UCLouvain

epl

(Continual) Coalitional active learning

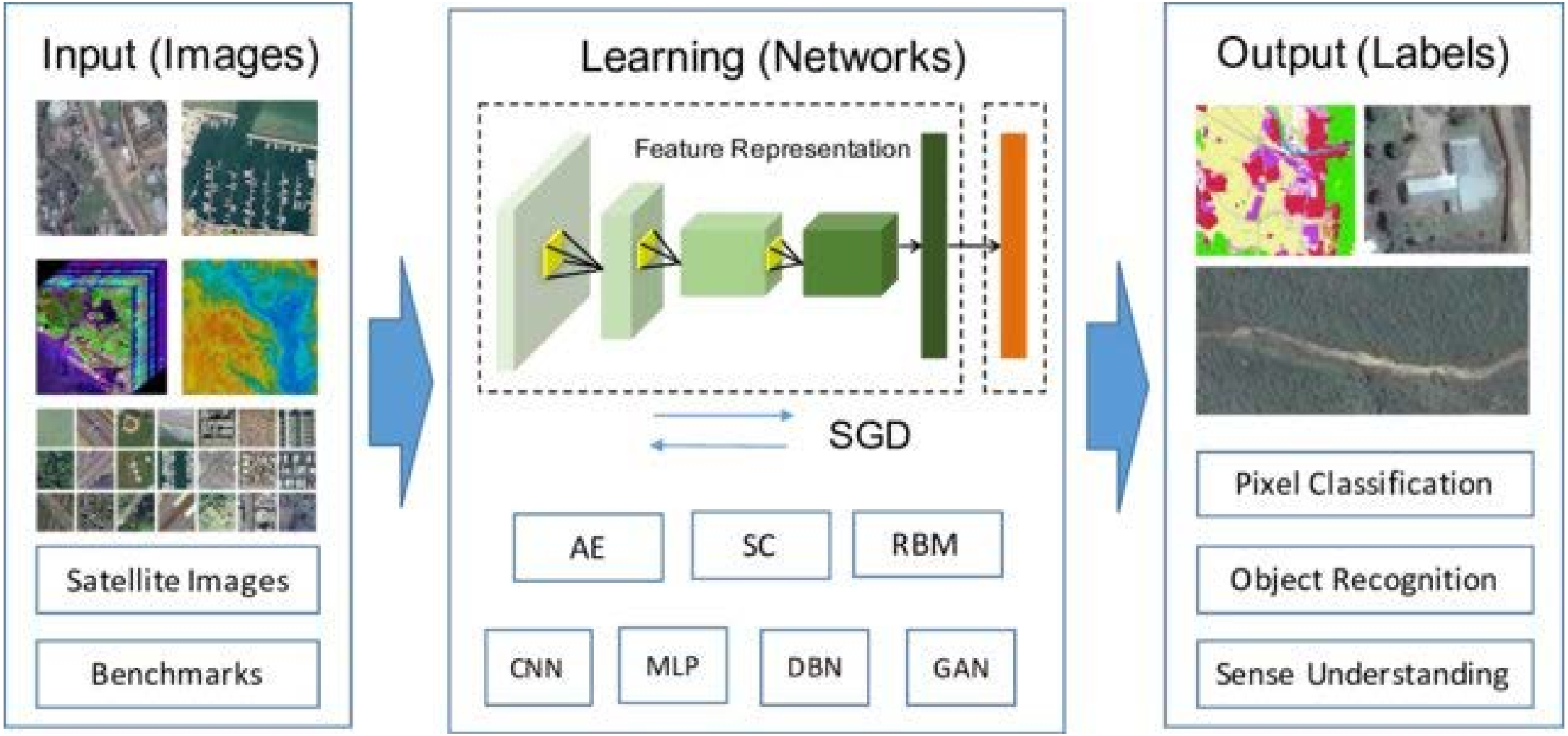
Prospective applications in satellite imaging

