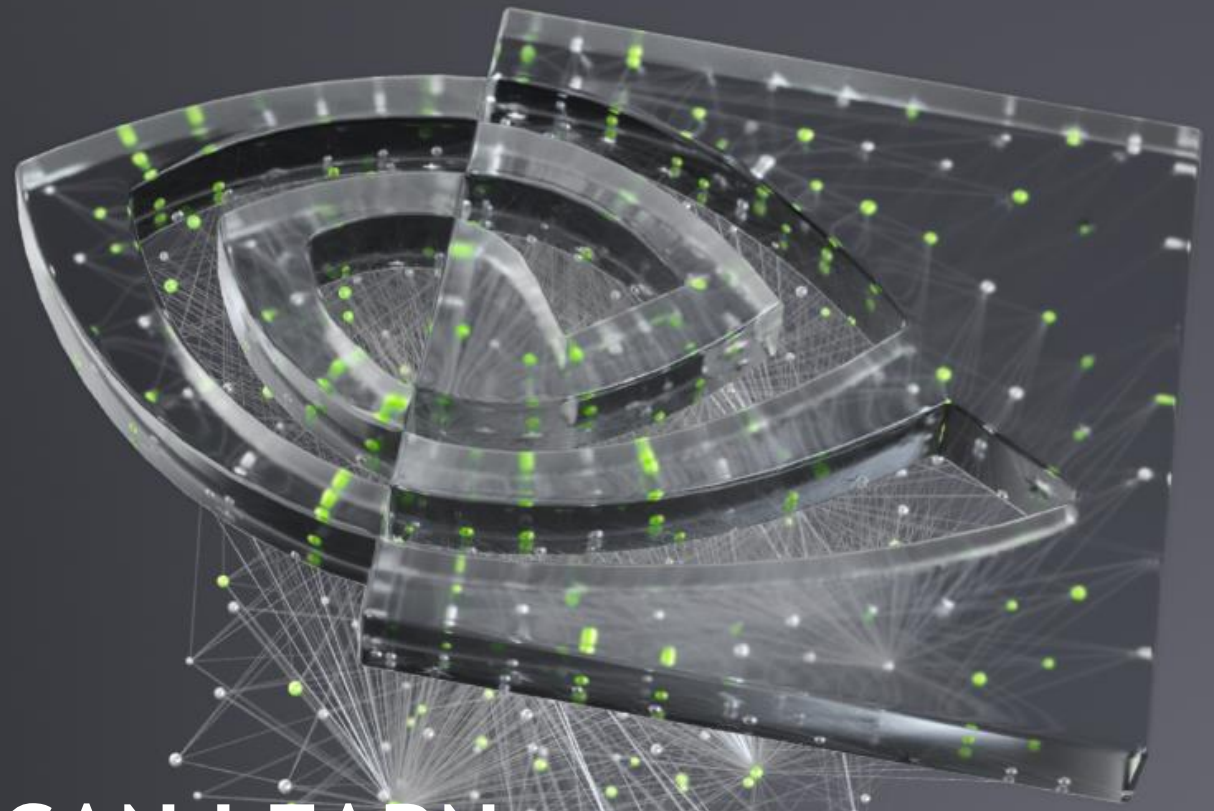


WHAT PATHOLOGY CAN LEARN FROM SELF-DRIVING CARS

Abdul Hamid Halabi | Global Director Healthcare | DPA 2020

@alhalabi_

CANCER

AFFECTS OUR FAMILIES, OUR FRIENDS AND OUR COMMUNITIES

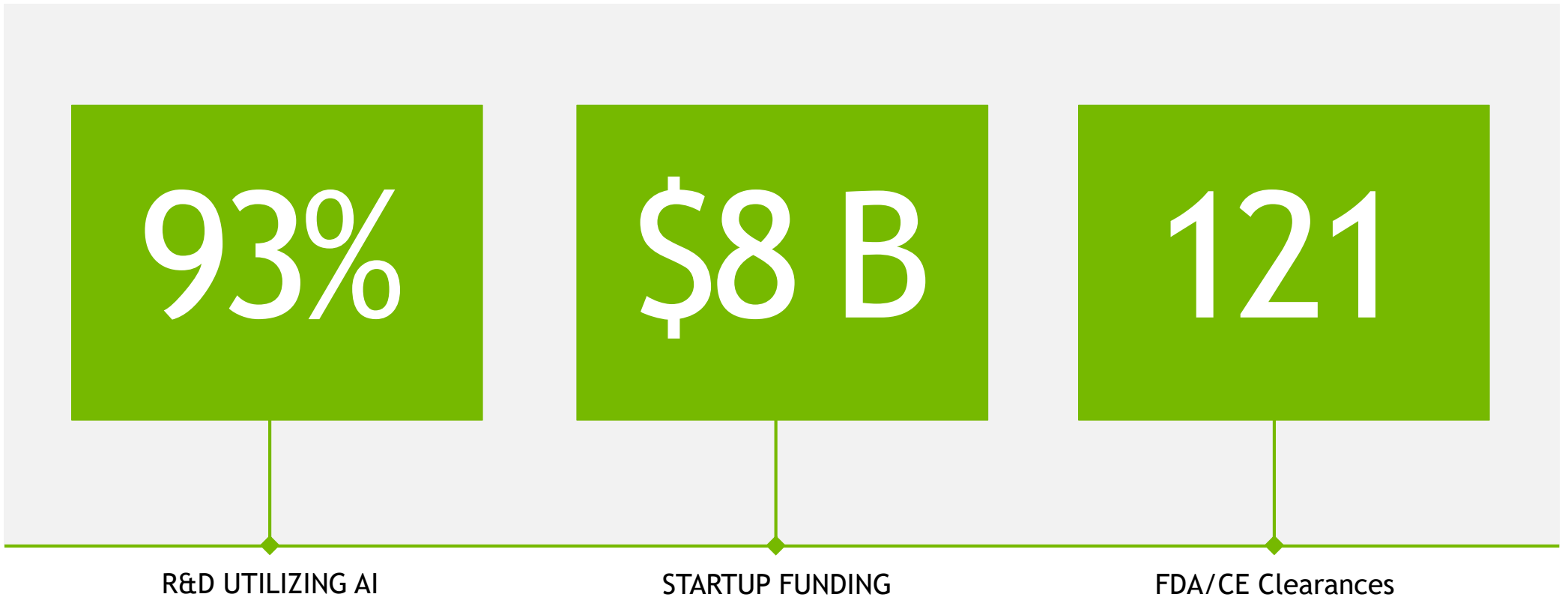
THE NEED CONTINUES TO GROW

High Quality Care for All

Source: https://www.medscape.com/viewarticle/913755,, Institute