Google Cloud Medical Imaging Suite Overview

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Google Cloud Medical Imaging Suite

Google Cloud

Agenda

- Re-cap of last CWIG Webinar (101422)
- Introduction to the Google Cloud Medical Imaging Suite
- Case Study: Image Data Commons
- Overview: Medical Imaging Lab

Google Cloud

Re-cap of Last NCI CWIG Webinar 10/14/22

- **Mike Callaghan** provided an overview of Alphabet and Google Cloud
- **David Belardo** provided an overview of Google Cloud Capabilities
  - Includes Introduction to HealthCare API and Medical Imaging Suite
- **Philip Meacham** provided and overview of the STRIDES Program
  - The next 4 slides were taken from Philip's presentation

source:Philip Meacham - NIH CWIG 10/14/22

NIH STRIDES Initiative

Science and Technology Research Infrastructure for Discovery, Experimentation, and Sustainability (STRIDES)

Serving **both the NIH Intramural and extramural research communities**, the STRIDES Initiative accelerates biomedical research in the cloud by simplifying access, reducing costs, lowering technological barriers, and improving processes.

Core motivations for STRIDES include:

- Democratization of computational research and data science:
  - Leveling the playing field for those traditionally underrepresented in biomedical research
- Cost savings and efficiencies for the research community at large:
  - More usage begets more savings and greater overall discounts for all
- Strong partnerships with cloud providers:
  - Resulting in collaborative R&D engagements and more direct focus and support on research

Partnerships with aws Google Cloud Microsoft Azure

source:Philip Meacham - NIH CWIG 10/14/22

NIH Cloud Lab

NIH Cloud Lab is a no-cost, 90-day pilot program that **enables NIH researchers to try commercial cloud services** in a NIH-approved environment. Trainings and guardrails are provided to protect against financial and security risks.
Let us know you're interested at: cloud.nih.gov/resources/cloudlab

Exploring the Cloud Consoles with Full Access

Researchers can gain an understanding of the look and feel of cloud environments before they jump into a full STRIDES account for research. Examples of actions include:

- Deploy a full range of resources
- CPU or GPU VMs
- Managed Jupyter notebooks
- Advanced AI/ML capabilities
- Bioinformatic workflow managers
- Access to compute clusters

Supplementing Cloud Training with Biomedical Tutorials

Researchers can use the sandbox to strengthen their understanding of cloud training or follow along with training content in a separate environment. Examples of included tutorials (with more being added) are:

- Variant Calling
- GWAS
- Medical Imaging
- RNA seq
- Single Cell RNA seq
- Proteomics
- Using HPC environments in the cloud

Experimenting with Simple Cloud Solutions

Researchers interested in solutions for specific scientific tasks can use the sandbox to build proof of concept or other simple solutions to understand LOE and other details for production.

Benchmarking Costs

Testing out different tools and configurations (instance types, sizes, etc.) to optimize research analyses

source:Philip Meacham - NIH CWIG 10/14/22

STRIDES Training

- Course offerings range from fundamentals, to research support to technical topics
- Custom courses with content and examples specific to biomedical research, meant to address researcher needs and challenges

Contact the STRIDES Training Team at: STRIDESTraining@nih.gov

Visit the STRIDES Training website at: cloud.nih.gov/training

Upcoming GCP Courses

- 10/20: GCP Fundamentals – Big Data & ML
- 11/2: Introduction to Biomedical Data Science in Google Cloud (Custom)
- 11/16: Data Driven Transformation with Google Cloud
- 12/2: Getting Started with Terraform for Google Cloud
- 12/12: Introduction to Biomedical Data Science in Google Cloud (Custom)
- 12/16: Governance and Cost Optimization for Google Cloud Projects

View the **STRIDES Training calendar** for all upcoming trainings with all CSPs: cloud.nih.gov/training/calendar

source:Philip Meacham - NIH CWIG 10/14/22

CRDC Radiogenomics: Machine Learning Research in the Cloud

Goal: Use deep learning and radiomics to predict mutation status of gliomas from pre-operative MRI scans.

