
AWS
re:Invent

WPS209

Reinventing medical imaging with machine learning on AWS

Prof. Bram van Ginneken

Professor of Medical Image Analysis
Radboud University Medical Center,
The Netherlands

Dr. Razvan Ionasec

Technical Leader for Healthcare, EMEA
AWS

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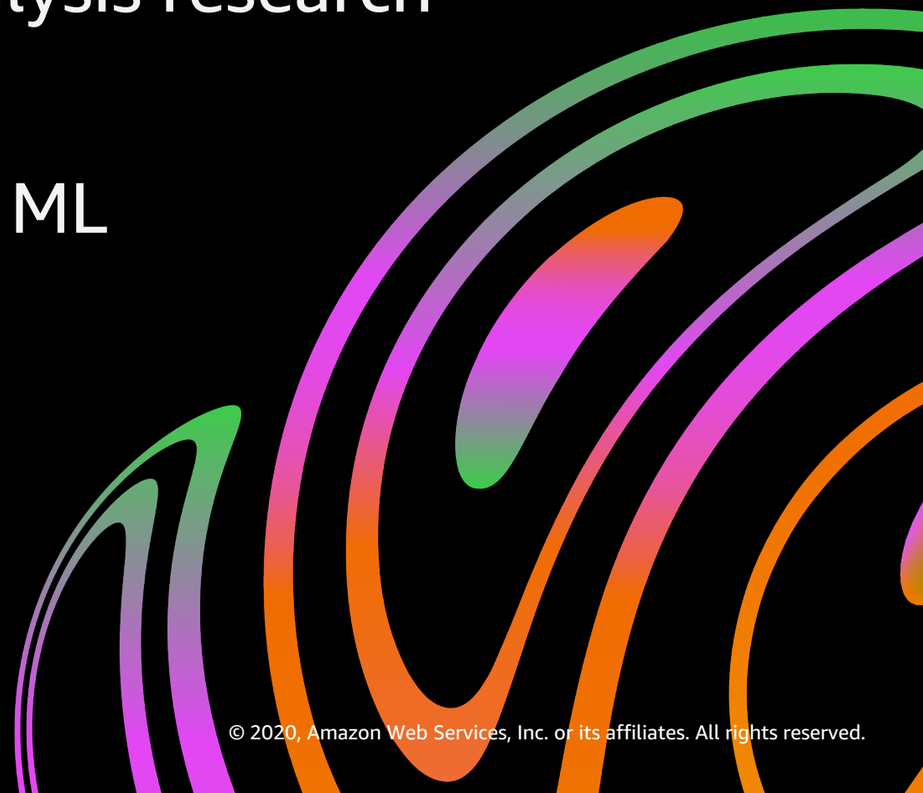
Agenda

Customer challenges and benefits with AWS cloud

Grand-Challenge.org, a global machine learning imaging platform

How to build a machine learning (ML) image analysis research environment with AWS?

How to run enterprise imaging in the cloud with ML and analytics capabilities?



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What are the customer challenges and business goals?

Shift to value-based care

54%

Percentage of hospital CEOs who say the transition from volume to value is their biggest financial challenge

Transformation from reading images towards an information business

Increasing volume of digital data

163ZB

Amount of data that will be generated globally in 2025. 10 times the 16.1 ZB of data generated in 2016

Cost savings in infrastructure and operations

Limited supply of radiologists

16.6%

Raise in error rates with 50% reduction in interpretation time

Physician burnout due manual processes that do not scale

Continuous technology advances

18 months

Rate at which computer processing power doubles, according to Moore's law

Skill gap and slow adoption of new technologies

Sophisticated security breaches

1 per day

Rate of security breaches (ransomware and hacking) in 2016 across healthcare organizations

Manage security and compliance risks while increasing agility

Sources: 2016 American College of Healthcare Executives Annual Survey; Moore's law; IDC Forecast, April 2017; Breach Barometer Report: Mid-Year 2017, by Protenus, Inc.; Berlin L: Faster Reporting Speed and Interpretation Errors: conjecture, evidence, and malpractice implications

How to reach the business goals with AWS?

Shift to value-based care

54%

Percentage of hospital CEOs who say the transition from volume to value is their biggest financial challenge

Transformation from reading images towards an information business

Scalable microservices architecture, faster cycles, and data analytics

Increasing volume of digital data

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Cost savings in infrastructure and operations

Hyper-scale storage with cost optimized life cycle

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Integrated Machine Learning pipelines from bench to bed

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Skill gap and slow adoption of new technologies

Highly available infrastructure with zero footprint apps

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Manage security and compliance risks while increasing agility

Global exchange with automated security and compliance

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Grand Challenge

grand-challenge.org

Grand Challenge Archives Reader Studies Challenges Algorithms Products

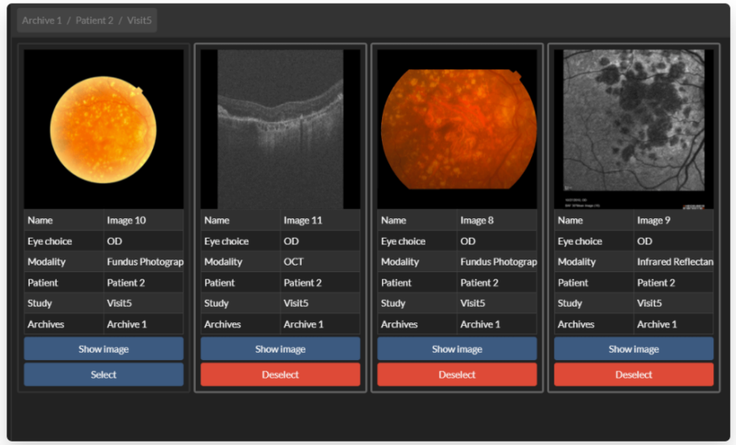
Grand Challenge

A platform for end-to-end development of machine learning solutions in biomedical imaging.