Benoit Macq

Deep Learning

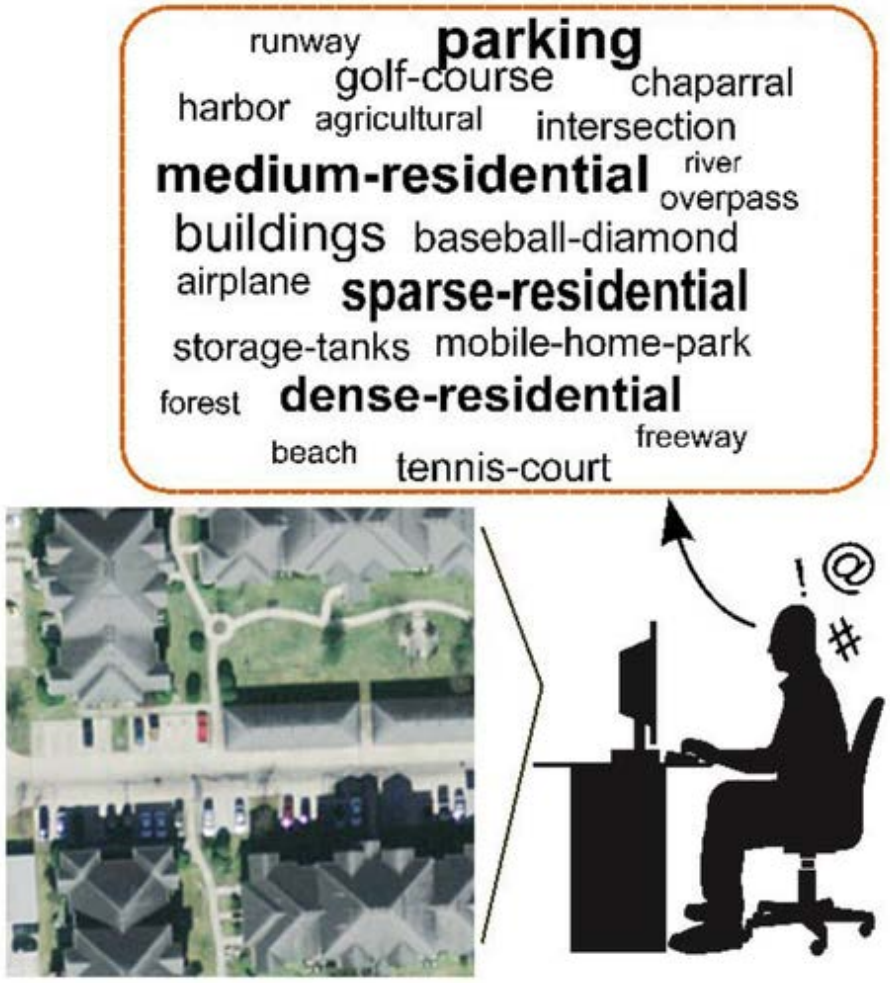
Example: classification and detection of tumors in mammograms

Deep learning is changing satellite imagery: need for large labelled databases



Adaptation to the problem: Deep learning on J-2000 multiresolution tiled-images

Labelling is hard and costly!



Labelling issue: 2 solutions

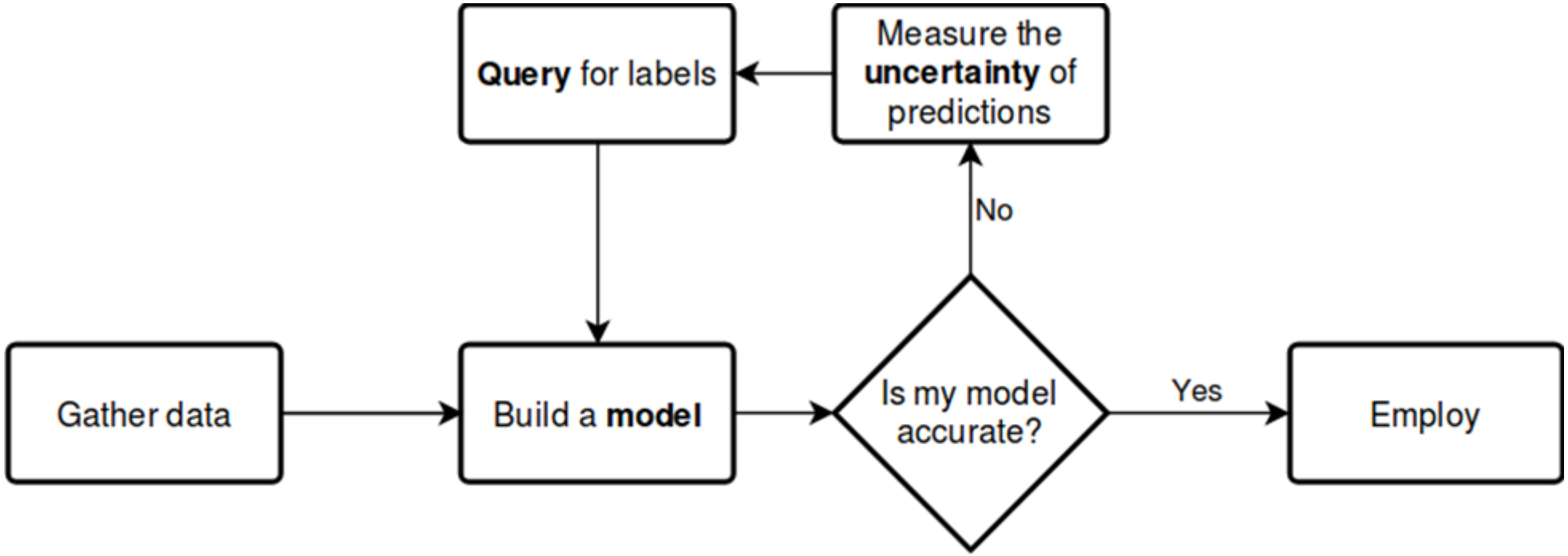
- Better : Active Learning
- More: Federated Learning
- Adaptive: Continual learning (of models and experts)

