Plant & Food Research
Rangahau Ahumāra Kai

Building an MLOps stack for rapid delivery of reproducible computer vision projects

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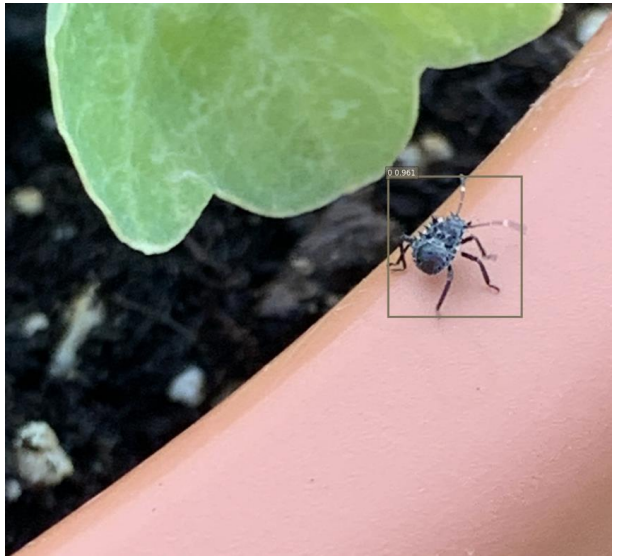
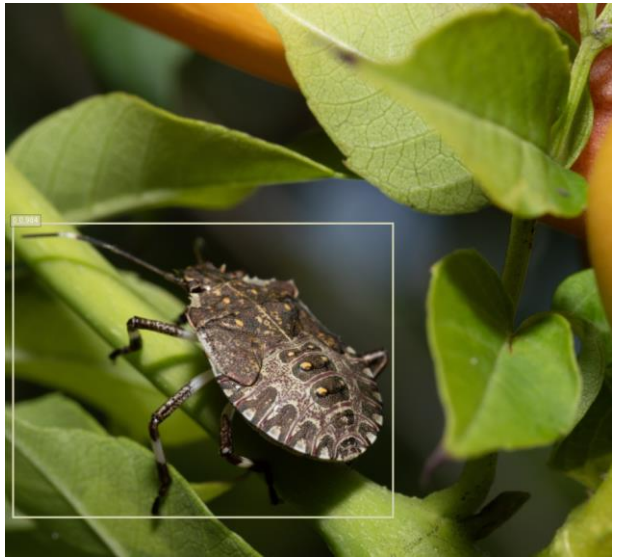
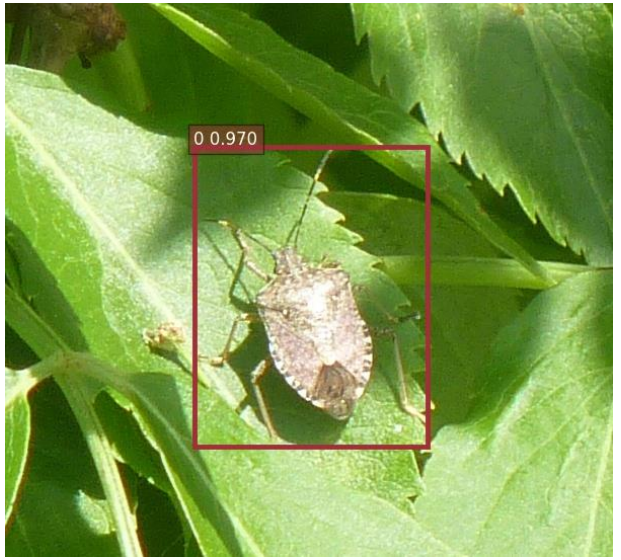
Object detection: brown marmorated stink bug

- Object detection labels
  - ImageNet: bugs, beetles and flies
- Classification labels
  - iNaturalist: stink bugs
  - PFR: stink bugs
- Train insect detector
- Inference on classification labels
- Train BMSB detector