Manage Your Data

- Upload medical imaging data easily and securely
- Control who has access to the data
- View data with our globally available browser-based workstations

View Archives



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From challenges to an integrated, global machine learning infrastructure



IMAGE DATA COLLECTION



DATA ANNOTATION



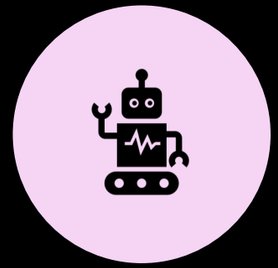
READER STUDIES



ALGORITHM DEVELOPMENT



VIEW ALGORITHM RESULTS



RE-USE ALGORITHMS



PRODUCTS

COVID-19 pandemic: role of imaging

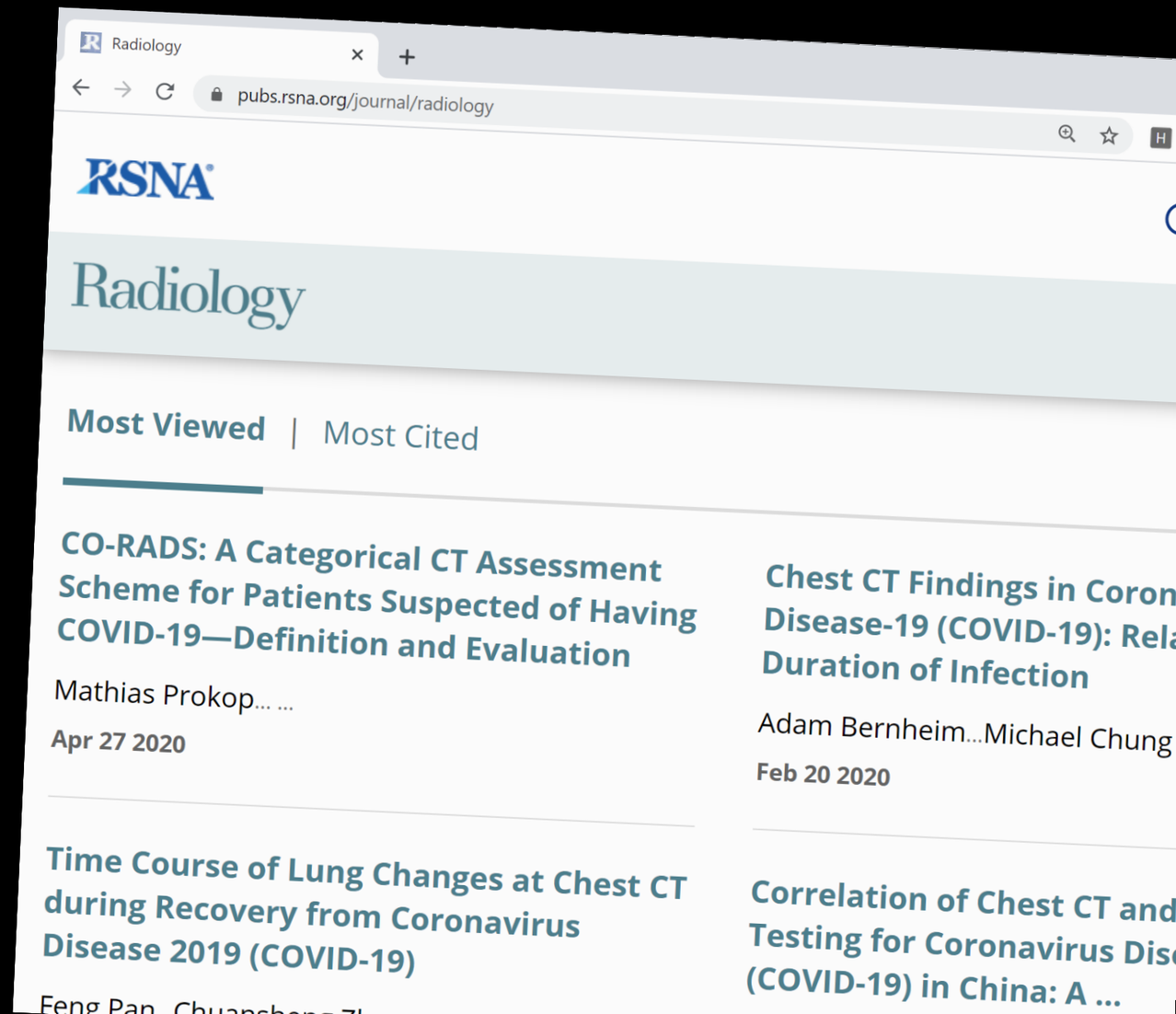
CT imaging helpful for

- working diagnosis while waiting for PCR result
- diagnosis when PCR-/symptom+
- assessing severity of disease