of Medicine (2015), http://www.clpmag.com/2017/10/digital-pathology-gives-rise-computational-pathology/

THE LEADING INDICATORS

R&D and STARTUPS

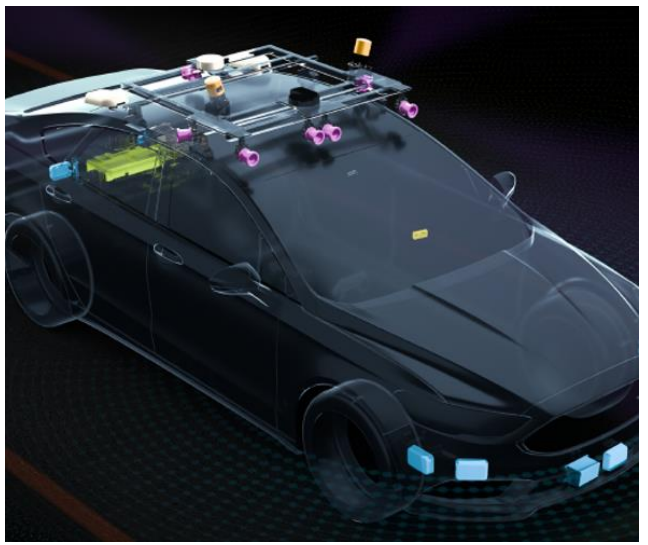


Source: MICCAI (2019), https://arxiv.org/abs/1912.12378?_lrsc=0b30bc06-52ba-441d-8efc-1af4edd6a1fb&ncid=so-lin-lt-798 , CB INSIGHTS (2019), Medical Futurist (2019)

WHY LEARN SELF-DRIVING?