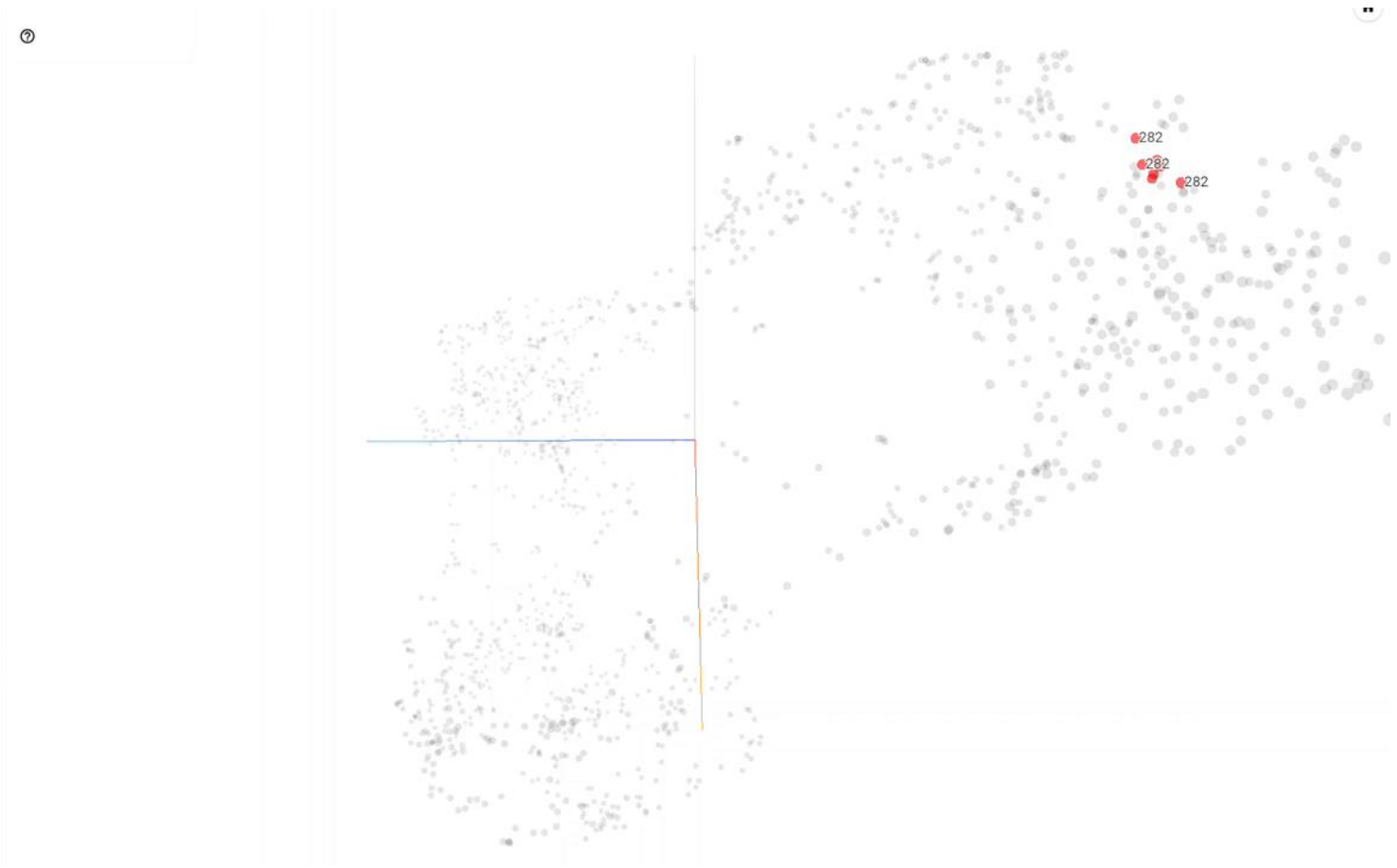


https://www.image-net.org/

https://www.inaturalist.org/

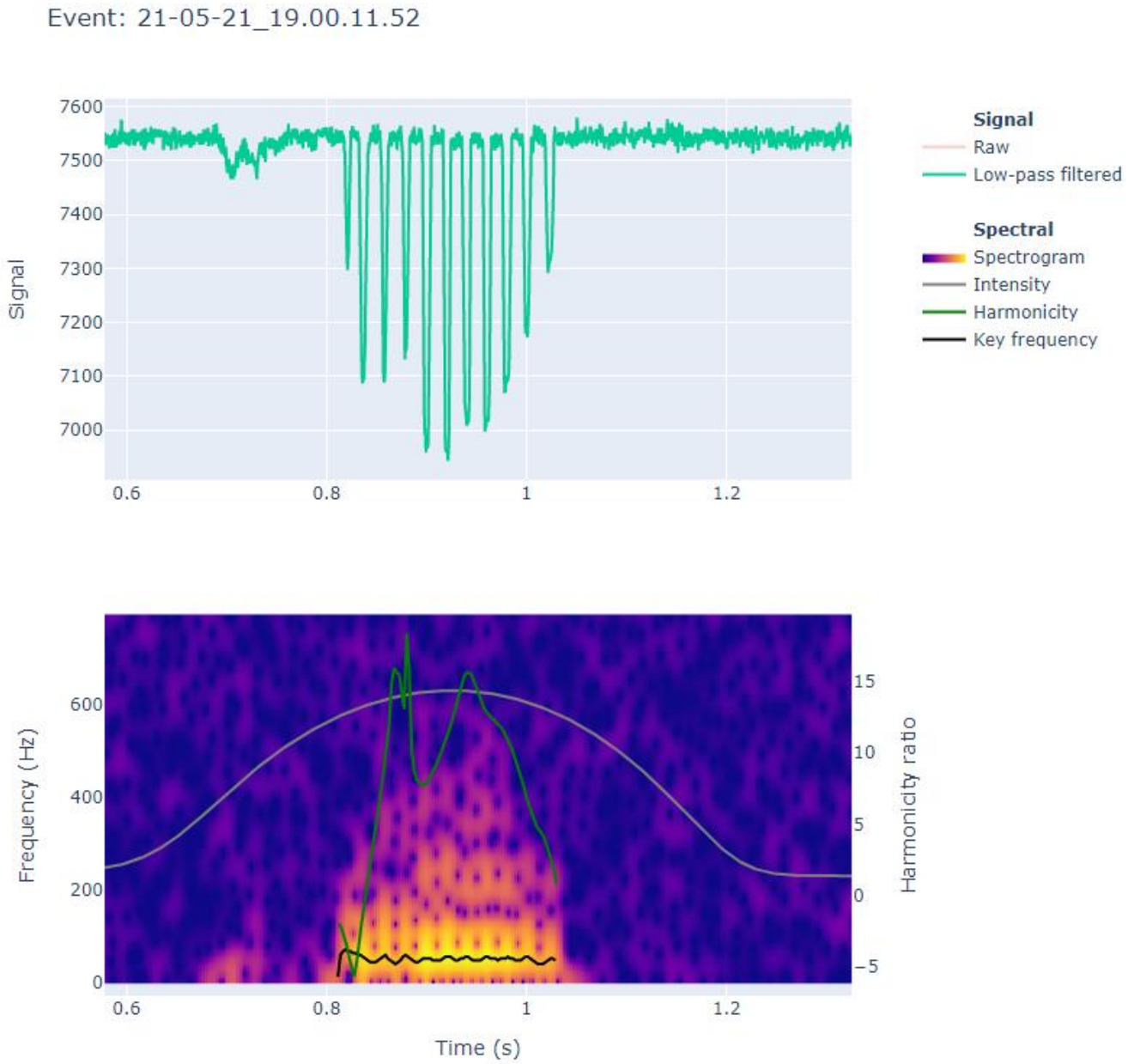
Identification by embedding

- Many similar classes (355), few labels per class (~3)
- Apply to new classes
- Embed model
- Learns distinguishing features
- Classify
- Cluster