How to report on CT scans

CO-RADS score: 1–5

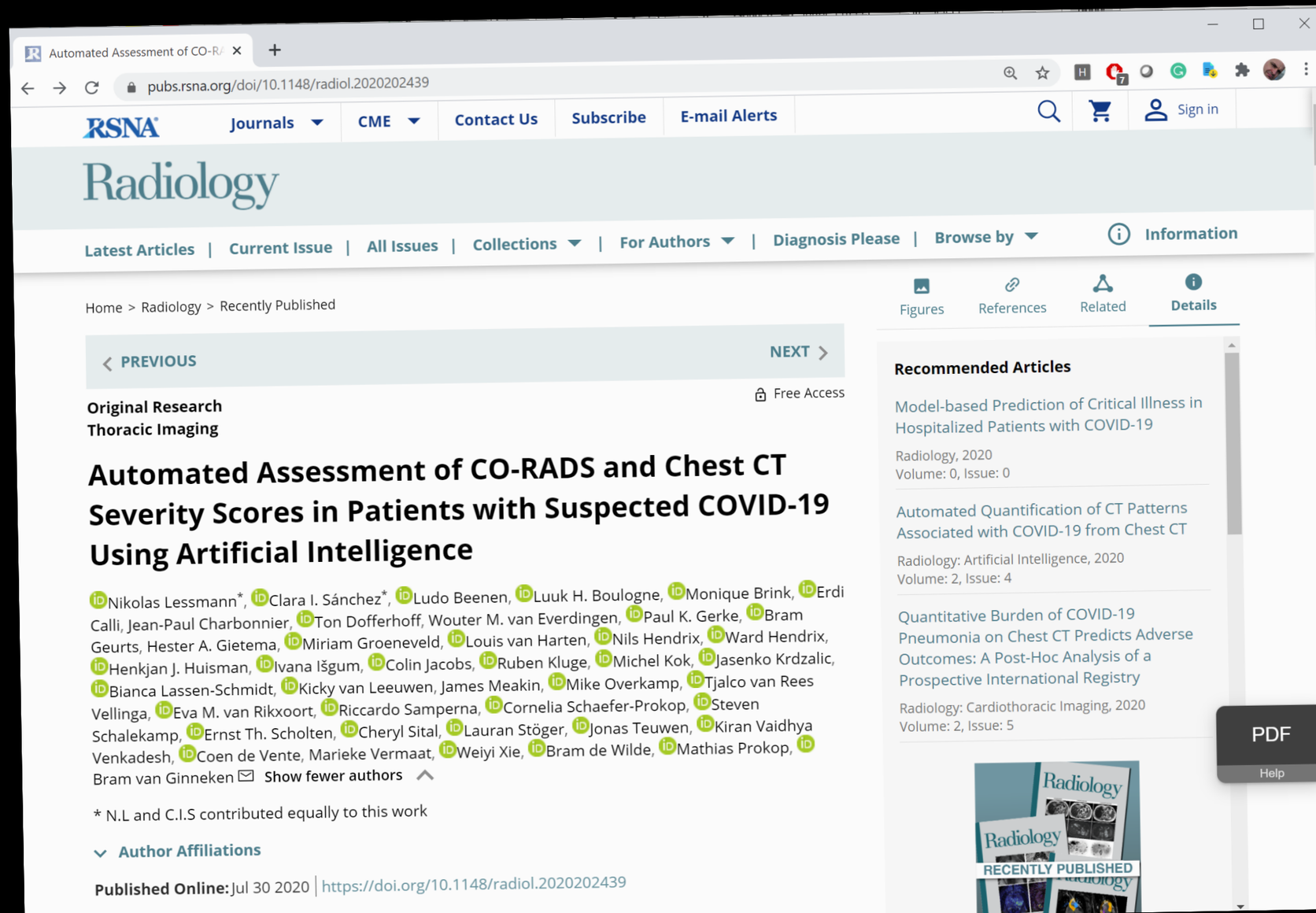
CT Severity Score: 0–25



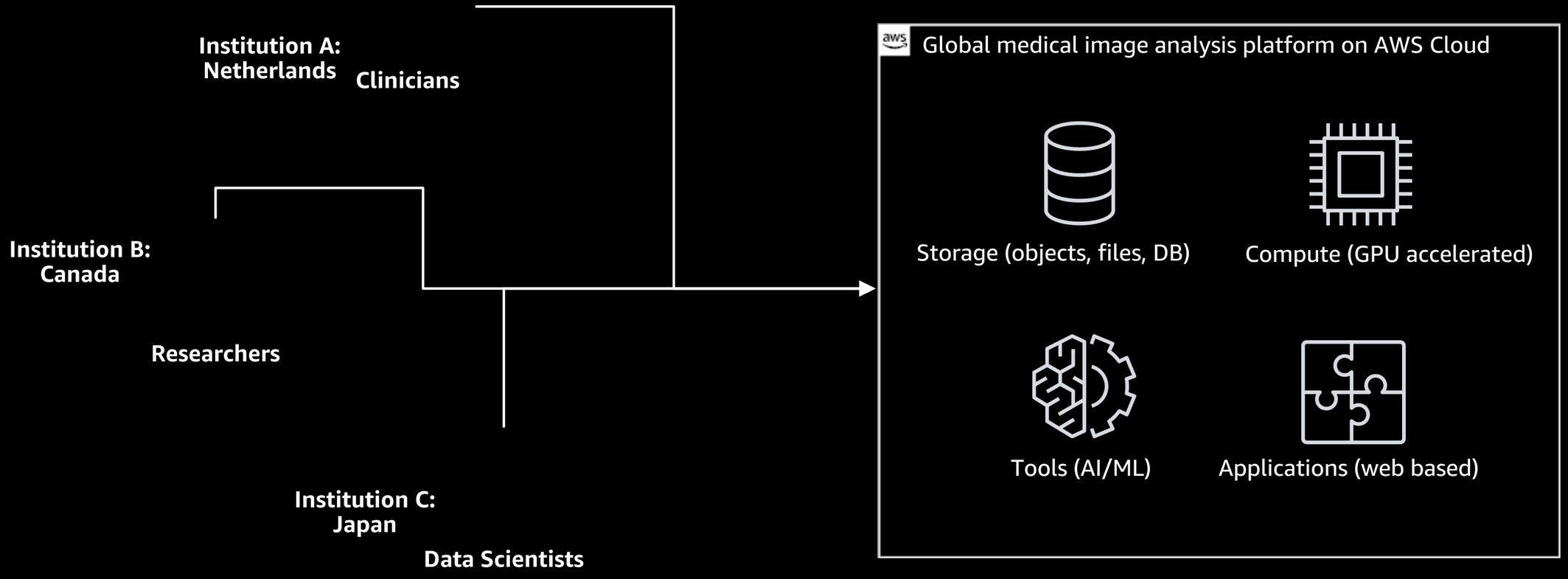
Grand-Challenge.org and AWS

How to handle thousands of radiologists worldwide taking our Reader Study and uploading CT scans to CORADS-AI and viewing the result in their browser?

We needed to put grand-challenge.org completely in the cloud



How to reinvent medical image analysis research with ML on AWS?