Perception Reasoning Action

Lives Matter
The Leading Cause of Accidental Deaths

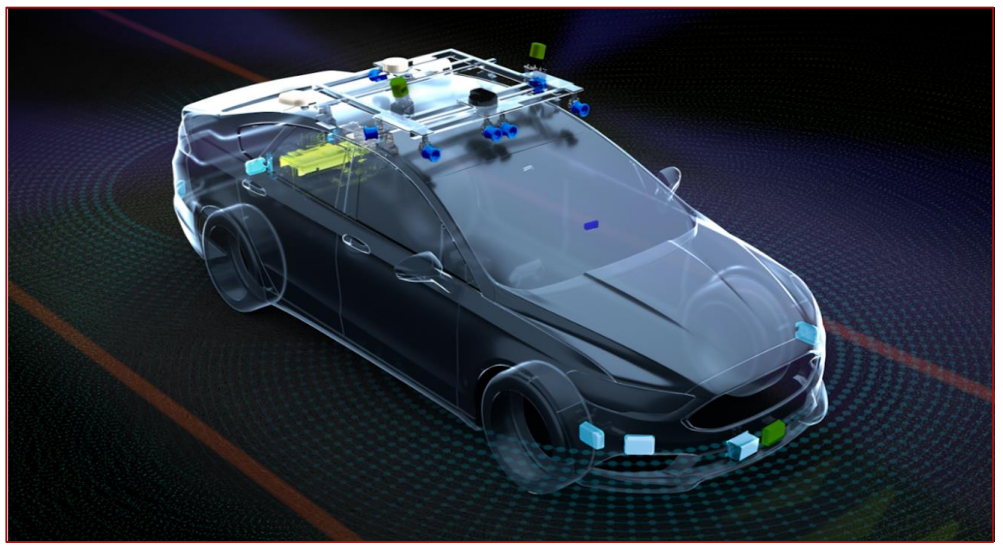


Large Data
1 Whole Slide Every 2 Minutes

Rare Events
200 Deaths Due To Animal-Related Accidents

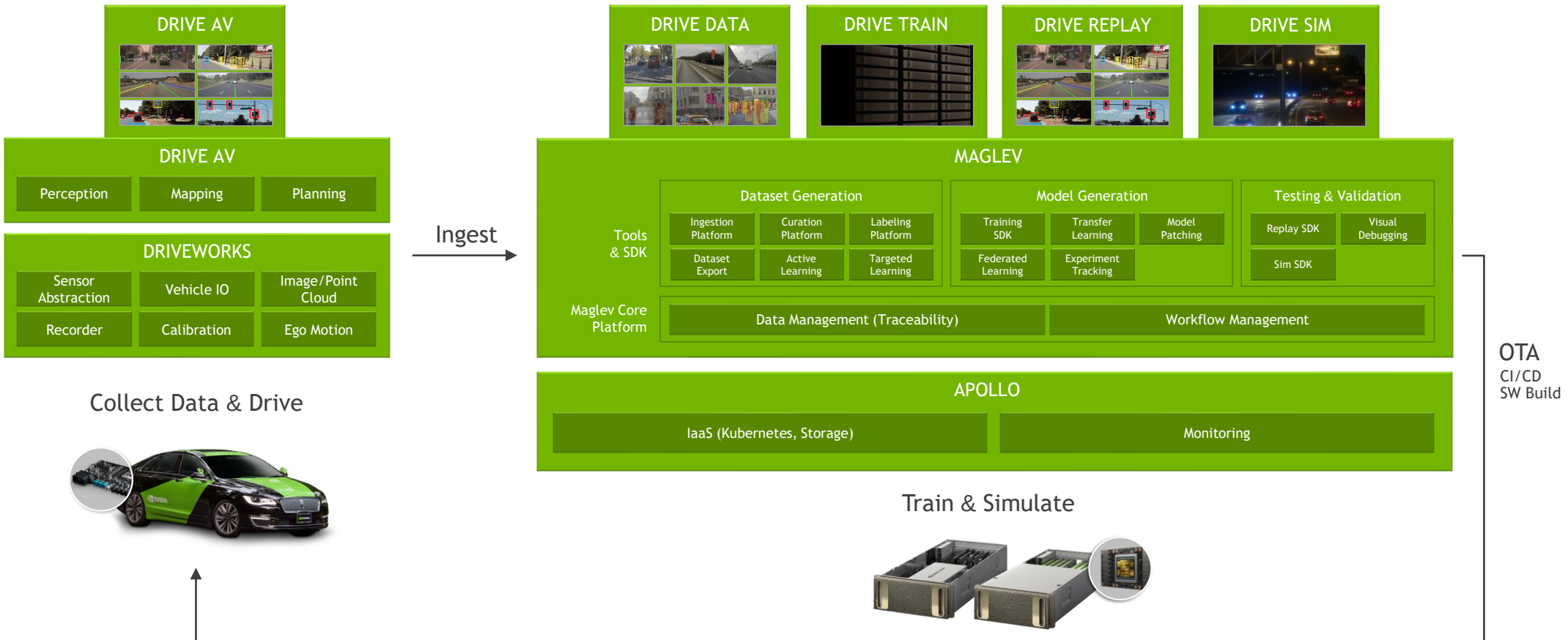
SOFTWARE-DEFINED AI-ENABLED ROBOTS

Autonomous Vehicles (AV)



CONTINUOUS AV DEVELOPMENT PROCESS

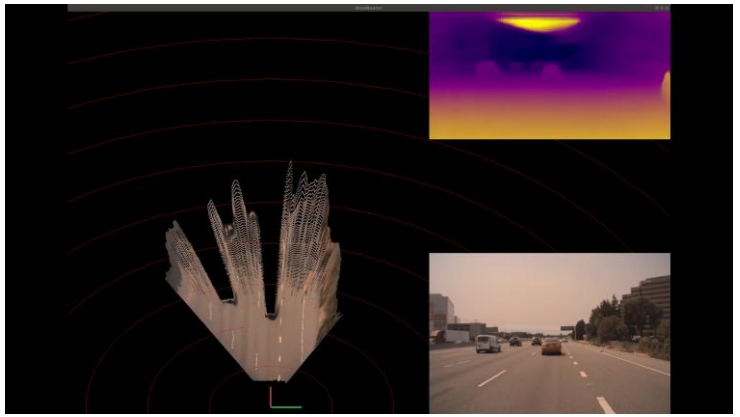
How to Train Your Software-defined AI-enabled Robot