- The three together: coalitional Active Learning

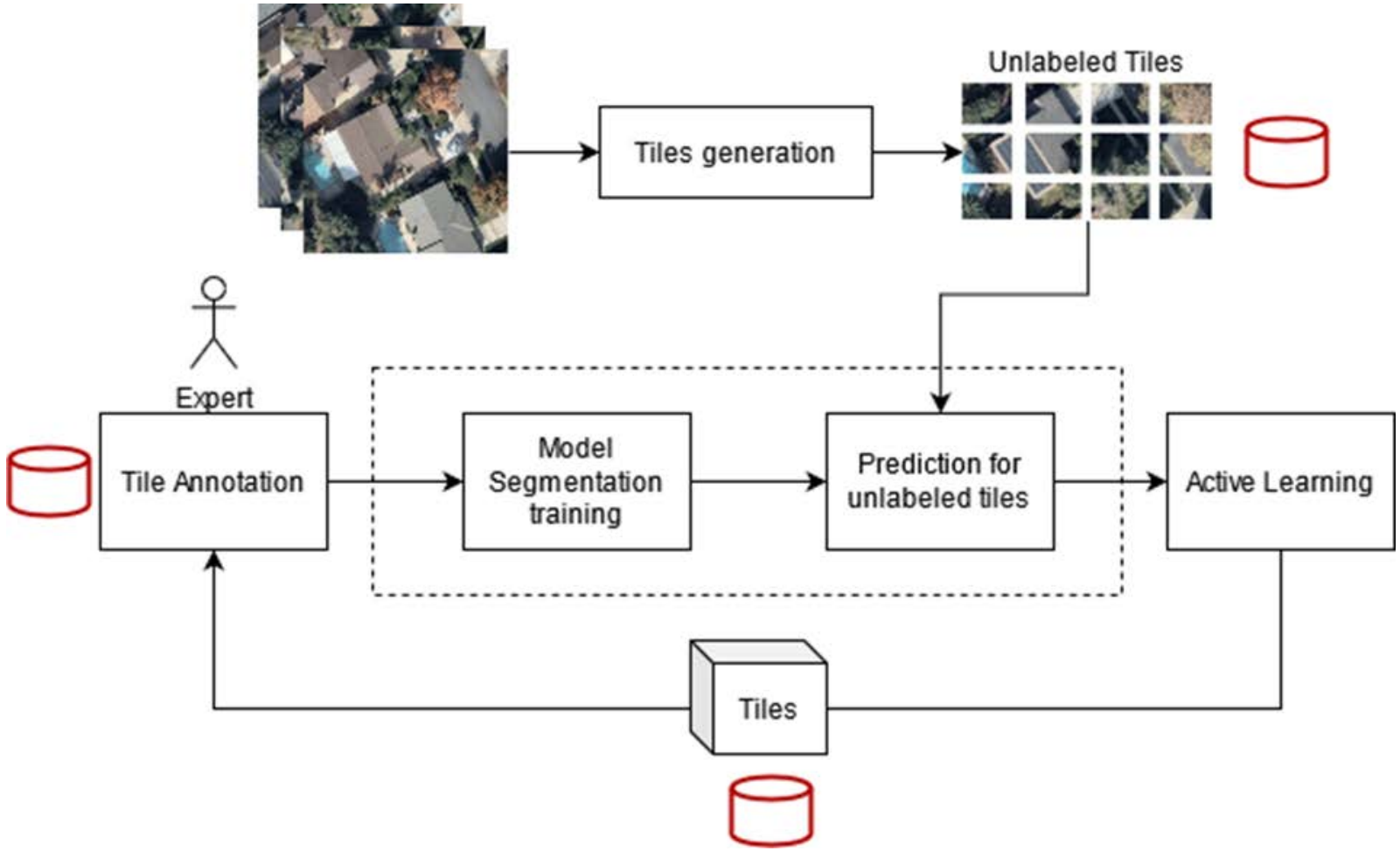
Active Learning

Smart annotation queries

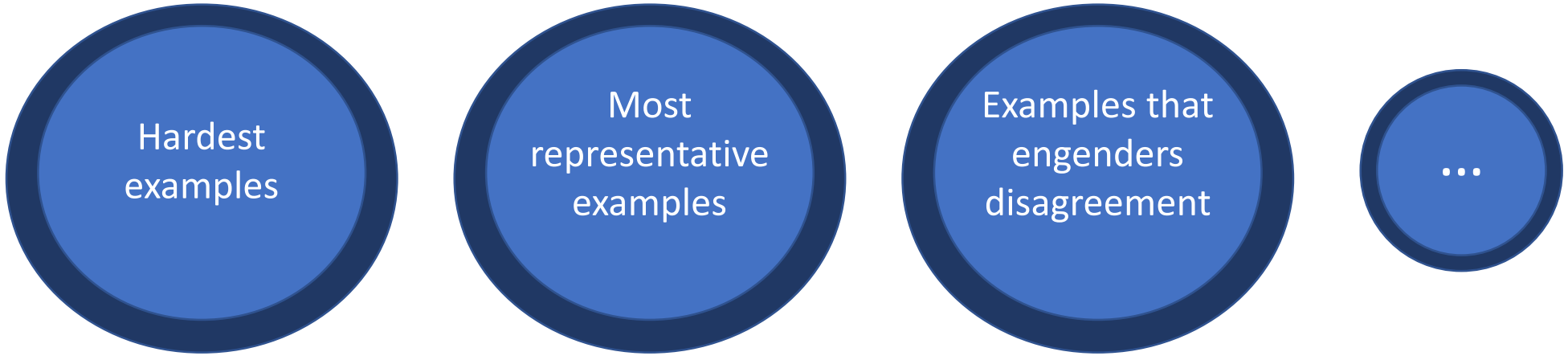
Active learning iterations/ can be continual learning



For very large images (Tiles of JPEG-2000)