> The days when a researcher could download data to the computer under their desk are rapidly fading. The NCI Imaging Data Commons, with its connections to the other data types (genomics, proteomics, clinical) in the Cancer Research Data Commons, provides an **efficient means to solve important multimodal AI problems using cloud-scale resources** that will advance biomedical science and the care of patients.
>
> –**Bradley Erickson**, MD, PhD, Professor of Radiology and Medical Director of AI at Mayo Clinic

IDC
- Imaging Data Commons (IDC)
- Cohort exploration
- Imaging data preparation and QA

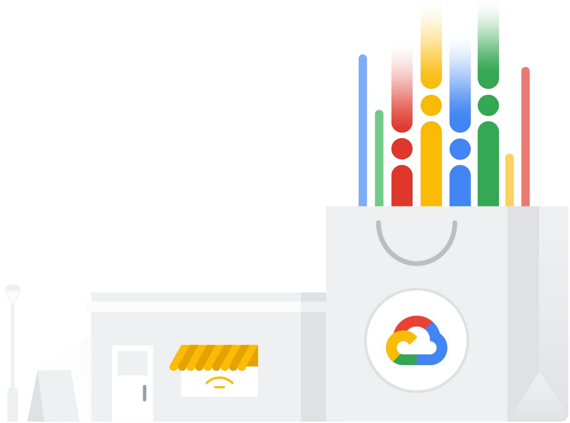
GDC
- Genomics Data Commons (GDC)
- Obtain mutation status
- Obtain demographics

GCP
- Google Cloud Platform (GCP)
- Match imaging & genomic data
- ML model development & evaluation

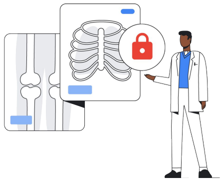
Slide courtesy of Conte and Erickson (Mayo Clinic)

Google Cloud

Introduction to Google Cloud Medical Imaging Suite



Common pain points in delivering AI in Medical Imaging

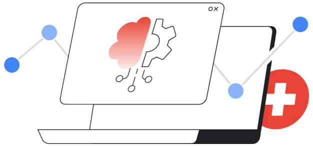


Interoperability of imaging data

Imaging data can be large, inconsistent, and often resides in silos on premises and in disparate healthcare data systems.

Imaging analysis and annotation

Preparing images and datasets for AI model training is typically highly manual, time-consuming, and costly.



Scalable AI/ML models

Developing accurate, reusable ML models can be difficult due to limited access to quality training data and lack of quality model development tools.

DICOM® — Digital Imaging and Communications in Medicine

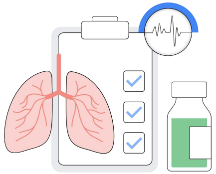
Google Cloud's Medical Imaging Suite helps organizations realize the potential of AI by making imaging data accessible, interoperable and useful

Accelerates imaging diagnostics with interoperability

Use the same tools that power Google to reduce time & resources to deliver scalable AI/ML.

