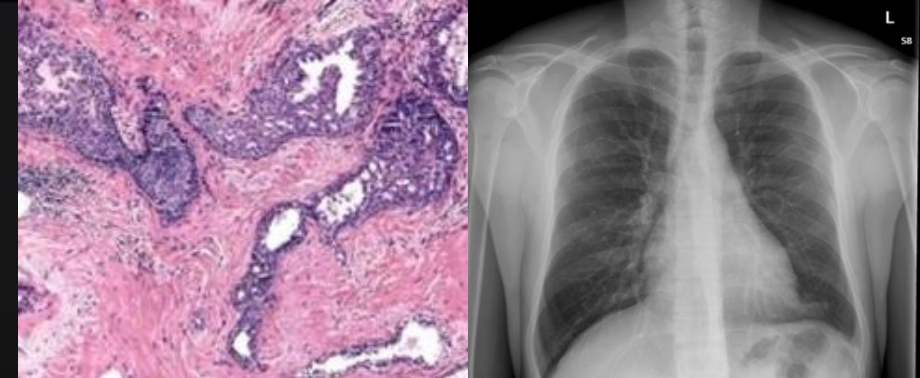
Making AI Research Count for Healthcare

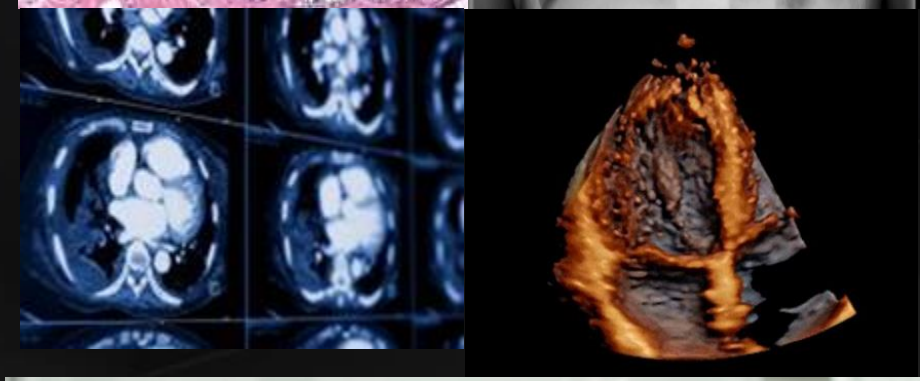
ANDREA DE SOUZA, GLOBAL BUSINESS DEVELOPMENT

