Scientific Computing Successes Beyond the Data Center – In the Field, Around the World, and On the Edge

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Introduction

Innovation in scientific computing capabilities is advancing public health, healthcare, and medical research in the field, around the world, and at the edge

Emerging technology, scientific and IT, and their convergence, have made these new modes of delivery possible

GDIT has been supporting advanced research and scientific computing in the field, around the world, and on the edge for decades.

Our approach infuses scientific insight across all aspects of IT service development to enable innovative solutions which leverage emerging technologies.

This includes ground-breaking work utilizing Artificial Intelligence, Machine Learning, cloud-based technologies, and computational biology.

In the Field

GDIT configured, optimized, and deployed specialized laptops that are used in the field with the MinION, one of the more portable Oxford platforms.

Using these laptops, CDC scientists were able to generate sequences and call bases in real-time, wherever they were deployed

- MinION, The first portable, simple, reliable, and cost-effective field sequencer
- Costs less than $500 for 50 gigabases of sequences
- It is a MinION and not a Minion

Innovations: GPU Accelerated Algorithms, Real-time Basecalling, Short Sample Preparation, Field-Deployable

Minion

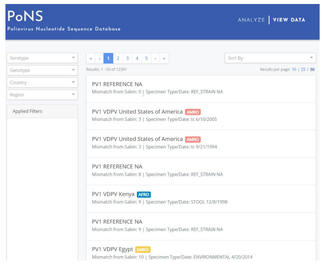
MinION

1st Generation MinION

MinION Mk1C

Around the World

GDIT developed the Poliovirus Nucleotide Sequence application for global surveillance of the Poliovirus using sequence data. CDC stakeholders as well as external partners including the World Health Organization leverage the system in support of the Global Polio Eradication Initiative.



Components: Integrated Demographic and Sequence Data, Sequence Alignment, Phylogenetics, API Gateway, Secure Access

GDIT developed of the National Cancer Institute's Cancer Genomics Cloud Resources to facilitates data sharing and scalable analysis of millions of data points from thousands of cancer patients. Users can leverage predeveloped tools and data or bring their own for integration with centrally managed resources.

Components: 3 PB PHI Data, BigQuery, AI Machine Learning, Large-Scale Compute, Advanced Analytics

On the Edge

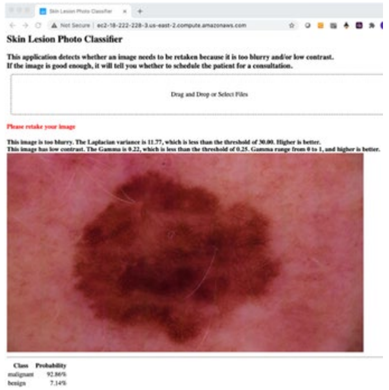
GDIT developed a mobile application with a cloud-based artificial intelligence classifier to identify malignant skin lesions based on photographic images for the Veterans Administration Artificial Intelligence Institute's AI Tech Sprint

Veterans can self-check to accelerate the time to an appointment and greatly speed up treatment times to greatly improve health outcomes

Our AI-based deep-learning application accurately detects the presence of malignant skin lesions with 92% accuracy

Methods: Telehealth, AI, Deep learning, Transfer Learning, Interpretability, Data Augmentation, Clinical Validity, Malignancy/Benign Prediction

Tools: Captum Framework, PyTorch, ResNext50 and Densenet161 Algorithms



Conclusions

The world is changing: New models of delivery are required to keep pace with the increased distributed nature of public health, healthcare, and medical research.

Integration and convergence of scientific and IT innovations are critical to enabling these new models.

Our examples are enabled by one common principle: Leading with the business need as opposed to throwing technology at a problem and hoping it sticks.

By focusing on the scientific requirements and objectives, we deliver innovative solutions using the most appropriate technology and approach to solve real-world problems in the field, around the world, and on the edge.

GENERAL DYNAMICS
Information Technology