AI enables faster diagnosis and helps increase productivity

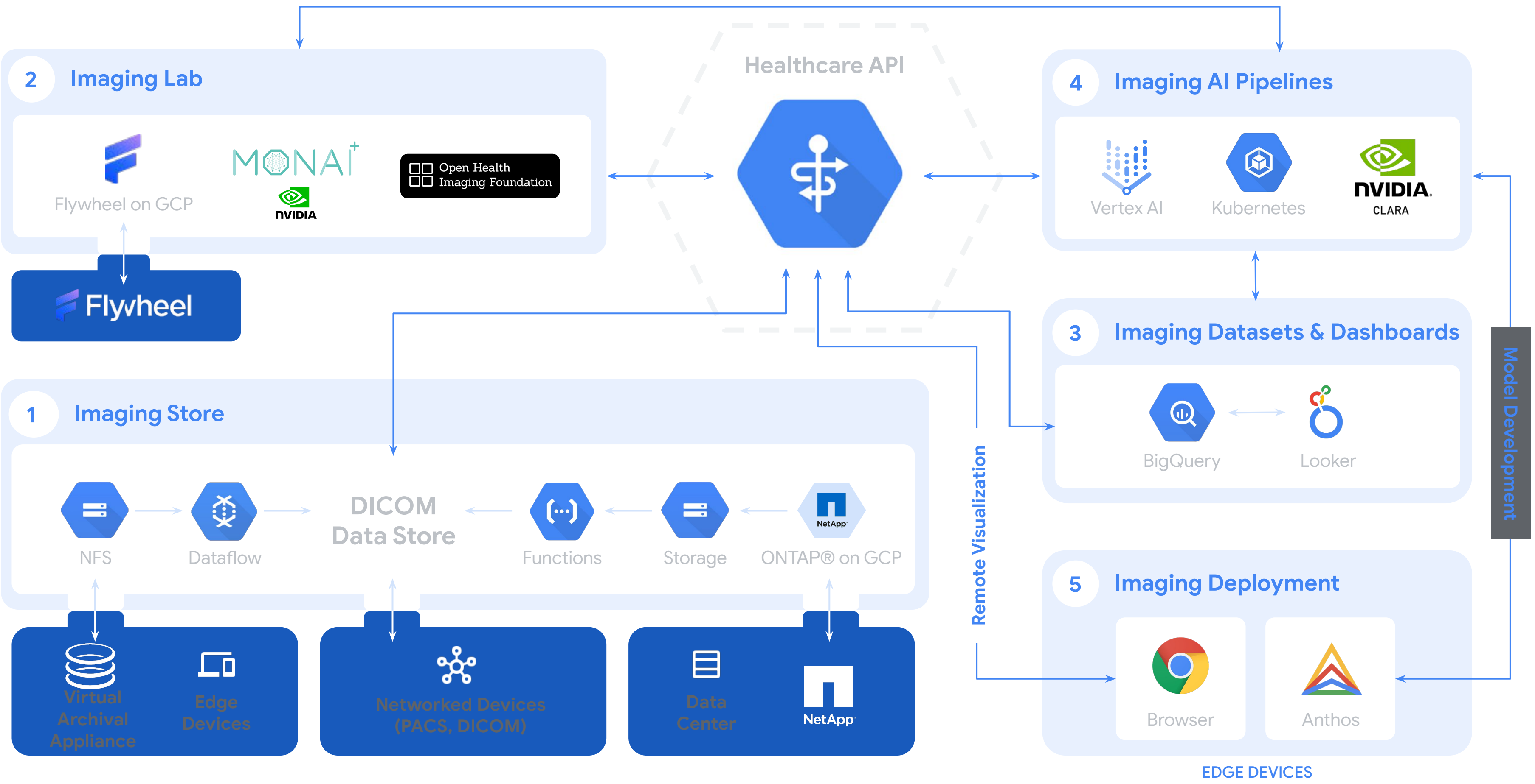
Better imaging interoperability can help speed up diagnoses, alleviate physician burnout, and increase efficiency of care delivery.



Helps improve access to better patient care & outcomes

Transform disease detection and diagnosis by prioritizing critical cases, augmenting treatment decisions, or expanding screenings in areas where there are shortages of doctors.

Google Cloud Medical Imaging Suite: Reference Architecture



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Medical Imaging Case Study: Image Data Commons (IDC)

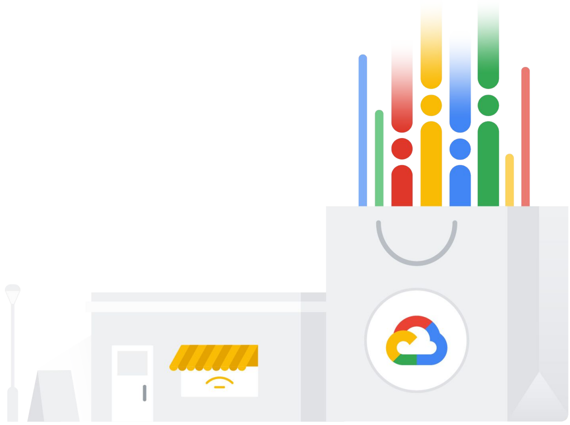


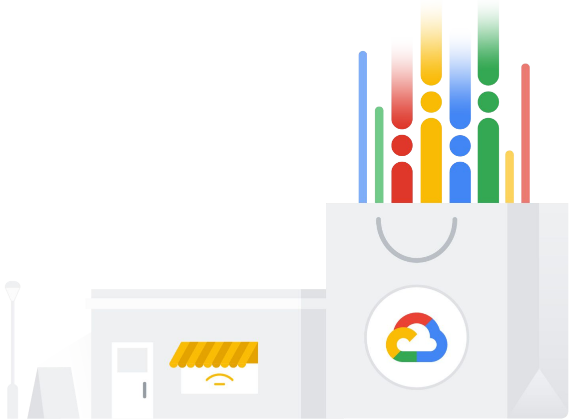
Image Data Commons Case Study

- Organizing Medical Imaging Data With DICOM
- Exploring different Medical Image Viewers
- Exploring Medical Image Metadata
- Access Images and Metadata using the Google Cloud Public Datasets
- BigQuery Tables and Views
- Data Studio Dashboards
- Browsing the Documentation and Notebooks

