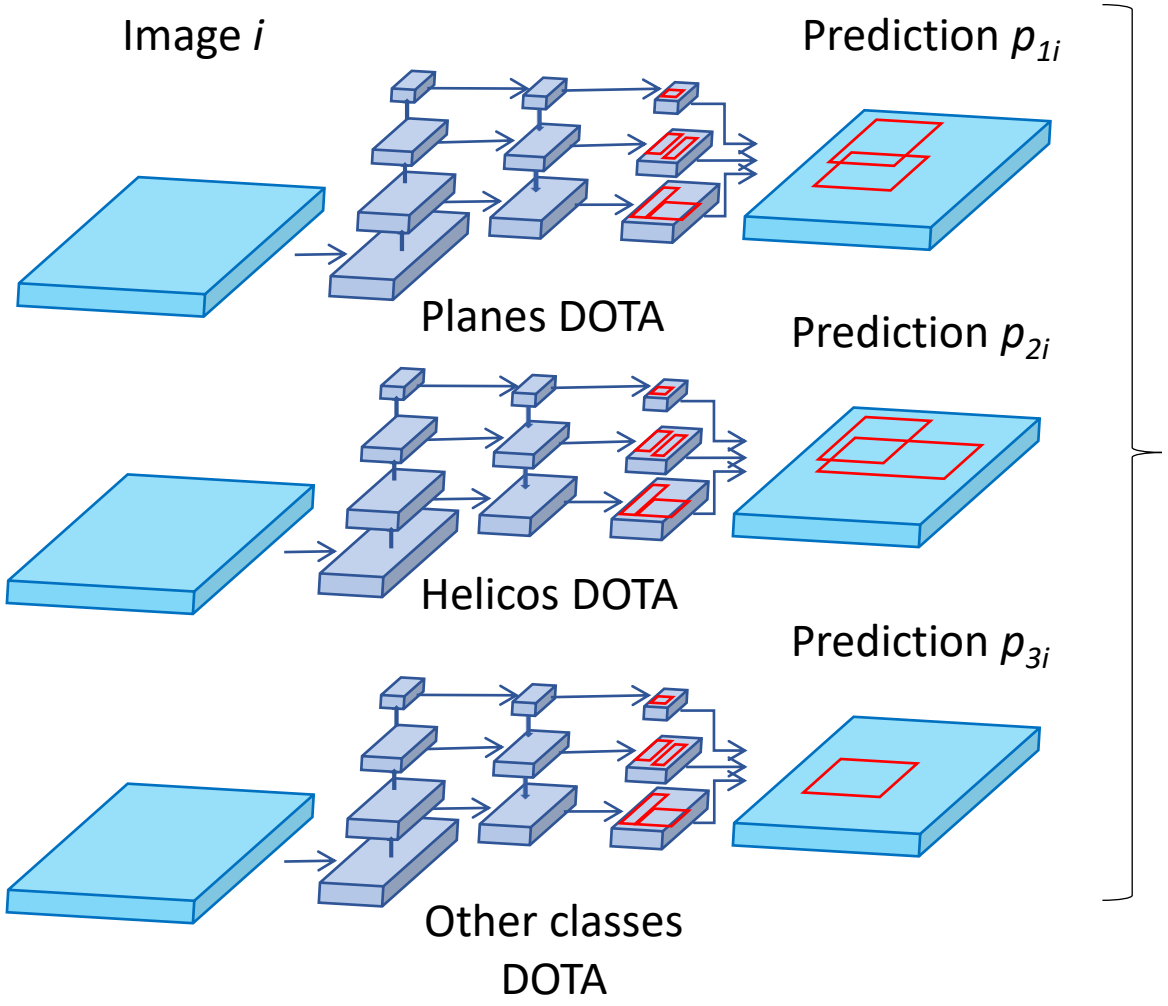
Until total budget / performance is reached:



Training of the model with AL



Query strategy: Ensemble

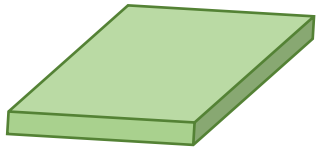


Score calculated by comparing the pairs detection *p* of each object *o*:

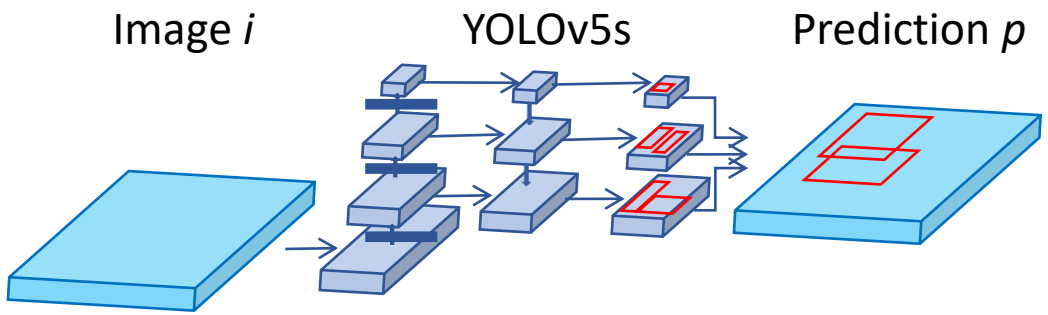
$p = \{p_{i,1}(b_{i,1}, ci_{1,} s_{i,1}), pi_{,2}(b_{i,2,} ci_{,2,} s_{i,2})\} \in Pair_{,o}$ of obj o:

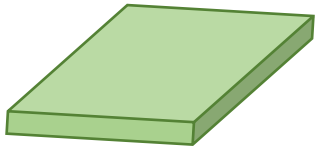
$\text{score}_i = \max(\frac{1}{|Pair_{,o}|} \sum_{p \in Pair_{,o}} (1 - \alpha_1 IoU(b_{i,1,} bi_{,2}) - \alpha_2 \mathbb{1}_{class}))$

SELECTION OF *k* IMAGES with highest score (uncertainty)

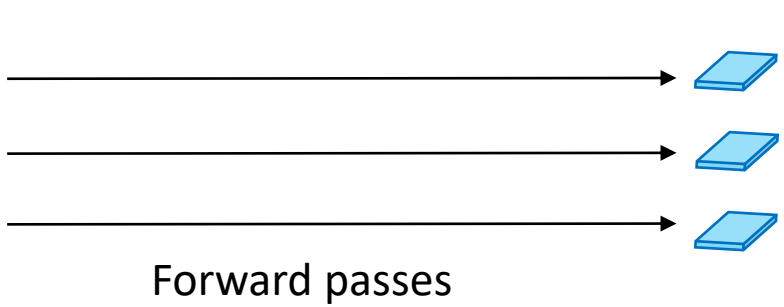


Query strategy: Dropout





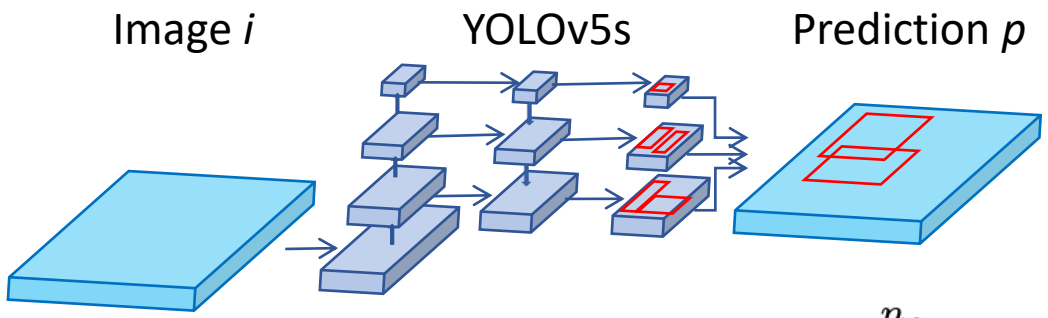
Dropout layer Desactivate some regions in the convolutional kernel



SELECTION OF *k* IMAGES with highest score (uncertainty)

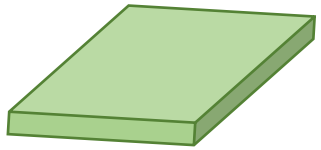
$$\text{score}_i = \frac{1}{n_o}\sum_{o=1}^{n_o} \text{Var}_{\ p(b_{i1},b_{i2})\in P_{air_o}}(IoU(b_{i1},b_{i2}))\text{Var}\ \max_{c\in n_c} p_\theta(\hat{y}_{c,o}|x_i)$$