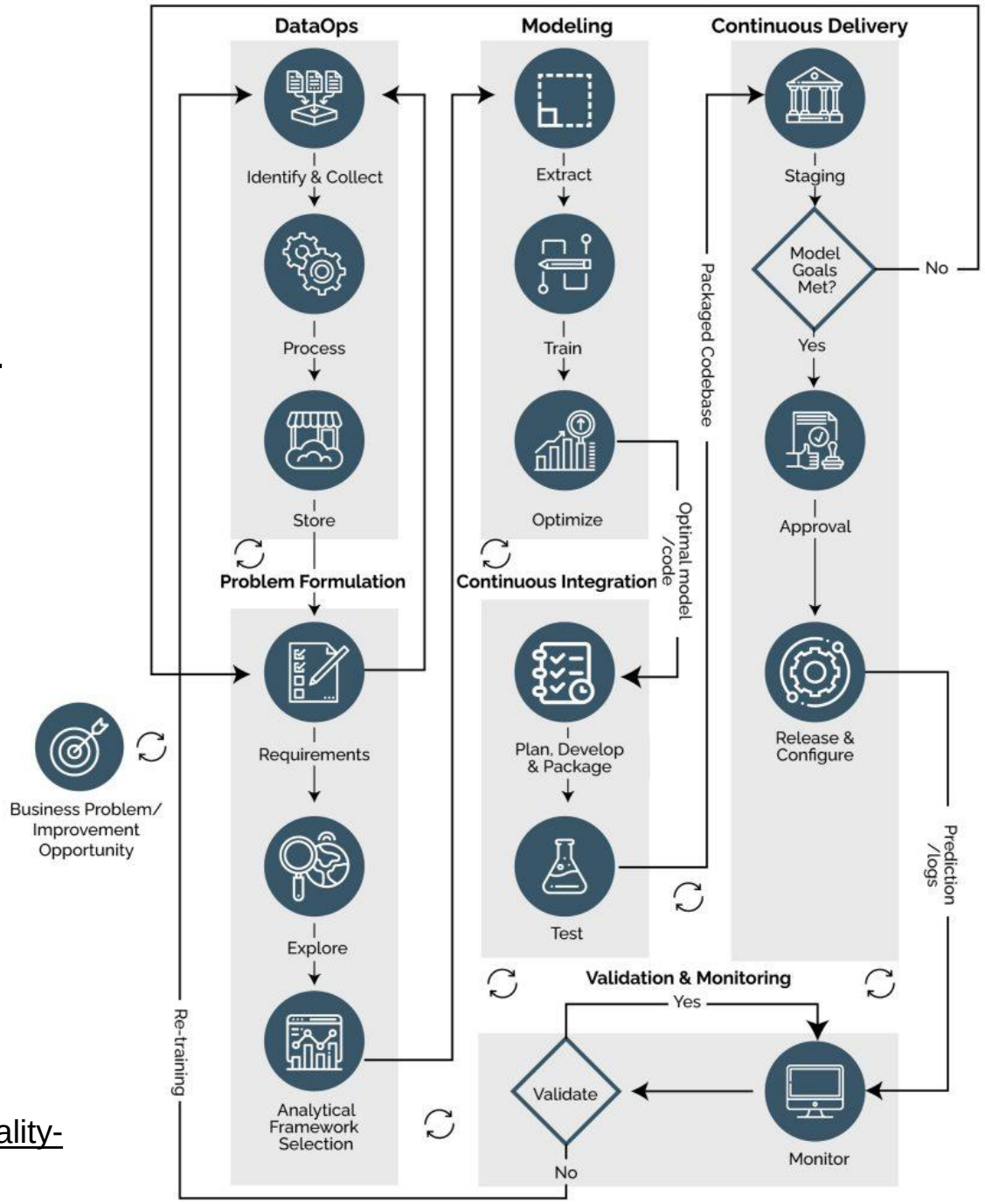
Spectral analysis for insect species classification

- Insect wingbeat signal
- Spectrogram
- Engineer features
- Or analyse as image
- RNN or transformer?



What is MLOps?