October 2017

@baileydesouza

NVIDIA

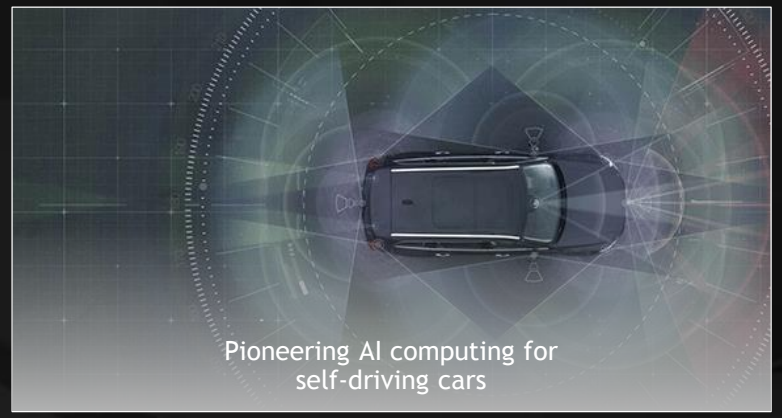




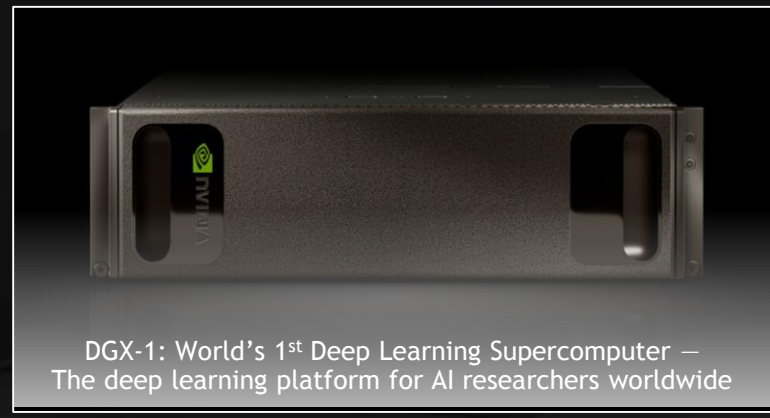
NVIDIA

Pioneered GPU Computing | Founded 1993 | $7B | 10,500 Employees

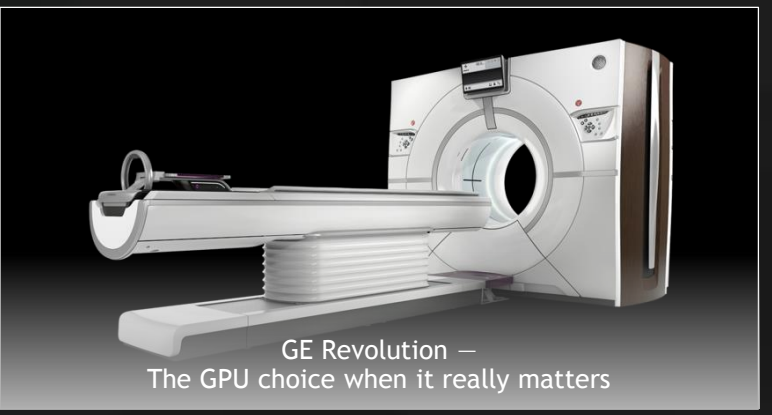
100M NVIDIA GeForce Gamers —
The world's largest gaming platform



Pioneering AI computing for
self-driving cars

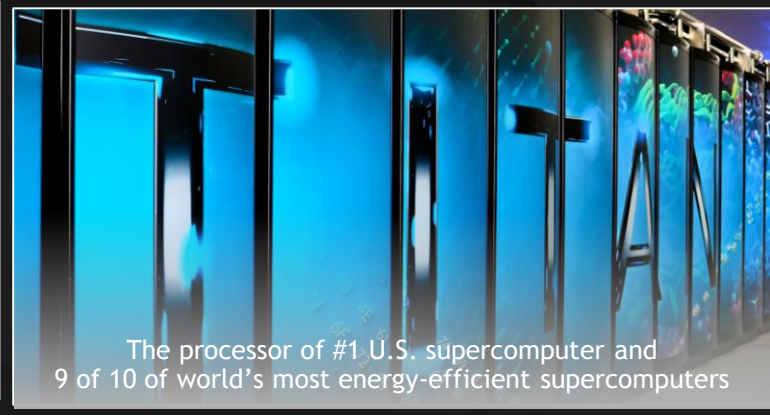


DGX-1: World's 1st Deep Learning Supercomputer —
The deep learning platform for AI researchers worldwide



GE Revolution —
The GPU choice when it really matters

Life Sciences and Healthcare

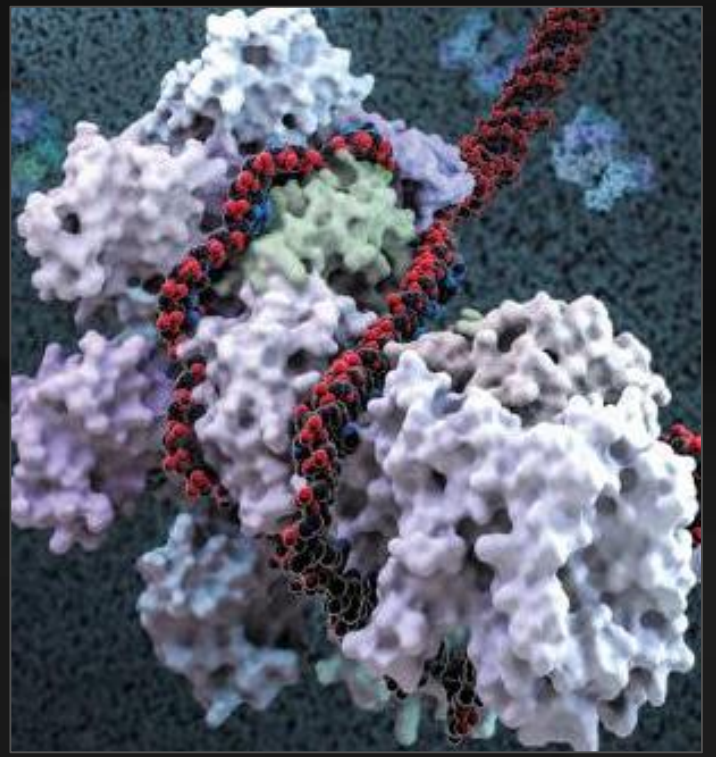


The processor of #1 U.S. supercomputer and
9 of 10 of world's most energy-efficient supercomputers