https://portal.imaging.datacommons.cancer.gov/

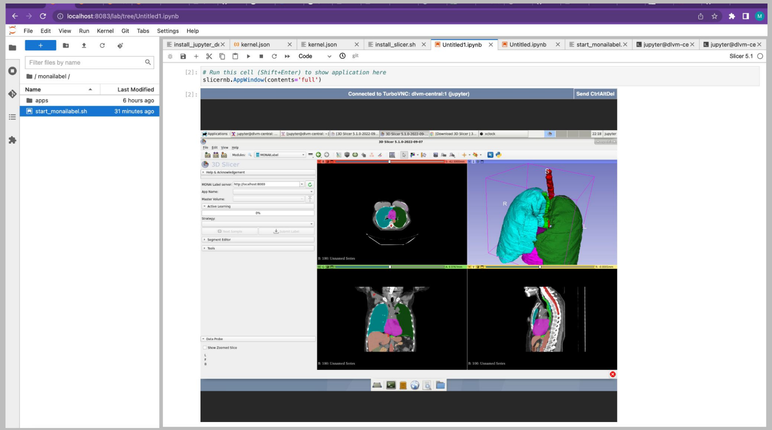
Google Cloud

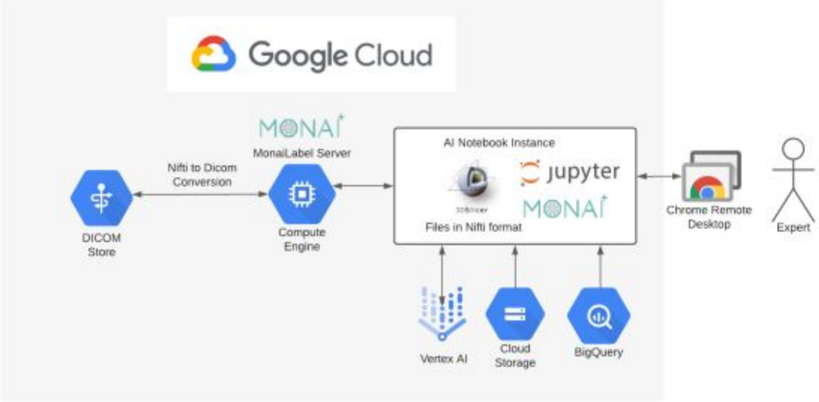
Google Cloud Medical Imaging Lab



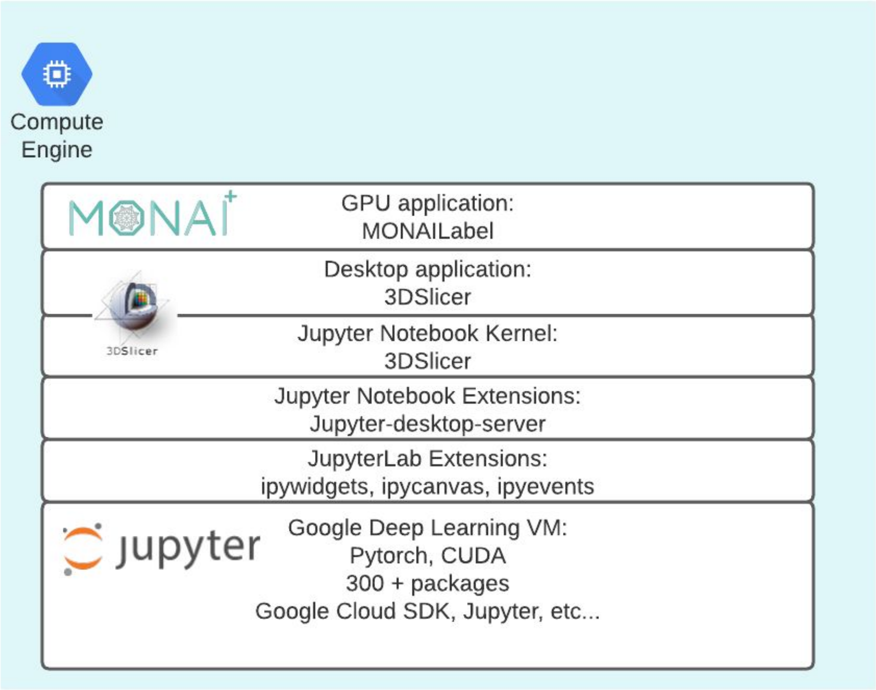
Medical Imaging Suite - Imaging Lab

AI assisted labeling and annotation to automate repetitive tasks

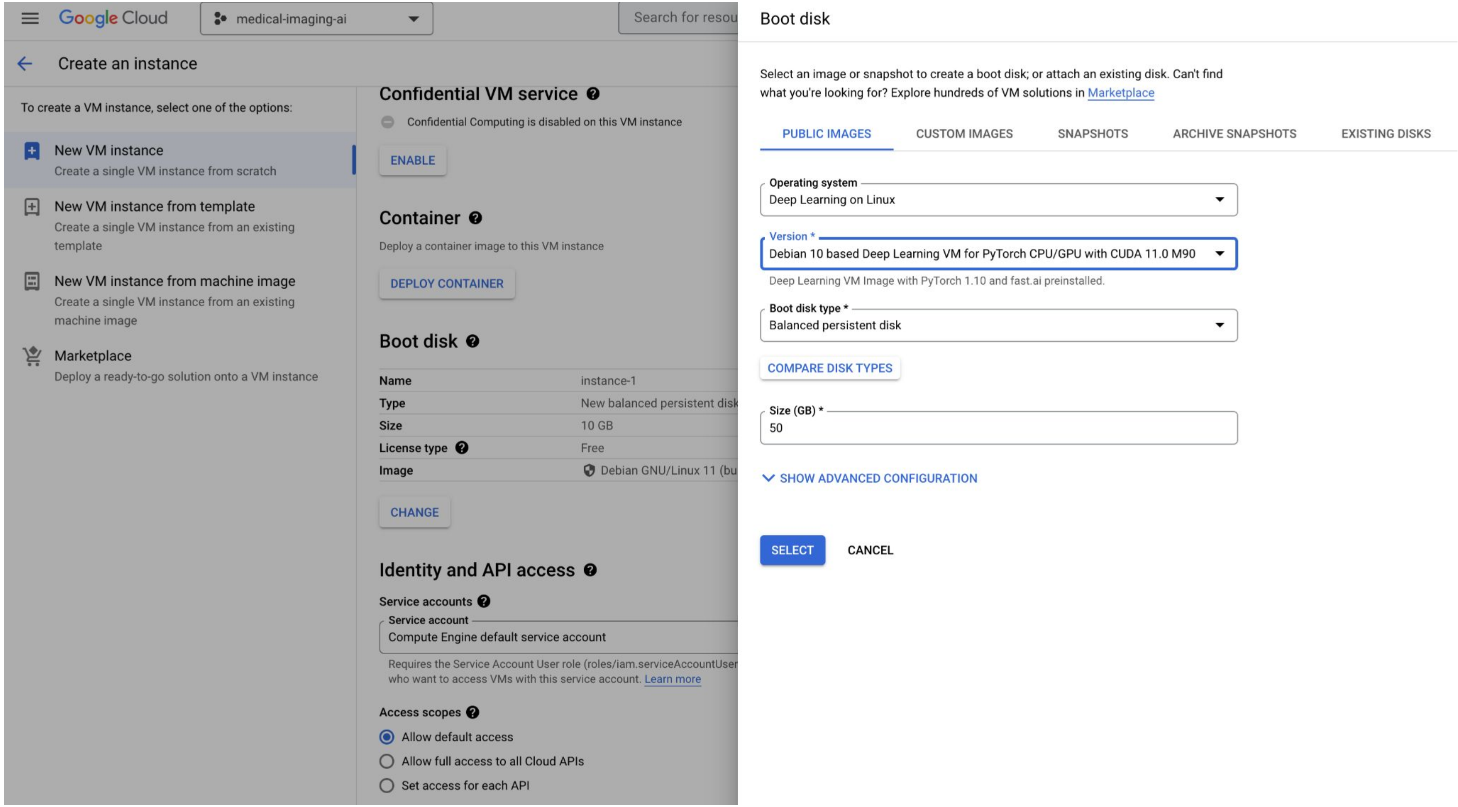




The Medical Imaging Lab: an extension of the Google Cloud Deep Learning VM



Creating a Deep Learning VM



Deep Learning VM M90 Packages (“a” to “l”) – 336 packages in total

Image name: pytorch-1-10-cu110-1645953106-clean
packages in environment at /opt/conda:
#
Name Version Build Channel
_libgcc_mutex 0.1 conda_forge conda-forge
_openmp_mutex 4.5 1_llvm conda-forge
aiohttp 3.8.1 py37h5e8e339_0 conda-forge