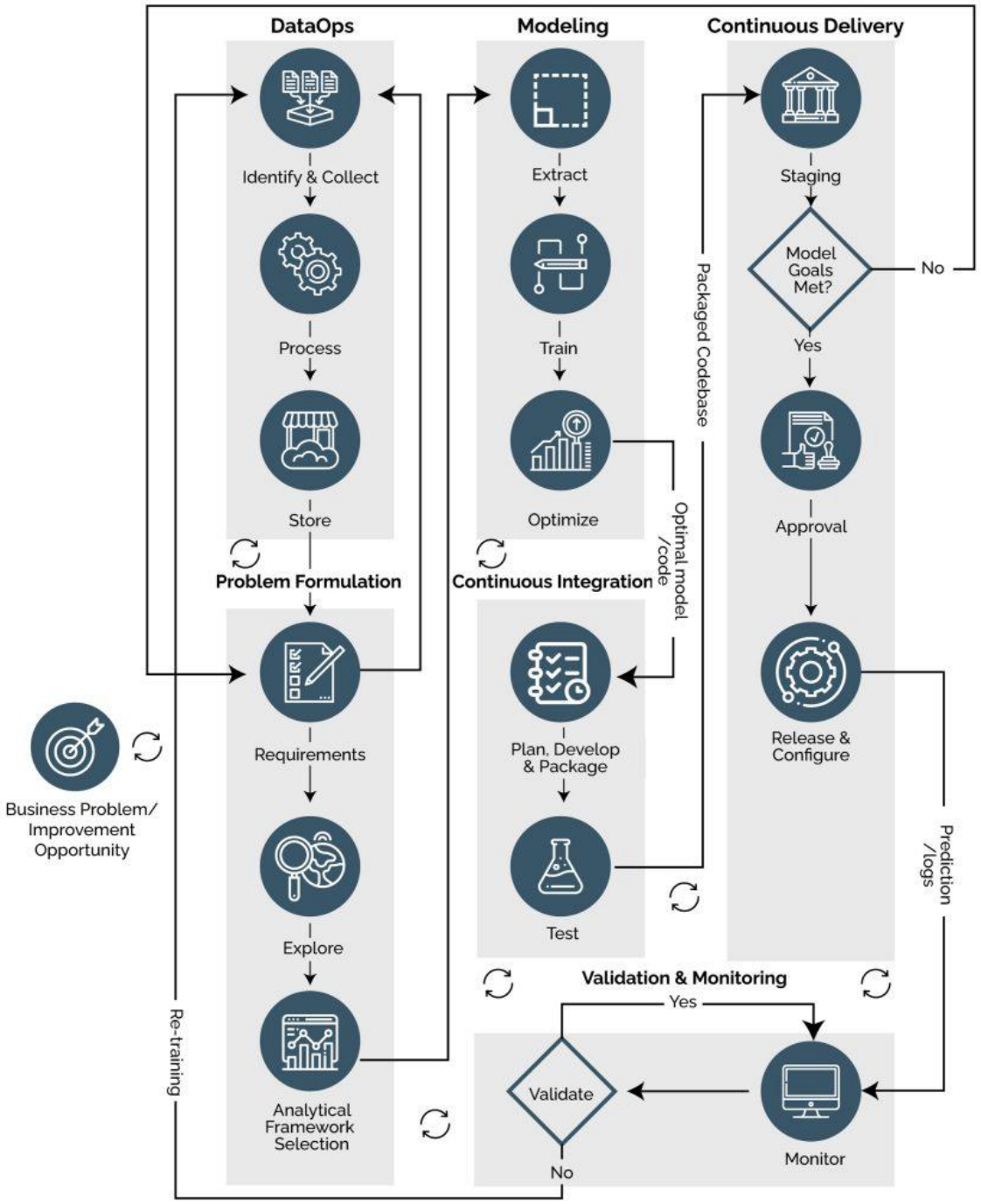
“MLOps is a set of practices that [combines] Machine Learning, DevOps, and Data Engineering practices for a reliable and data-centric approach to Machine Learning systems during production.”



https://radiant.digital/the-fundamentals-of-mlops-the-enabler-of-quality-outcomes-in-production-environments/