DATASET GENERATION: BYOND AUGMENTATION

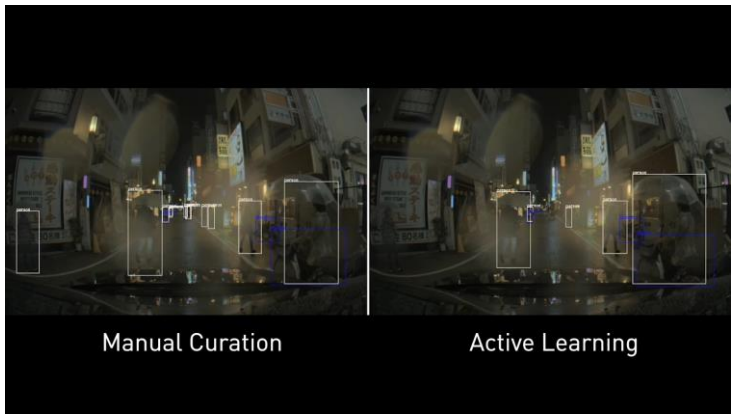
PARKING SPACE PERCEPTION

Thoughtful Data Label Design



DENSE OBJECT DETECTION

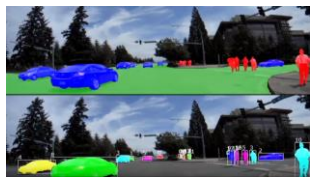
Radar to Train Camera

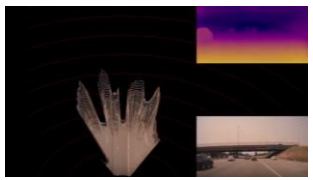


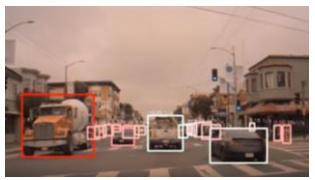
NIGHTTIME PED. DETECTION

Active Learning: Label what Matters

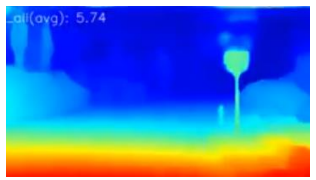
NVIDIA DRIVE AI MODEL HIERARCHY


Obstacles

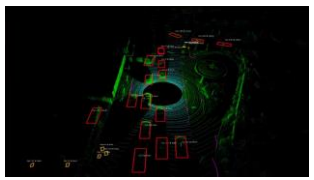

Distance


Time to Collision (RNN)