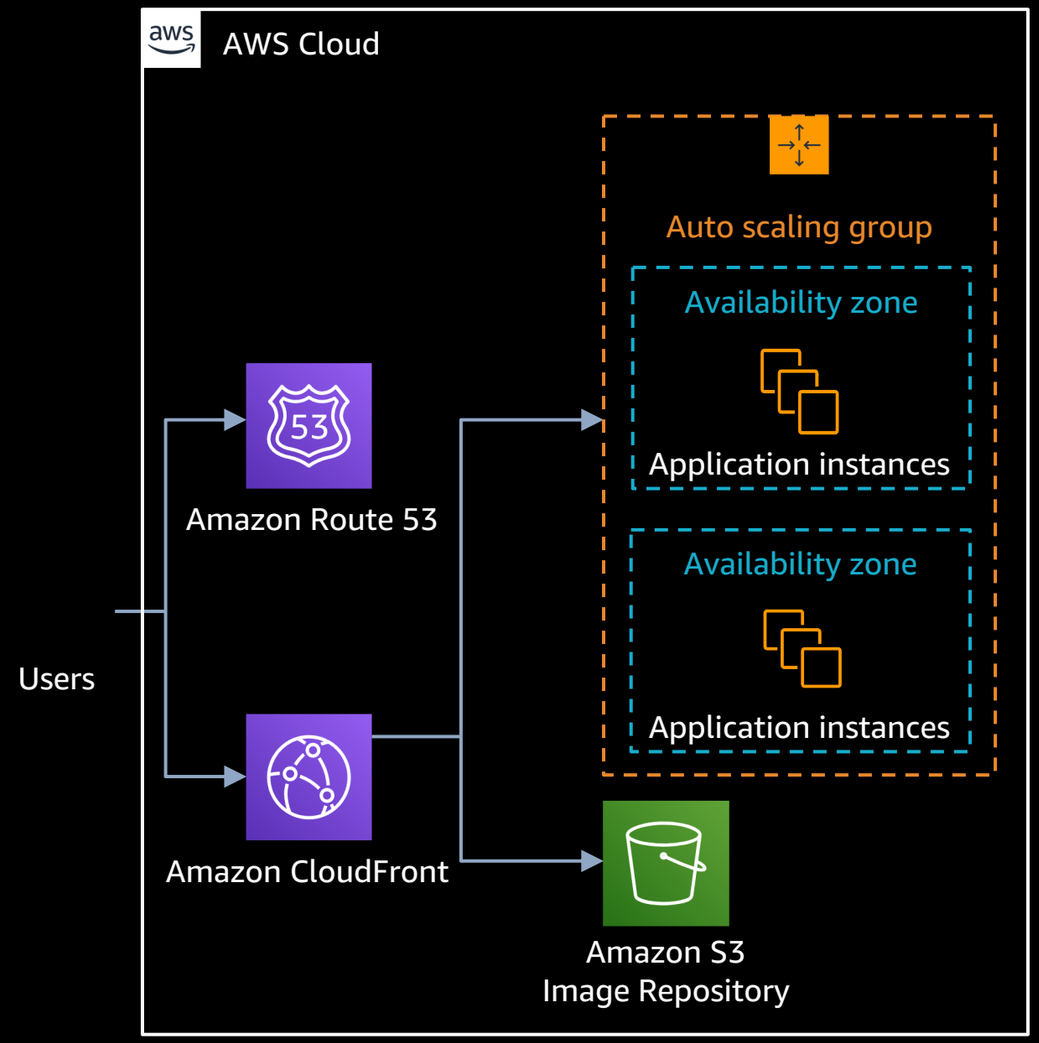


Storage and exchange data with the global research community

Challenge: Massive data, locked in data siloes and proprietary formats, confined on premises, spread globally

Solution: Amazon S3 with accelerated transfers, CloudFront and integrated URL signing

Results: Limitless scalability, flexibility of imaging formats including DICOM, share data with permission control

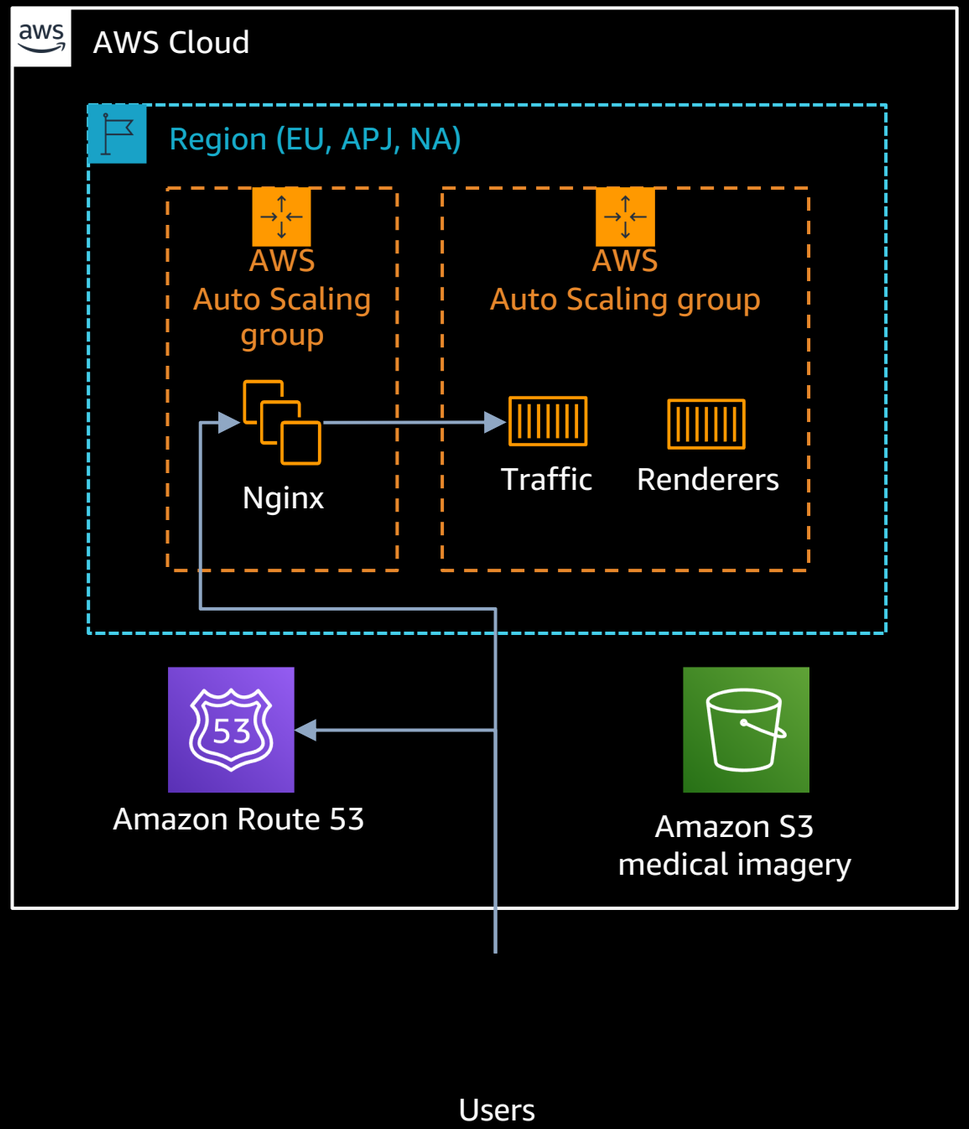


Low-latency and scalable web-based imaging workstation

Challenge: Zero footprint MIP/3D volumetric rendering, low-latency interactive tools, highly available, and global deployment (EU, NAM, JP)

Solution: CIRRUS medical imaging workstation, server-side rendering on GPU accelerated instances, WebSocket streaming to single page web app, scale horizontally with Docker and AWS Auto Scaling group in each region

Results: Route users to proximal region based on location, start the container on-demand for a new user, in less than 30sec, load typical 300MB CT, 500 slices is less than 10 seconds, and stream with <20ms latency