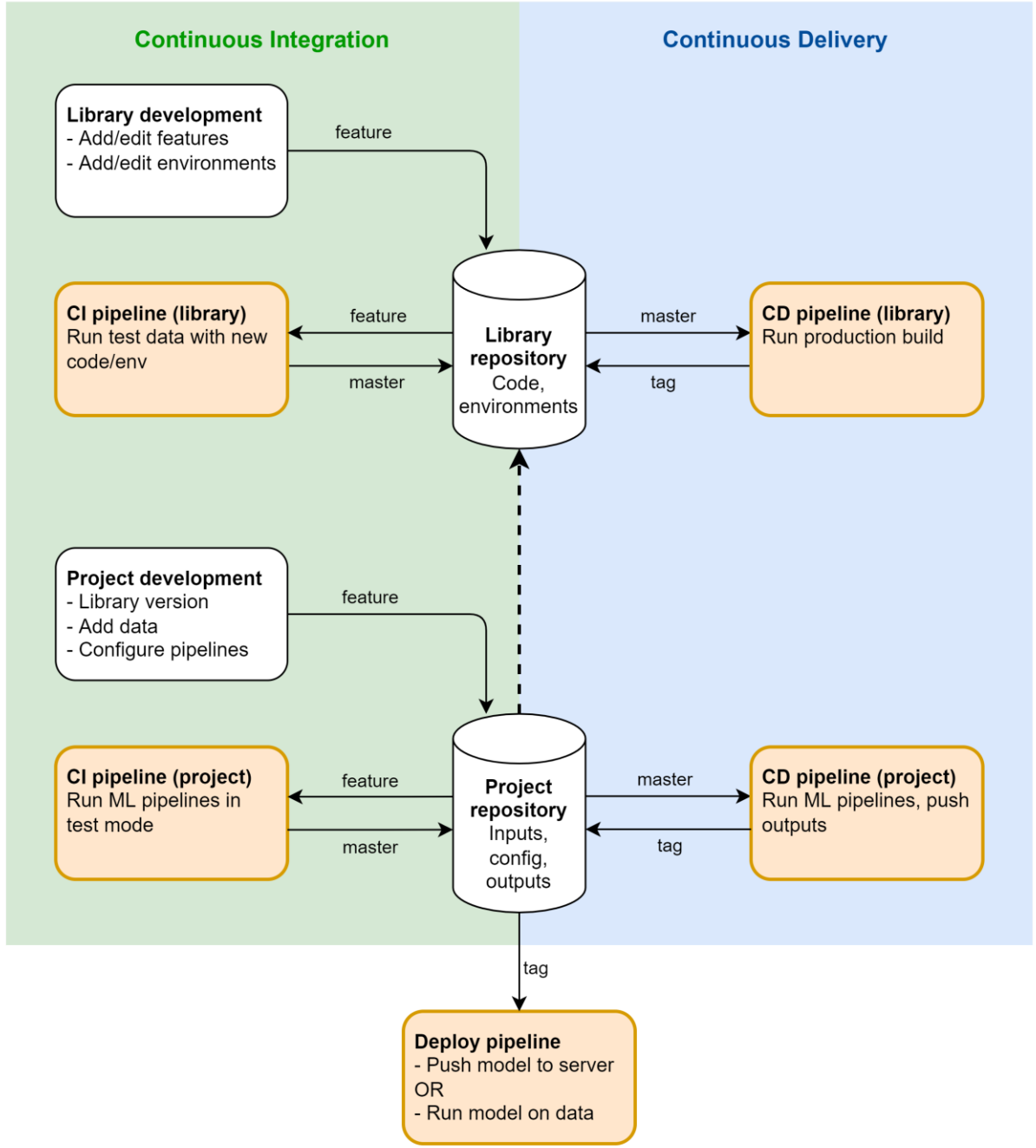
Our MLOps process and stack

- Project templating: Cookiecutter
- Image labelling: Supervisely
- Data storage: DVC (on git)
- Data exploration: Jupyter
- ML pipelines: Nextflow
- CI/CD pipelines: Jenkins
- Model serving: Multi-Model Server