AI FOR EVERYONE

Across All Industries

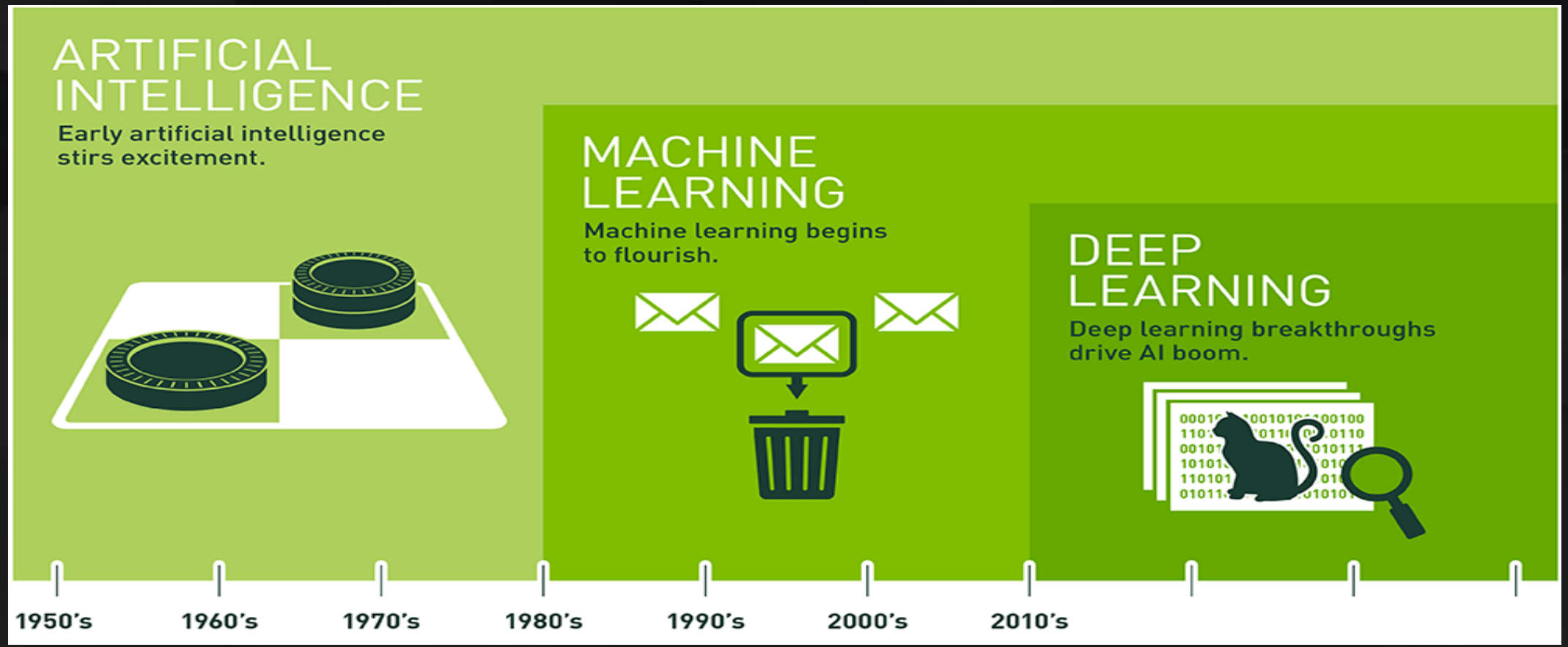
TRANSPORTATION



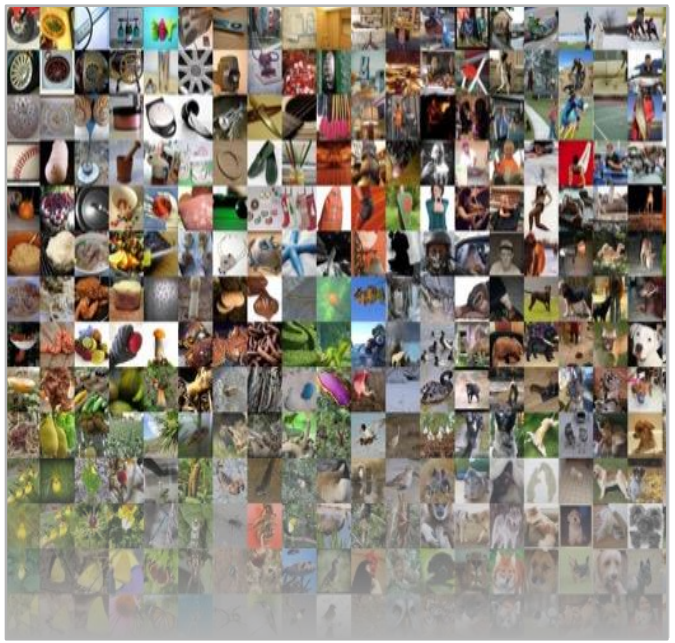
HEALTHCARE

SOCIETY

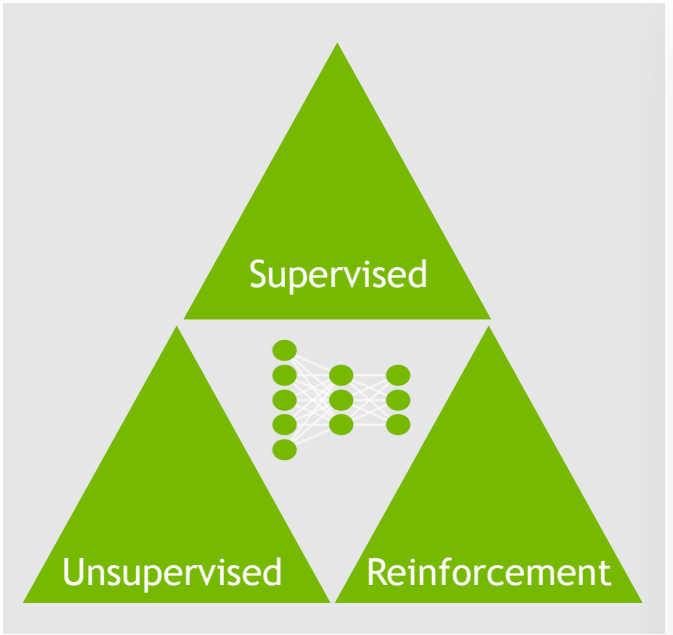
DEEP LEARNING IS THE MODERN AI



THE DEEP LEARNING RECIPE



Data



Algorithms

Compute

HOW DOES IT WORK?