Free Space

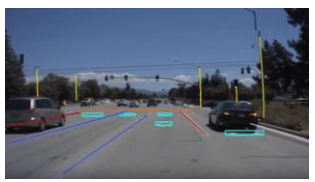


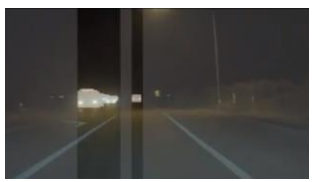
Structure from Motion


Lidar

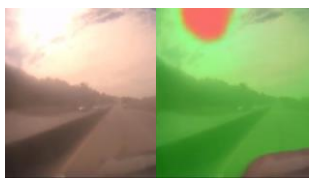
Paths

Signs

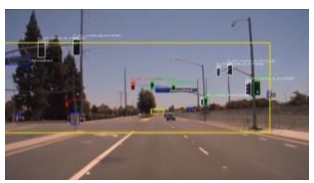

Map

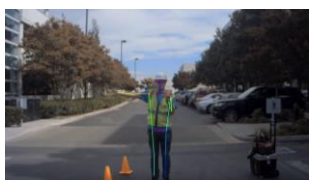

High Beam

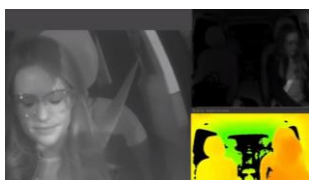
Parking

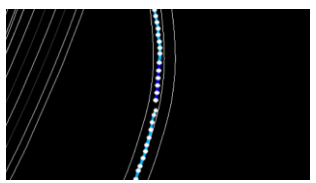

Camera Blindness

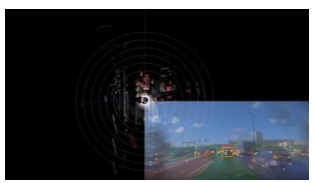
Intersection


Traffic Lights


Gestures/Pose

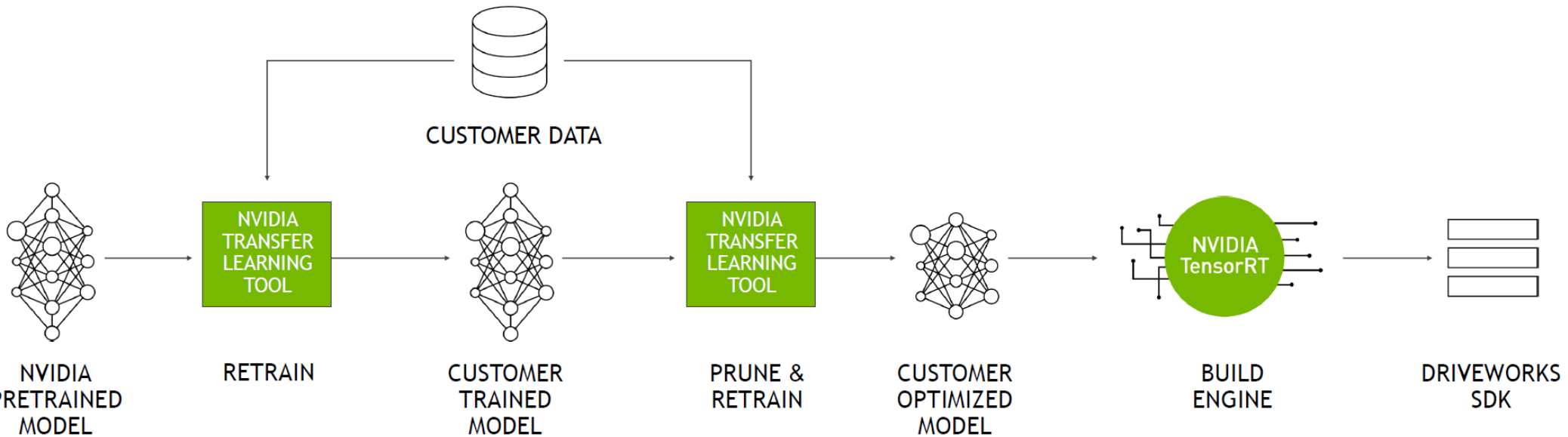

Gaze


Prediction (RNN)


Radar

Trained on Thousands of Hours of Highest Quality Labeled Data | Detection, Classification, Temporal Models, Models for Perception, Planning, Localization, Mapping

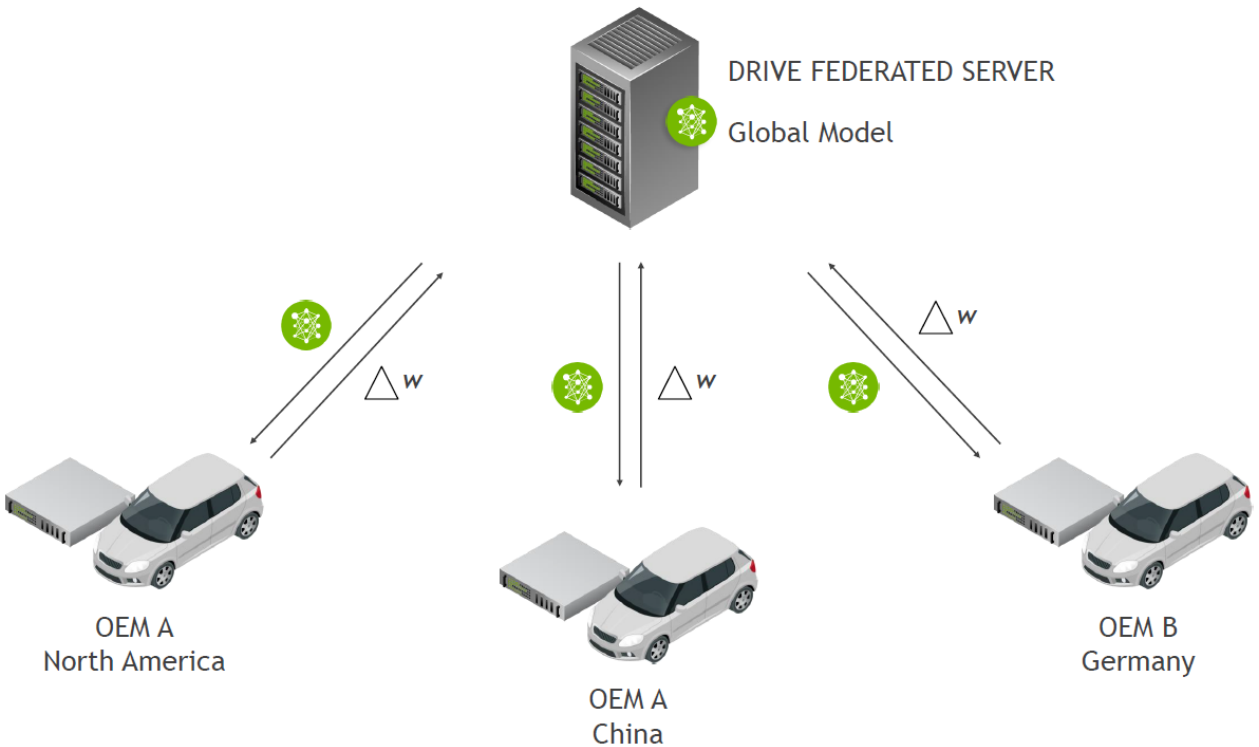
COLLABORATION MODEL: DRIVE TRANSFER LEARNING