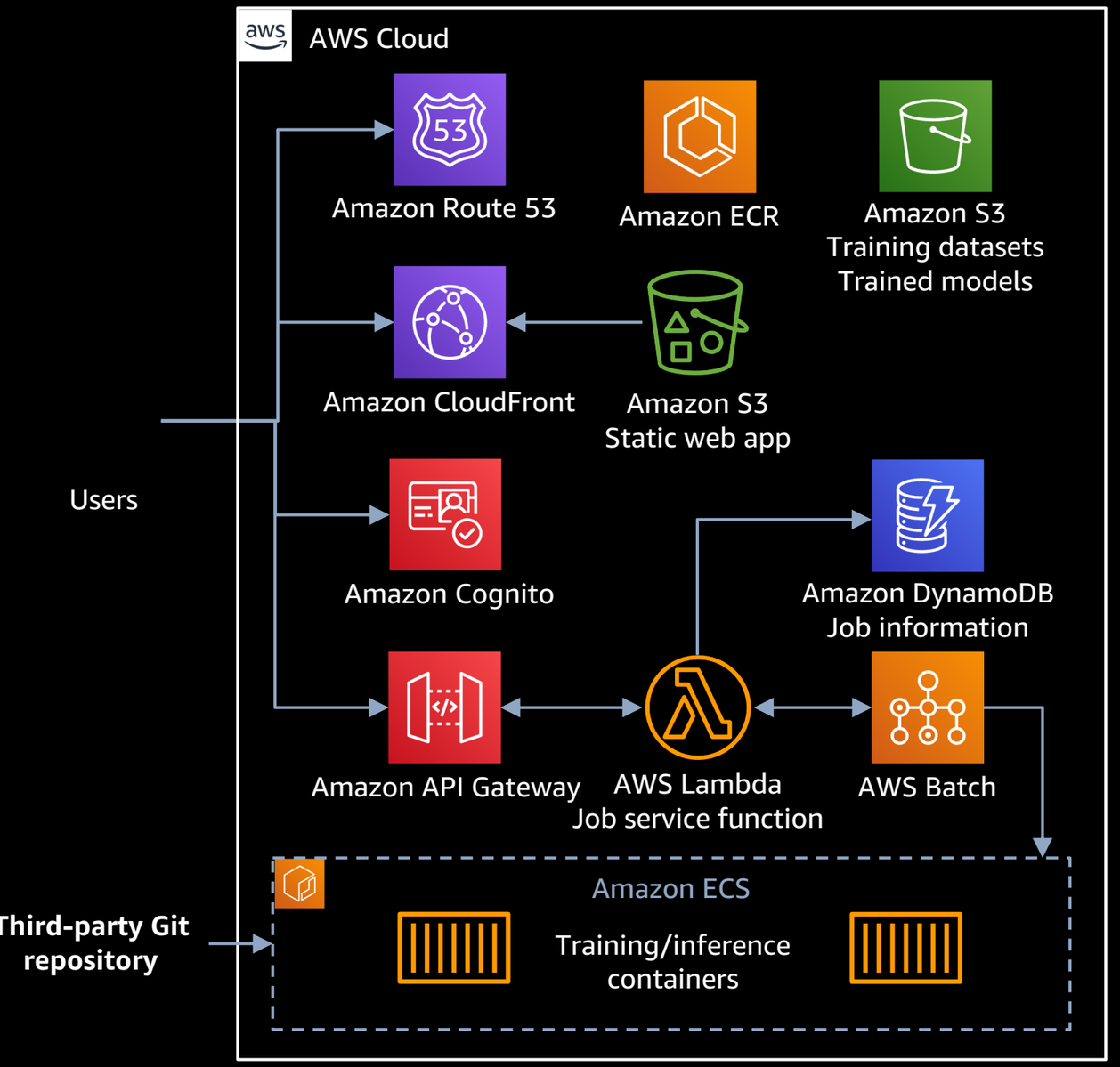


Integrated ML pipelines with external parties

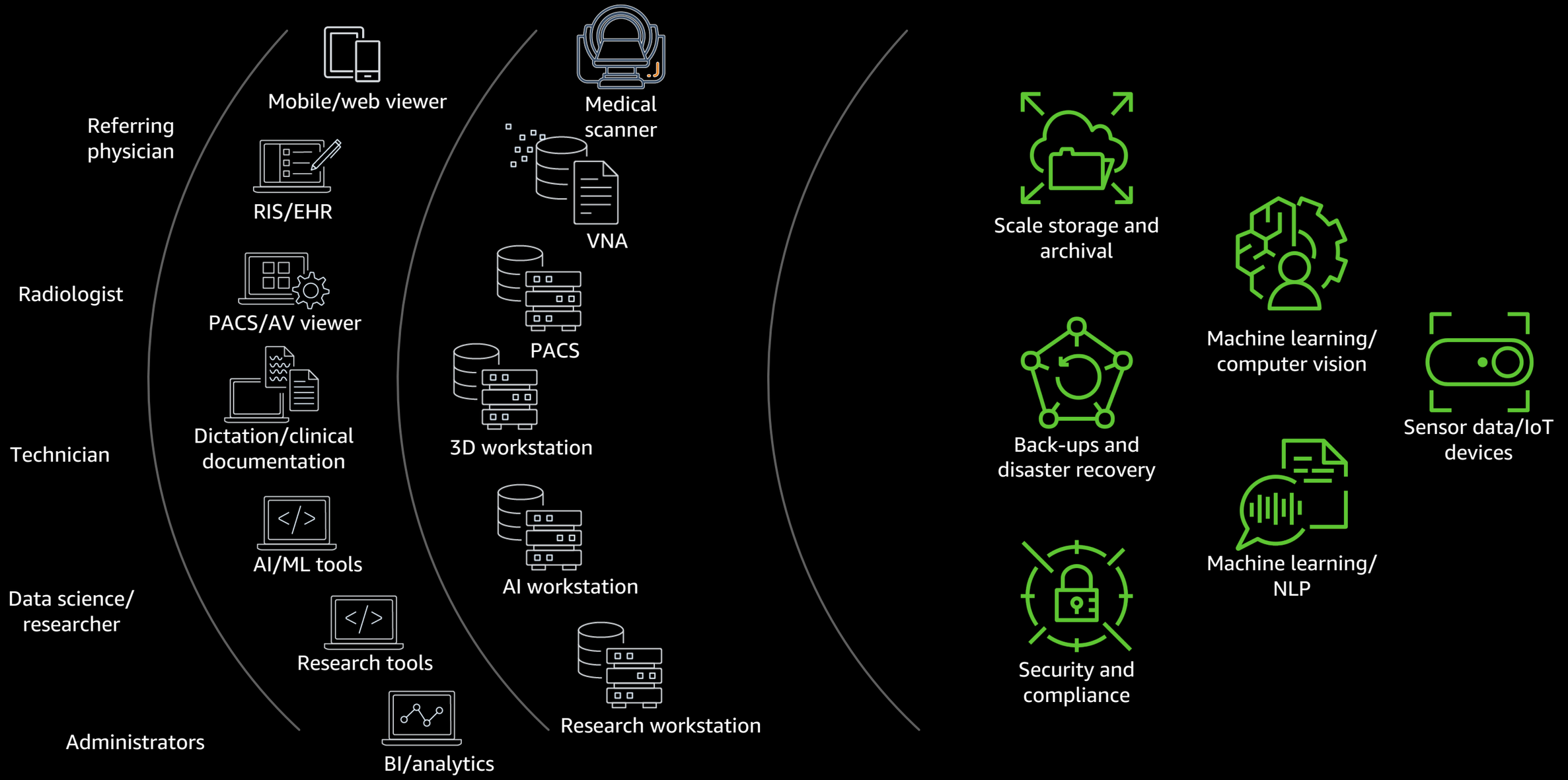
Challenge: External researchers seek access to perform ML training or inferencing, data cannot be exported, code is untrusted, automated security required