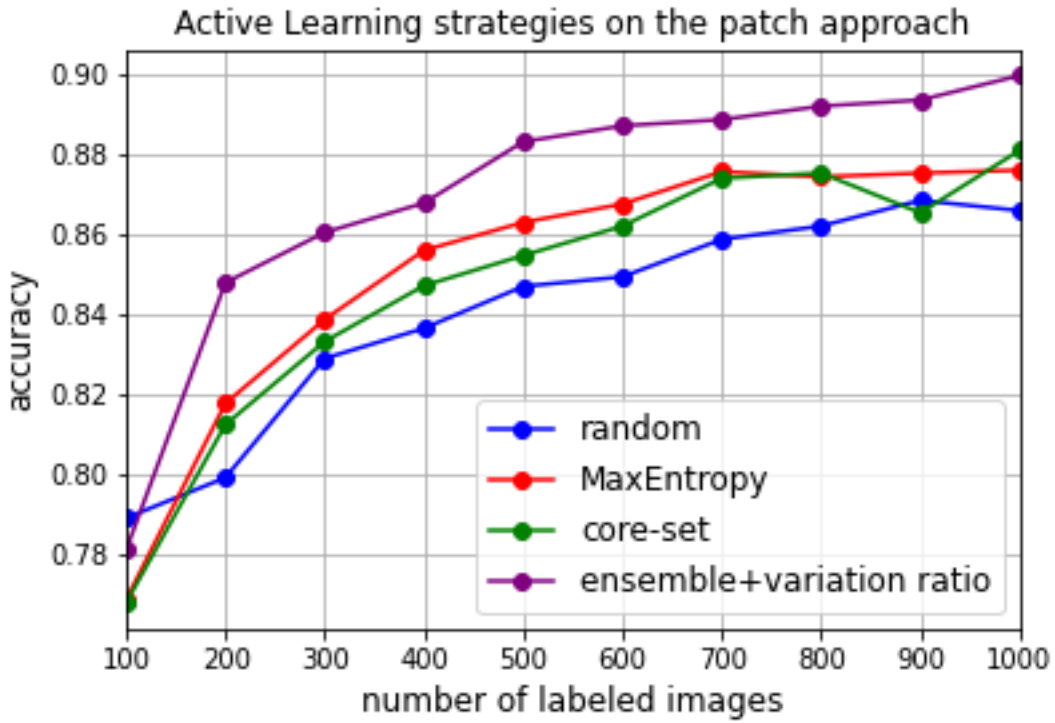
Intelligent selection

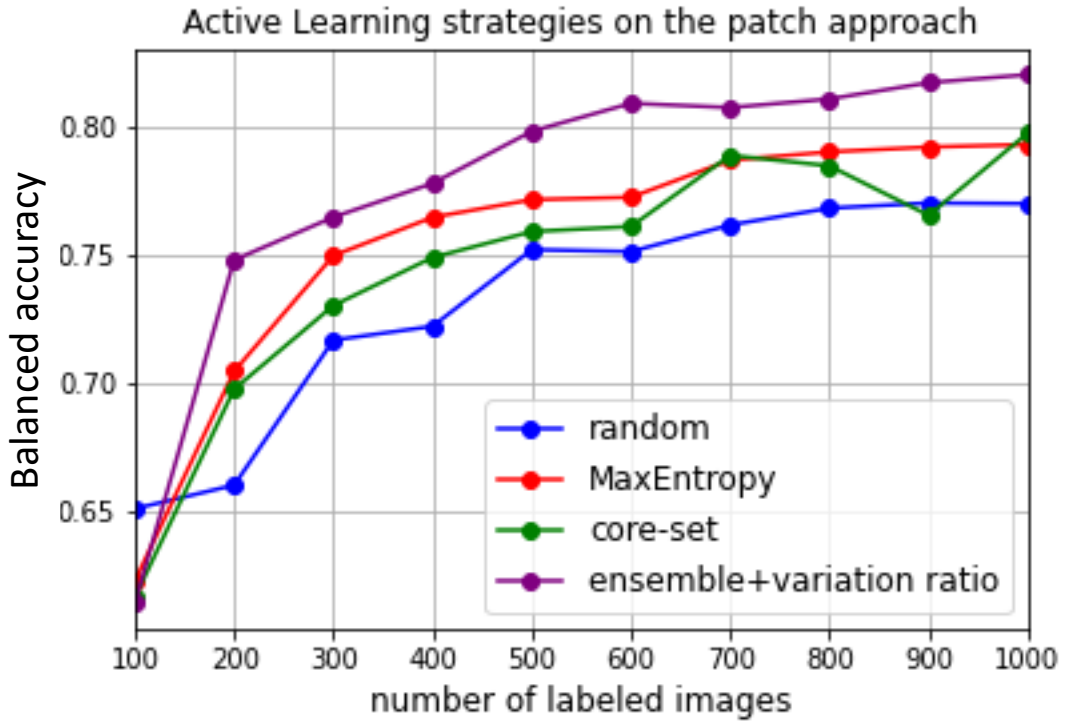


Three methods

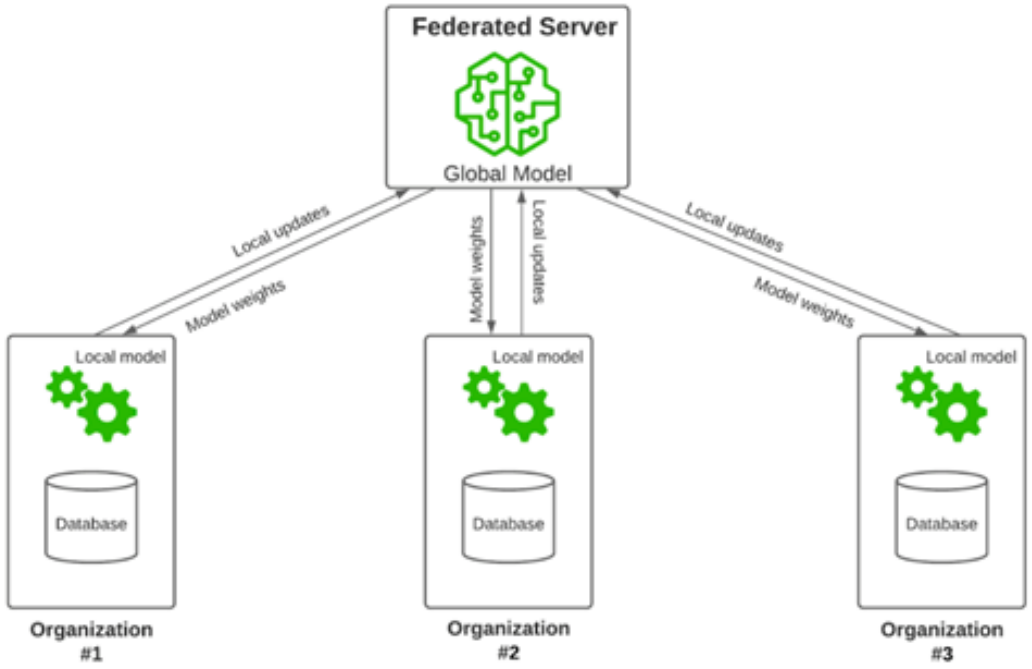
- **Uncertainty (shake the model)**
- **Diversity (measure distances)**
- **Query-by-committee (agreement between competing models)**