Fine-Tune NVIDIA Pre-Trained Models with OEM Data

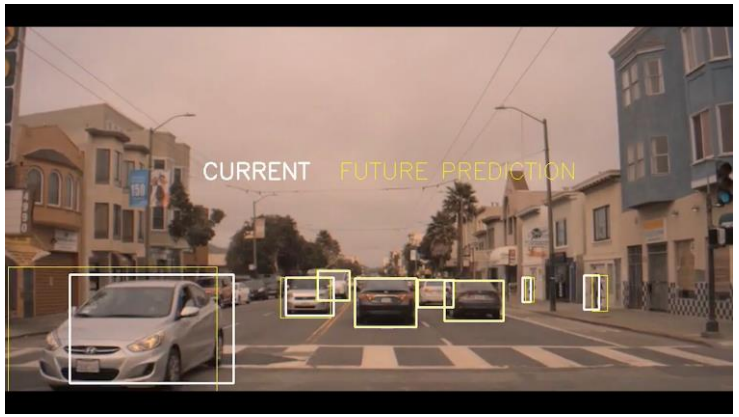
End-to-End Flow for OEMs: Hyperion 7 - Data Collection Car | Human Loop - AI Curating & Labeling
NGC - Repository of Pre-Trained Models | TLT - Transfer Learning Tool | TensorRT 7 - Neural Network Graph Compiler

COLLABORATION MODEL: DRIVE FEDERATED LEARNING



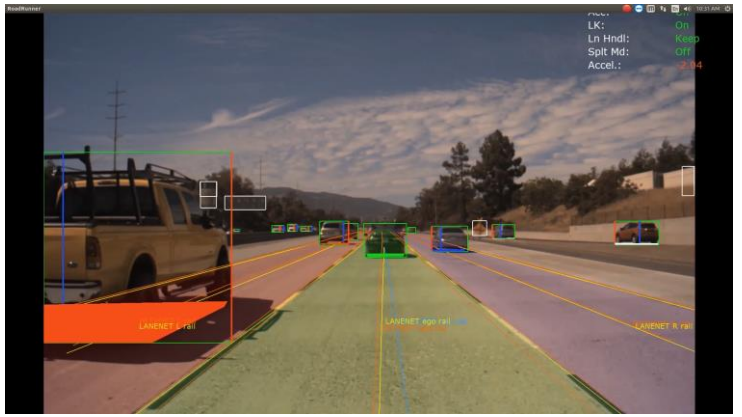
NVIDIA FL Running on NVIDIA Server | Pre-Train Models Shared Among Partners
Enable Collaboration Among Companies, Brands and Regions | Protect Data Ownership & Privacy

AI MODEL GENERATION



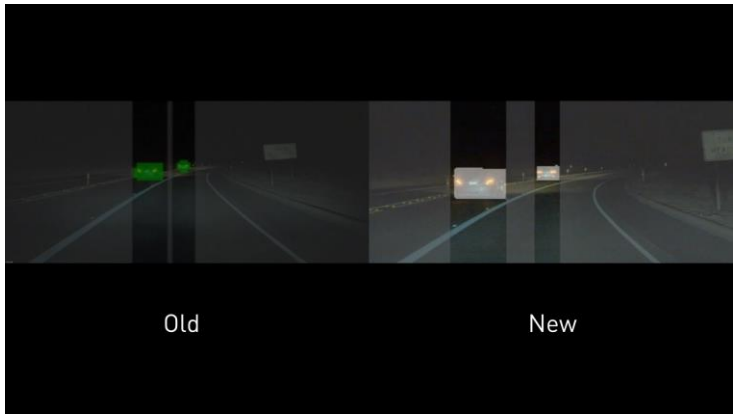
FUTURE MOTION DETECTION

Context/Sequence Understanding (RNN)



PATH PERCEPTION ENSEMBLE

Redundancy & Diversity



LIGHT SOURCE PERCEPTION

Lifelong Learning & Localizing!

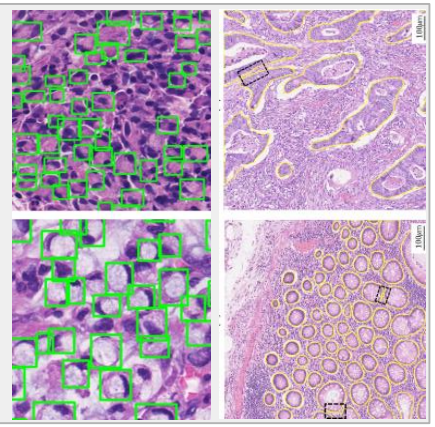
VALIDATION: DRIVE SIMULATION

WHAT CAN WE LEARN FROM SELF-DRIVING?