aiosignal 1.2.0 pyhd8ed1ab_0 conda-forge
ansiwrap 0.8.4 py_0 conda-forge
anyio 3.5.0 py37h89c1867_0 conda-forge
appdirs 1.4.4 pyh9f0ad1d_0 conda-forge
argon2-cffi 21.3.0 pyhd8ed1ab_0 conda-forge
argon2-cffi-bindings 21.2.0 py37h5e8e339_1 conda-forge
arrow 1.2.2 pyhd8ed1ab_0 conda-forge
asn1crypto 1.4.0 pyh9f0ad1d_0 conda-forge
async-timeout 4.0.2 pyhd8ed1ab_0 conda-forge
asynctest 0.13.0 py_0 conda-forge
attrs 21.4.0 pyhd8ed1ab_0 conda-forge
babel 2.9.1 pyh44b312d_0 conda-forge
backcall 0.2.0 pyh9f0ad1d_0 conda-forge
backports 1.0 py_2 conda-forge
backports.functools_lru_cache 1.6.4 pyhd8ed1ab_0 conda-forge
beatrix-jupyterlab 3.1.7 pypi_0 pypi
binaryornot 0.4.4 py_1 conda-forge
black 22.1.0 pyhd8ed1ab_0 conda-forge
blas 2.113 mkl conda-forge