Solution: User submits URL to Git repo, DynamoDB for job information, AWS Batch to schedule jobs, and ECS to run Docker containers and store results in Amazon S3, IAM to enforce access control

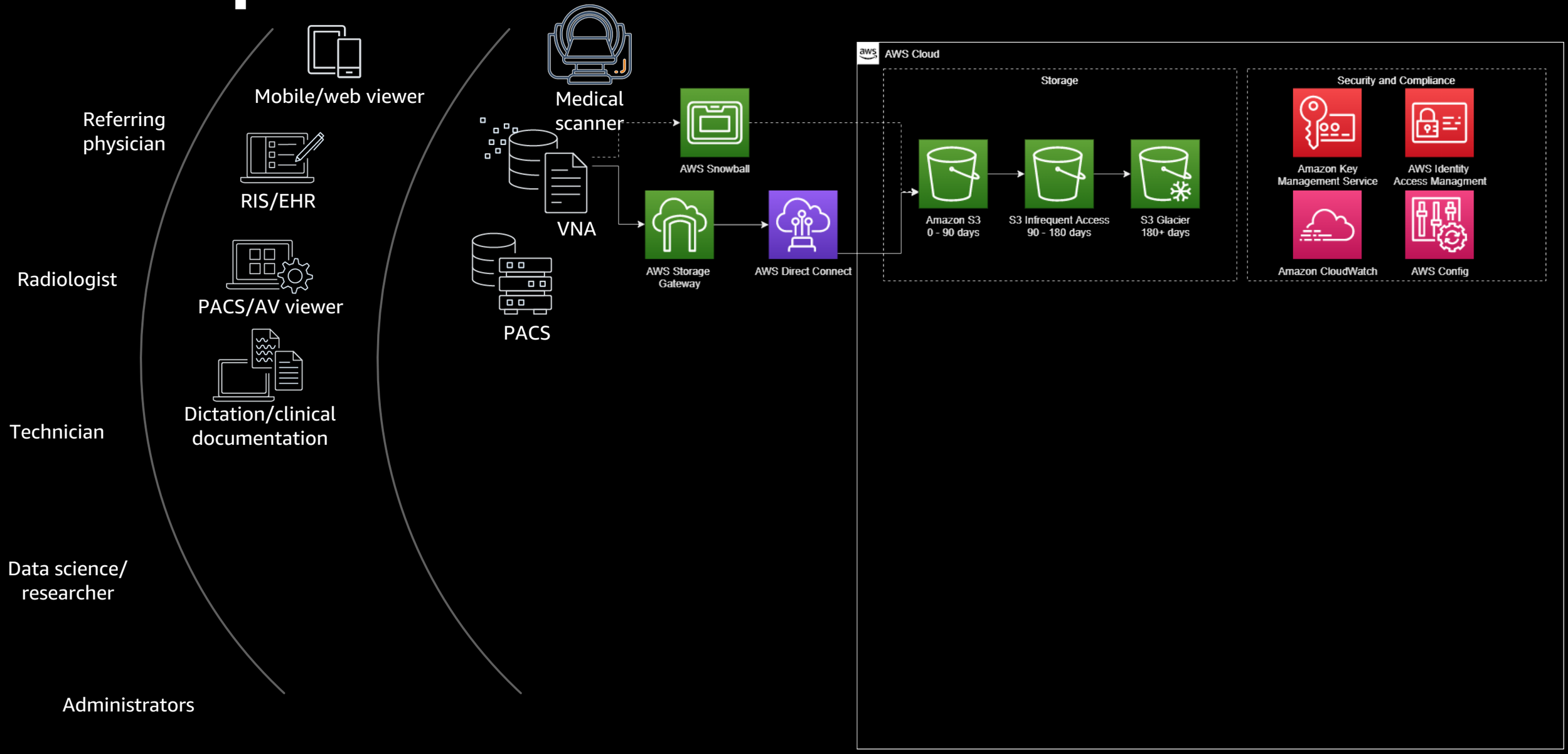
Results: Users train on pulled data and export ML models