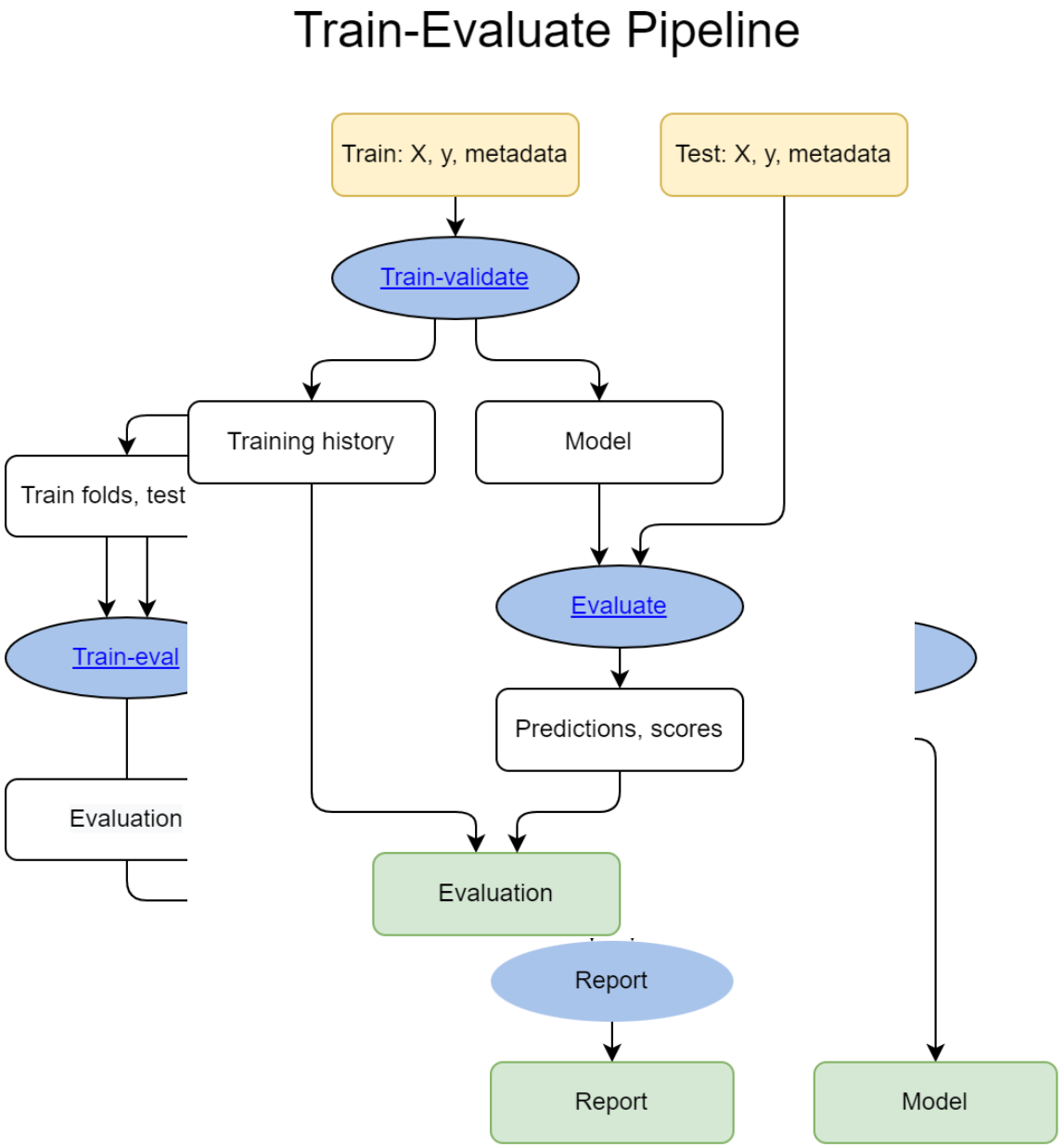
Development process

- Library and project repos
- Develop independently or together
- Development on feature branch
- CI tests and merges to master
- CD tags and produces models
- Deploy pipeline