blas-devel 3.9.0 13_linux64_mkl conda-forge
bleach 4.1.0 pyhd8ed1ab_0 conda-forge
blinker 1.4 py_1 conda-forge
bottleneck 1.3.4 py37h6c7ee08_0 conda-forge
brotli 1.0.9 h7f98852_6 conda-forge
brotli-bin 1.0.9 h7f98852_6 conda-forge
brotlipy 0.7.0 py37h27cfd23_1003
c-ares 1.18.1 h7f98852_0 conda-forge
ca-certificates 2021.10.8 ha878542_0 conda-forge
cachetools 5.0.0 pyhd8ed1ab_0 conda-forge
catalogue 2.0.6 pypi_0 pypi
certifi 2021.10.8 py37h89c1867_1 conda-forge
cffi 1.15.0 py37h036bc23_0 conda-forge
chardet 4.0.0 py37h06a4308_1003
charset-normalizer 2.0.12 pyhd8ed1ab_0 conda-forge
click 8.0.4 py37h89c1867_0 conda-forge
cloudpickle 2.0.0 pyhd8ed1ab_0 conda-forge
colorama 0.4.4 pyh9f0ad1d_0 conda-forge
conda 4.11.0 py37h89c1867_0 conda-forge
conda-package-handling 1.7.3 py37h27cfd23_1