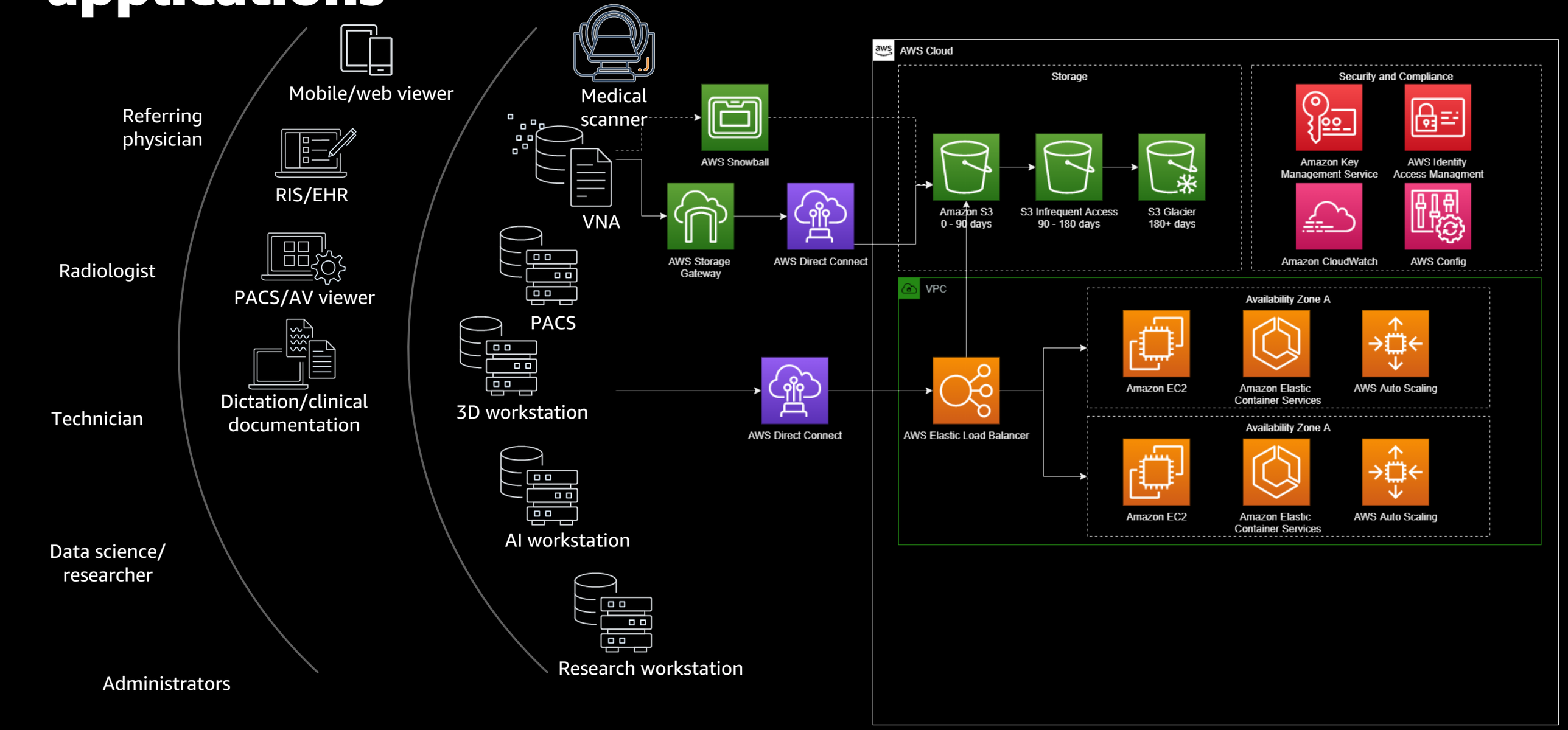
How to reinvent enterprise imaging with ML on AWS?



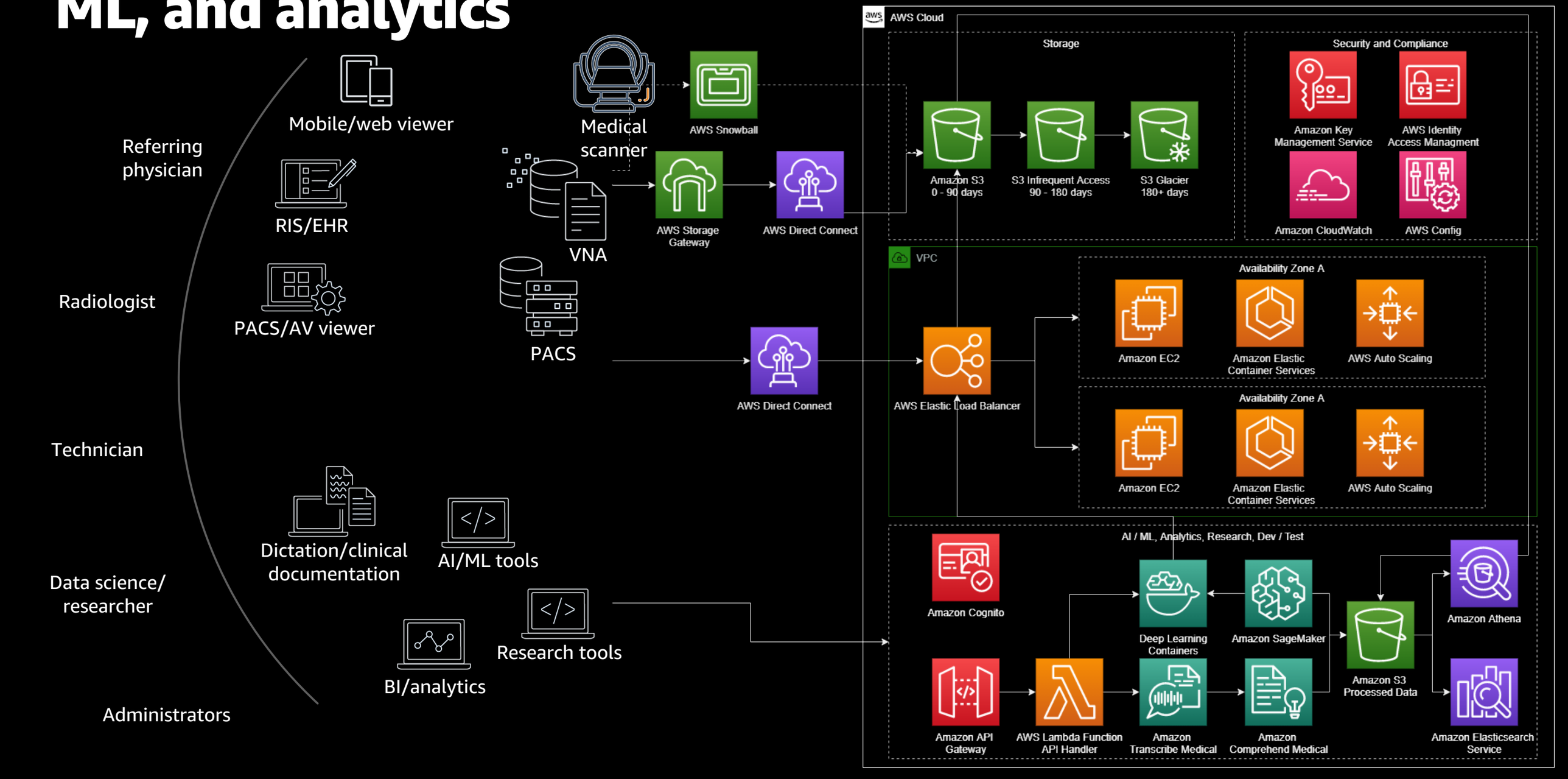
Hyperscale storage with automated life cycle, security, and compliance