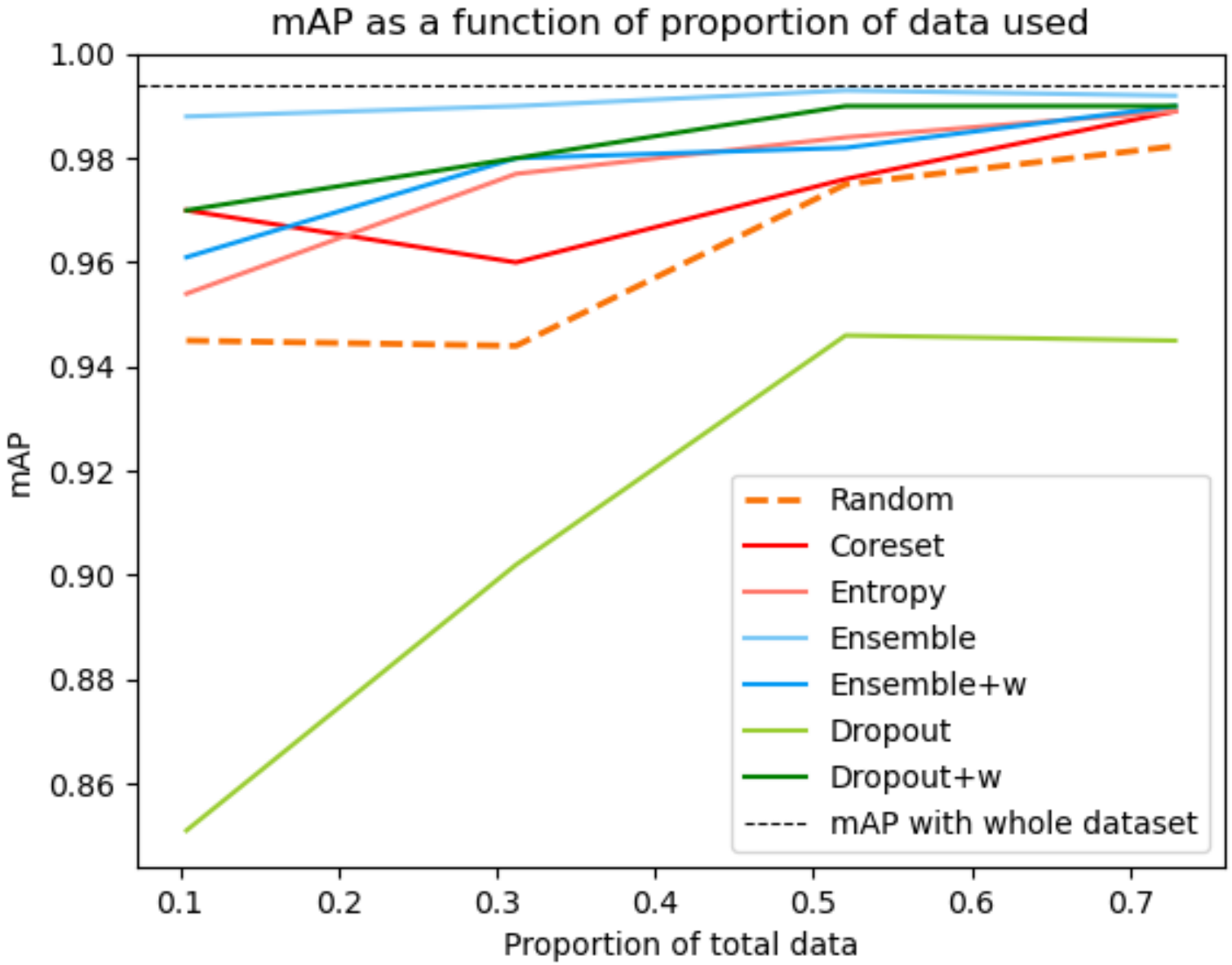
Query strategy: Weighting with instances per class



$$\text{score}_i = \frac{1}{n_o}\sum_{o=1}^{n_o} w_c \ \text{uncertainty}_o \qquad w_c = \frac{\text{Number of o} \in c}{\text{Total number of o}}$$

SELECTION OF *k* IMAGES
with highest score
(uncertainty)





- Ensemble, Dropout+w & Ensemble+w > Random, Coreset & Entropy
  Best: Ensemble
  Worst: Dropout

- Same performance with half of data
  → Less annotation

- Dropout+w > Dropout
  BUT Ensemble+w < Ensemble
- → Gain of weighting with instances per class?

Future work

- Other method to take into account objects in one image
- Method to take into account quality of annotation