conda 4.11.0 py37h89c1867_0 conda-forge
conda-package-handling 1.7.3 py37h27cfd23_1
confuse 1.7.0 pyhd8ed1ab_0 conda-forge
cookiecutter 1.7.3 pyh6c4a22f_1 conda-forge
cryptography 36.0.1 py37hf1a17b8_0 conda-forge
cudatoolkit 11.1.1 h6406543_10 conda-forge
cycler 0.11.0 pyhd8ed1ab_0 conda-forge
cymem 2.0.6 pypi_0 pypi
dataclasses 0.8 pyhc8e2a94_3 conda-forge
debugpy 1.5.1 py37hcd2ae1e_0 conda-forge
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docker-pycreds 0.4.0 py_0 conda-forge
entrypoints 0.4 pyhd8ed1ab_0 conda-forge
fastai 2.5.3 pypi_0 pypi
fastcore 1.3.29 pypi_0 pypi
fastdownload 0.0.5 pypi_0 pypi
fastprogress 1.0.2 pypi_0 pypi
flit-core 3.7.1 pyhd8ed1ab_0 conda-forge
fonttools 4.29.1 py37h5e8e339_0 conda-forge
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frozenlist 1.3.0 py37h5e8e339_0 conda-forge
fsspec 2022.2.0 pyhd8ed1ab_0 conda-forge
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google-api-core 2.5.0 pyhd8ed1ab_0 conda-forge
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google-api-python-client 2.38.0 pyhd8ed1ab_0 conda-forge
google-auth 2.6.0 pyh6c4a22f_1 conda-forge
google-auth-httplib2 0.1.0 pyhd8ed1ab_0 conda-forge
google-auth-oauthlib 0.4.6 pyhd8ed1ab_0 conda-forge
google-cloud-aiplatform 1.10.0 pypi_0 pypi
google-cloud-appengine-logging 1.1.0 pypi_0 pypi
google-cloud-audit-log 0.2.0 pypi_0 pypi
google-cloud-bigquery 2.34.0 pypi_0 pypi
google-cloud-bigquery-storage 2.12.0 pypi_0 pypi
google-cloud-bigtable 2.5.2 pypi_0 pypi
google-cloud-core 2.2.2 pyh6c4a22f_0 conda-forge
google-cloud-dataproc 3.3.0 pypi_0 pypi
google-cloud-datastore 2.4.0 pypi_0 pypi
google-cloud-firestore 2.3.4 pypi_0 pypi

google-cloud-firestore 2.3.4 pypi_0 pypi
google-cloud-kms 2.11.0 pypi_0 pypi
google-cloud-language 2.3.2 pypi_0 pypi
google-cloud-logging 3.0.0 pypi_0 pypi
google-cloud-monitoring 2.8.0 pypi_0 pypi
google-cloud-pubsub 1.7.0 pypi_0 pypi
google-cloud-scheduler 2.6.0 pypi_0 pypi
google-cloud-spanner 3.13.0 pypi_0 pypi
google-cloud-speech 2.12.0 pypi_0 pypi
google-cloud-storage 1.44.0 pypi_0 pypi
google-cloud-tasks 2.8.0 pypi_0 pypi
google-cloud-translate 3.7.0 pypi_0 pypi
google-cloud-videointelligence 2.6.0 pypi_0 pypi
google-cloud-vision 2.6.3 pypi_0 pypi
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google-resumable-media 2.1.0 pyh6c4a22f_0 conda-forge
googleapis-common-protos 1.54.0 py37h89c1867_0 conda-forge
greenlet 1.1.2 py37hcd2ae1e_1 conda-forge
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importlib-metadata 4.11.1 py37h89c1867_0 conda-forge
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ipywidgets 7.6.5 pyhd8ed1ab_0 conda-forge
jbig 2.1 h7f98852_2003 conda-forge
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jeepney 0.7.1 pypi_0 pypi
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jinja2-time 0.2.0 py_2 conda-forge
joblib 1.1.0 pyhd8ed1ab_0 conda-forge
jpeg 9e h7f98852_0 conda-forge
json5 0.9.5 pyh9f0ad1d_0 conda-forge
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langcodes 3.3.0 pypi_0 pypi
lcms2 2.12 hddcbb42_0 conda-forge
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libsodium 1.0.18 h36c2ea0_1 conda-forge
libstdcxx-ng 11.2.0 he4da1e4_12 conda-forge
libtiff 4.3.0 h542a066_3 conda-forge
libuv 1.42.0 h7f98852_0 conda-forge
libwebp 1.2.2 h3452ae3_0 conda-forge
libwebp-base 1.2.2 h7f98852_1 conda-forge
libxcb 1.13 h7f98852_1004 conda-forge
libzlib 1.2.11 h36c2ea0_1013 conda-forge

Compatible with Other Google Notebook Environments

colab

kaggle

Medical Imaging Lab Demonstration

- Interactive Python Widgets
- 3DSlicer Notebooks and 3DSlicer Kernel
- Jupyter Desktop
- Loading data from the IDC into Health Care API DICOM Store
- Using the MONAILabel Plugin for 3DSlicer
  - Loading IDC data into the DICOM Store
  - Using Active Learning
  - Using AI Assisted Annotation
  - Saving Annotations to the DICOM Store
- Using Dynamic Dashboards
- Inspecting Annotated Images with OHIF
- Inspecting Annotated images using the DICOM Browser plugin for 3DSlicer

Q&A

Google Cloud