Highly available infrastructure with zero footprint applications



Scalable microservices architecture, faster cycles with ML, and analytics




AMBRA


PHILIPS


SMART
REPORTING


iz.ai


ARTERYS
REDEFINE WHAT'S POSSIBLE


aidoc


GE Healthcare


THERAPANACEA
Reinventing cancer care through AI


thirona


inferVISION
推想科技

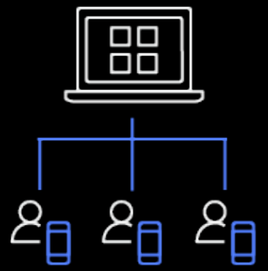

Butterfly™


FEEDBACKmedical
INNOVATION IN IMAGING

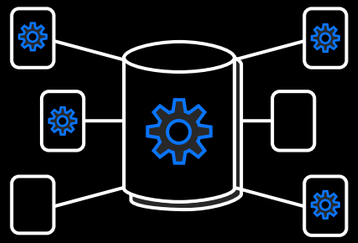
Reinventing medical imaging with machine learning on AWS



Hyperscale storage with optimized life cycle



Highly available infrastructure with zero footprint applications



Scalable microservices architecture, faster cycles, and data analytics

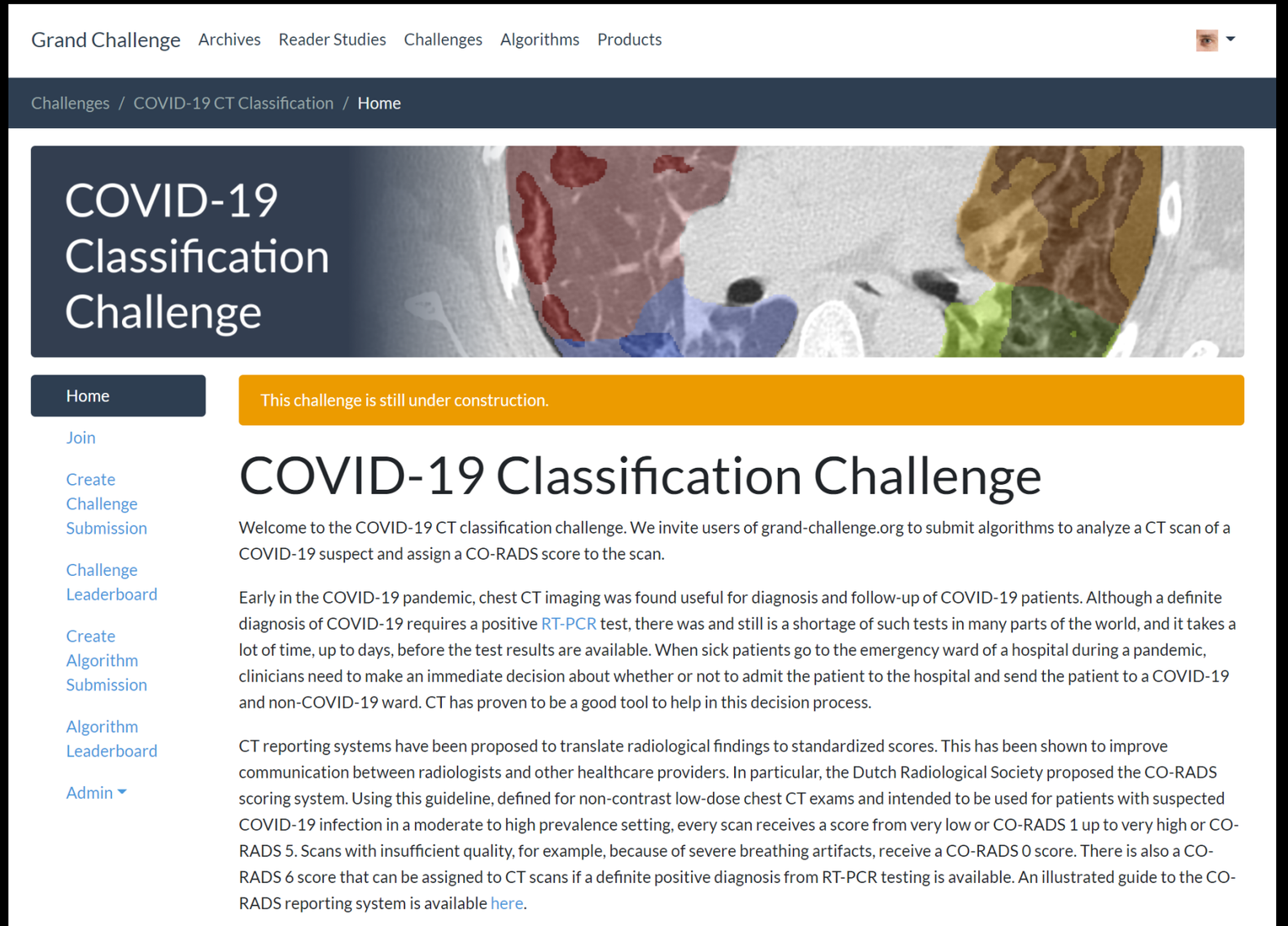


Global exchange with automated security and compliance



Integrated machine learning pipelines from bench to bed

New COVID-19 challenge on Grand-Challenge.org



Healthcare sessions at re:Invent 2020

ID	TITLE
HLC201	Healthcare executive outlook: accelerating transformation
HLC202	Making healthcare more personal with MetroPlus Health
HLC203	Securing personal health information and high risk data sets
HLC204	Accelerating the transition to telehealth with AWS
WPS202	Transform research environments with Service Workbench on AWS
WPS209	Reinventing medical imaging with machine learning on AWS
WPS211	An introduction to healthcare interoperability and FHIR Works on AWS
WPS304	Achieving healthcare interoperability with FHIR Works on AWS
AIM303	Using artificial intelligence (AI) to automate clinical workflows
AIM310	Intelligent document processing for healthcare organizations
MKT206	Simplify healthcare compliance with third-party solutions
GPS211	AWS partners driving innovation amidst the COVID pandemic

Thank you!

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AWS
linkedin.com/in/ionasec/

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