Data Is How You Transfer Your Knowledge

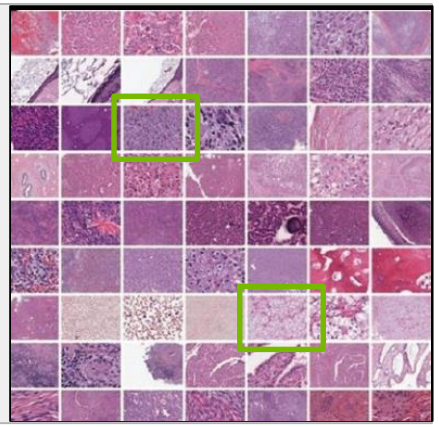
LABEL DESIGN

Consider Data Diversity



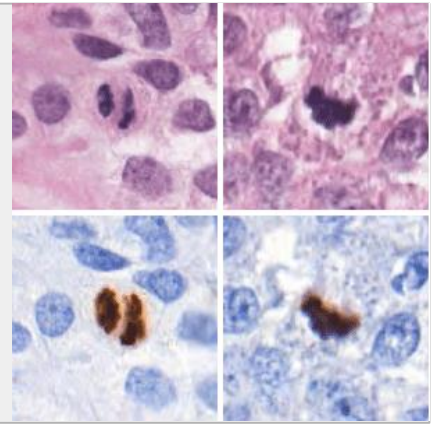
ACTIVE LEARNING

Label ONLY What Matters



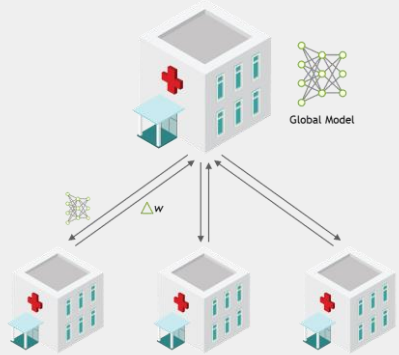
FREE LABELS

Other Stains & NLP



AUGMENT & SHARE

GANS, Transfer & Federated

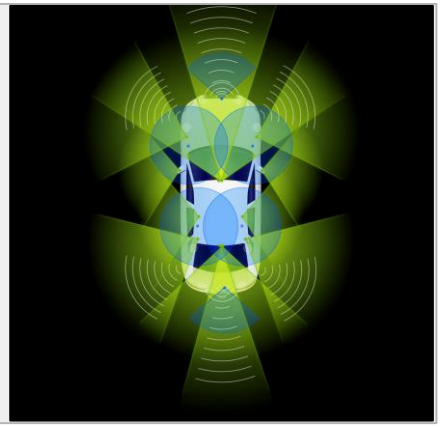


WHAT CAN WE LEARN FROM SELF-DRIVING?