ML Pipelines

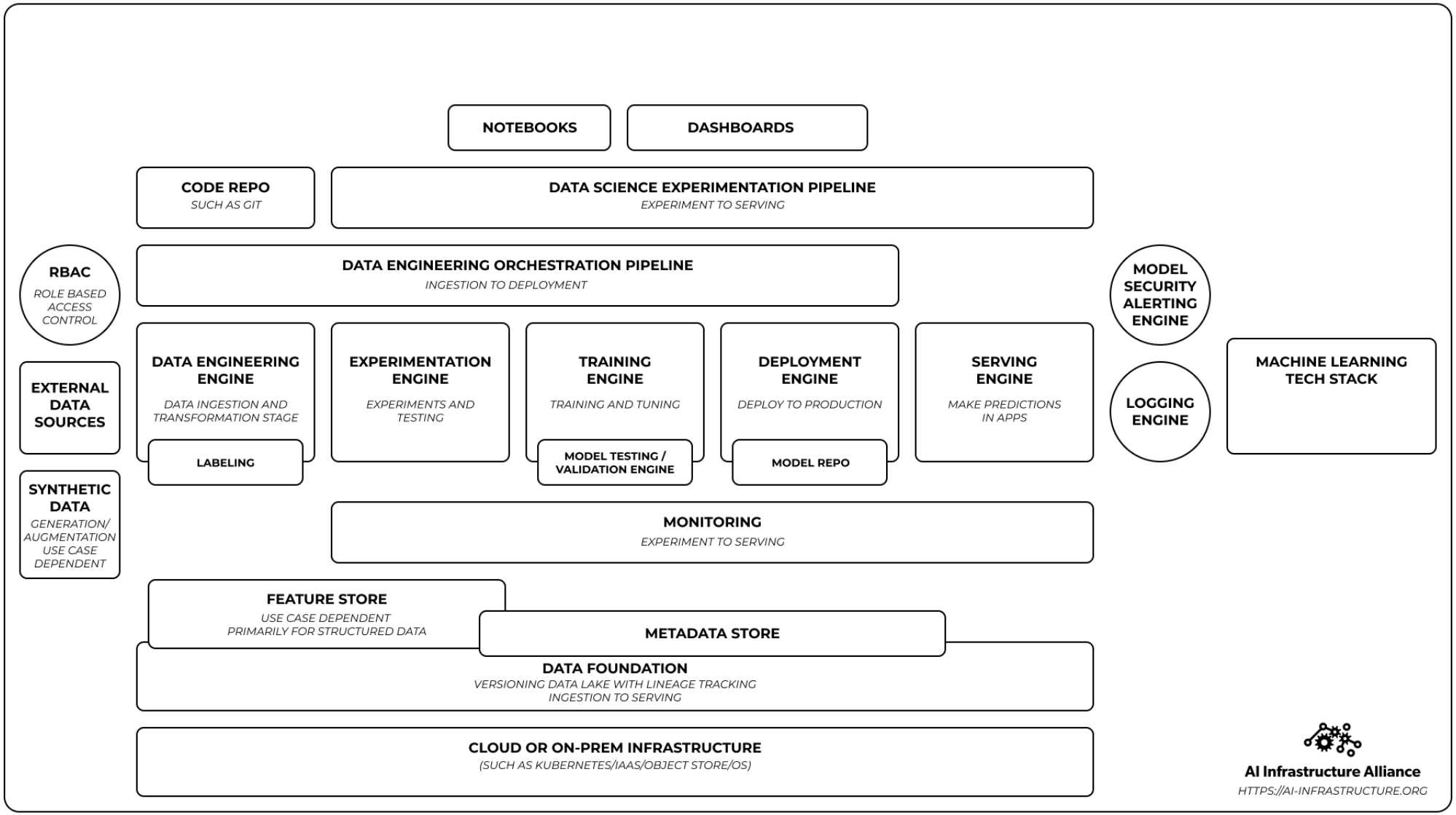
- Nextflow with DSL2
- HPC
- Environments
- Modular, nestable and extensible
- Configure at each level



Gaps and Future Work

- Production monitoring/validation
- Active learning
- Auto ML
- Explainable AI

MLOps Stack



https://opendatascience.com/the-rapid-evolution-of-the-canonical-stack-for-machine-learning/

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Disclaimer

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Thank you

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