Active Learning for classification



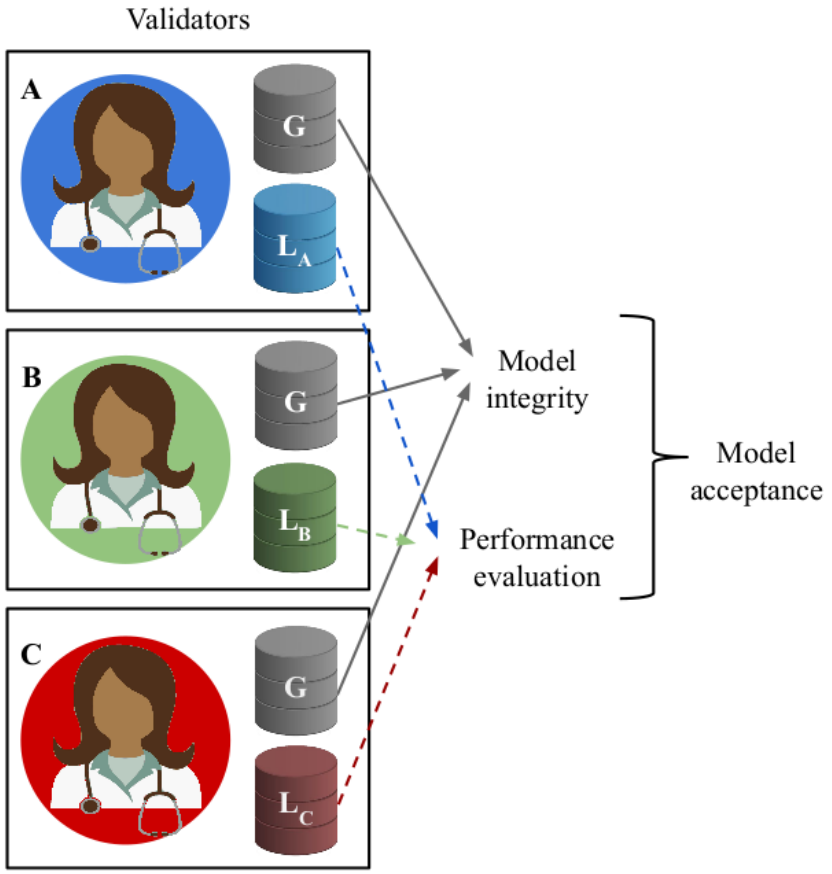


Federated learning: learning together without sharing data

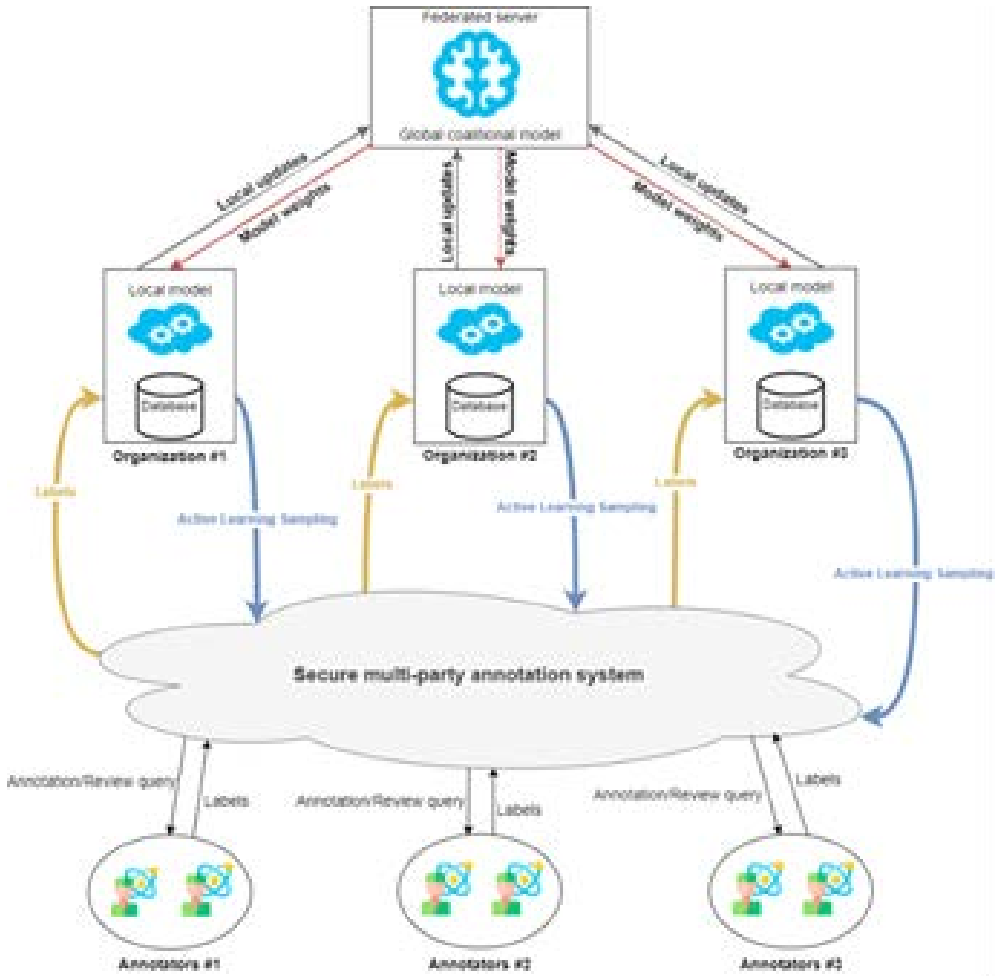


Federated Byzantine Agreement

- Two types of test databases:
  global test database (G),
  local test database (L)
- A “general” is randomly selected among the validators
- The “general” creates a new candidate block referencing the new model
- Every validator validates the viability (model) and integrity of this new candidate block
- Each validator broadcasts its opinion (positive or negative)
- The FBA process ends when 2/3 of the validators agree



Coalitional active learning: our graal!



Coaltional Active Learning is a dynamic system

- In support of continually improving decisions for all
- In support of a continual education of experts

SCALING will provide

- Optimal coalitional gain
- Coalitional learnability
- Consensus for decision
- Human time budget bounds
- Incentivisation
- Trustworthy annotations

How a coaliton of heterogeneous hospitals sharing the same ways of caring can share common DL models
-In support of high quality clinical decision for all
-In support of a continual education of all experts in the coalition

Jointly local and coalitional active learning

federated active learning
for heterogeneous hospitals sharing the same ways of caring
1) Aggregation of multi-scaled annotations
2) Double model (local-coalitional) for bias management and quality improvement
-> Emulation between accuracy (local learning) and bias (coalitional learning)

Time-budget of human experts is optimally used

active learning sampling for join optimized
1) Continual learning of models (adapt to evolving data and knowledge)
2) Continual learning of experts (improvement of expert's annotations)

Secure and incentivize participation in the coalition

secure data/image communication
algorithms for multiparty annotations
1) Providing unbiased ranking of annotation by experts
2) Traceability of accesses to images
3) Reward of participation through CEM credits

UCLouvain

epl

Thank you for your attention!

Do not hesitate to ask any questions