Imeka harnesses AI techniques and Nextflow from Seqera to gain insights from brain scans to help select treatments

CUSTOMER

https://imeka.ca/

LOCATION
Sherbrooke, Quebec

INDUSTRY
Biopharmaceutical research

OBJECTIVES
Imeka required scalable automated pipelines for image analysis and GPU-based machine learning algorithms to accelerate analysis and help pharmaceutical companies select optimal treatments.

CHALLENGES

- Support for containerized applications
- Critical requirement for reproducibility
- Large datasets, many parallel compute steps
- Compute-intensive GPU-based workloads

SOLUTION

- Nextflow to manage a containerized workflows
- PyTorch to train predictive models
- Support services from Seqera

RESULTS

- Increased productivity
- Simplified integration
- Regulatory compliance
- Improved quality

Summary

Imeka offers a brain imaging technology platform specializing in microstructure and white matter connectivity. The company needed a scalable solution to automate analysis of diffusion MRI imaging and manage AI-based models to map white matter integrity and understand the central nervous system morphology of patients.

The business

Imeka's technology platform offers pharmaceutical and biotech companies the possibility to reconstruct the brain's fiber network, providing insights into the white matter and the central nervous system, including the spinal cord.

The challenge

Imeka processes diffusion MRI images, representing the diffusion of water molecules along the brain's nerve bundles. To scale processing and analysis, they needed to run these images through pipelines that perform quality checks, main image processing, and statistical processing. They also required a solution that supported Singularity containers and that could easily run on their on-premise compute cluster.

A big part of Imeka's requirement was the need to run compute-intensive machine learning algorithms developed using PyTorch. Model training is performed

on GPUs, and inference jobs are then applied to images of brain scans running on CPUs.

Imeka needed a solution that would allow them to draw pipelines directly from Git repositories and automate pipelines consisting of 50 compute steps with highly parallel processing. They also needed to ensure that pipeline processing was auditable and reproducible to meet regulatory requirements.

The solution

After evaluating multiple workflow tools, Imeka selected Nextflow to run a variety of pipelines for quality checks, image processing, statistical processing, model training, and inference.

Nextflow provided Imeka with the flexibility to easily incorporate containerized analysis steps into their pipelines and run on their existing on-premises cluster comprising GPU nodes.

With Nextflow's native Python support, Imeka was able to quickly incorporate their PyTorch based training models and automate them using Nextflow.
Finally, with responsive services from Seqera Labs, the creators of Nextflow, Imeka was able to implement the solution quickly and easily overcome technical hurdles.

Results

By using Nextflow to power their image processing pipelines, Imeka has realized several advantages:

INCREASED PRODUCTIVITY

By using fast, high-throughput pipelines that maximize parallelism, Imeka has been able to increase their research productivity. Also, the need for manual intervention is minimized saving time and avoiding errors. Nextflow has helped automate the end-to-end analysis process including image processing and analysis, quality checks, statistical processing, and inference.

SIMPLIFIED INTEGRATION

Nextflow's support for existing scripting languages, containers, and its dataflow programming model enabled Imeka to easily adapt existing workflows and containers to the Nextflow environment. Features such as caching and resume functionality simplified pipeline development, by enabling developers to quickly identify and resolve issues without the need to restart long-running analysis pipelines from scratch.

REGULATORY COMPLIANCE

By using Nextflow, and taking advantage of its close integration with GitHub and support for versioned containers, Imeka is able to ensure reproducibility and auditability — critical for meeting strict regulatory requirements.

According to Felix Morency, CTO at Imeka:

"Nextflow elegantly solves problems and addresses the multiple challenges that we faced. We tested a lot of tools to orchestrate and launch containerized pipelines on our cluster. Nextflow just works, and provides reproducibility, which is so important in a regulated industry."

IMPROVED QUALITY

By expressing their workflows in Nextflow, Imeka has been able to automate a variety of processes and gain confidence in the validity of datasets and results. They have also been able to increase the quality of their predictive models by training them on the higher-quality datasets, ultimately resulting in better treatment options for patients .

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