Safety is Paramount

REDUNDANCY

Do Everything at Least Twice

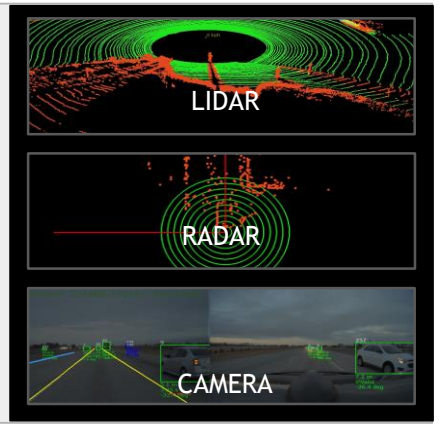


LIFE LONG LEARN

Localize & Update Models

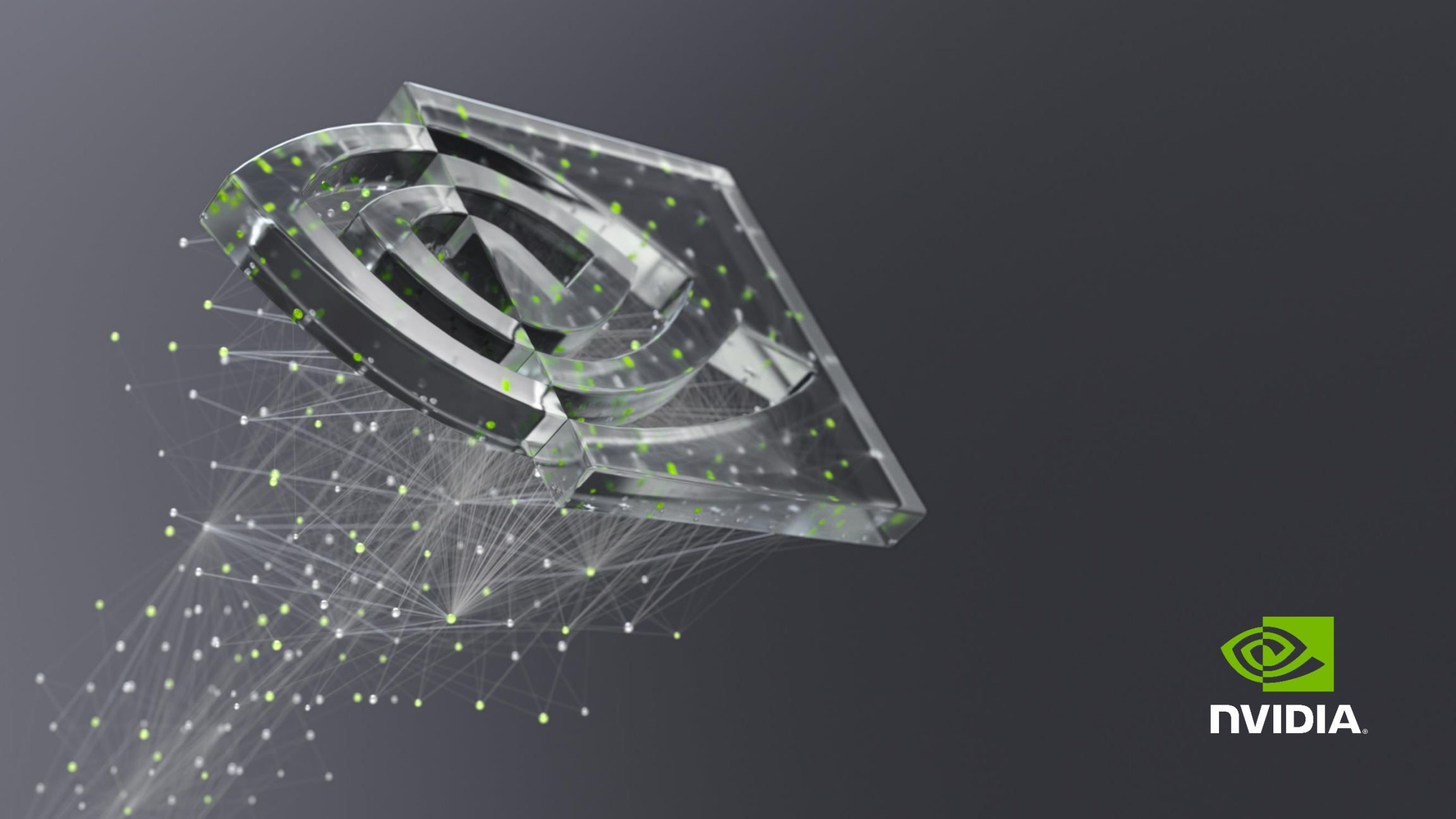
DIVERSITY

Do it in Two Different Ways



VALIDATION

An Order of Magnitude More Data
Hierarchical Learning


NVIDIA

AI INTEGRATION: WORKFLOW & HOSPITAL IT

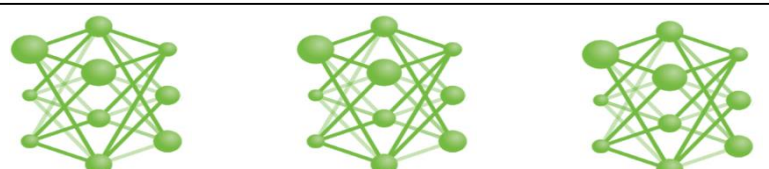
Containerization, Edge Technology & Data Highways

Innovative Applications

Specialized Market Places

Worklist | Viewing | Reporting

Integrated AI



Containerization & Standard APIs

Worklist | Viewing | Reporting

EDGE CLOUD

EDGE TECHNOLOGY

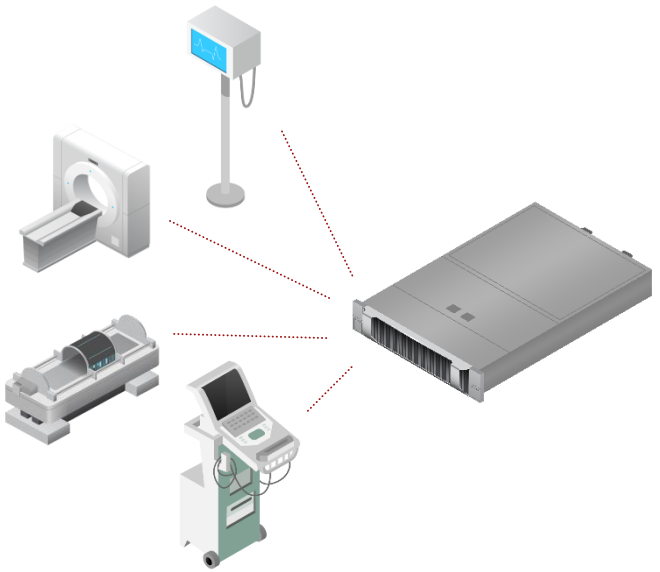
AI APPLIANCE CLOUD SCALING

DEPLOYING AI FOR MEDICAL DEVICES

Delivering Real-Time AI at the Edge

Embedded AI

Sidecar AI



Streaming AI