Modeled on the Human Brain and Nervous System

TRAINING

Learning a new capability from existing data

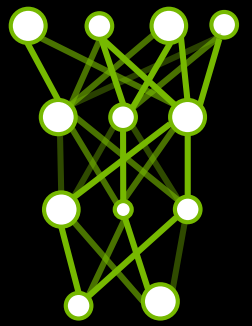
Untrained Neural Network Model

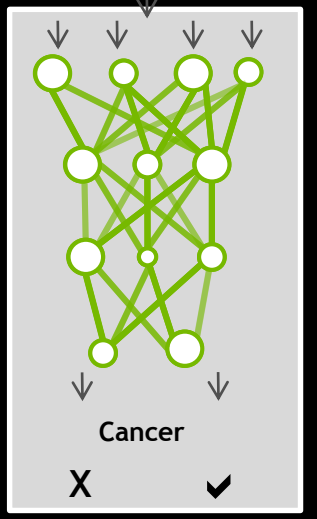
Deep Learning **Framework**

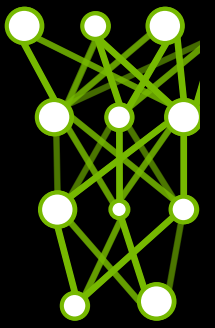
TRAINING DATASET

"Cancer"

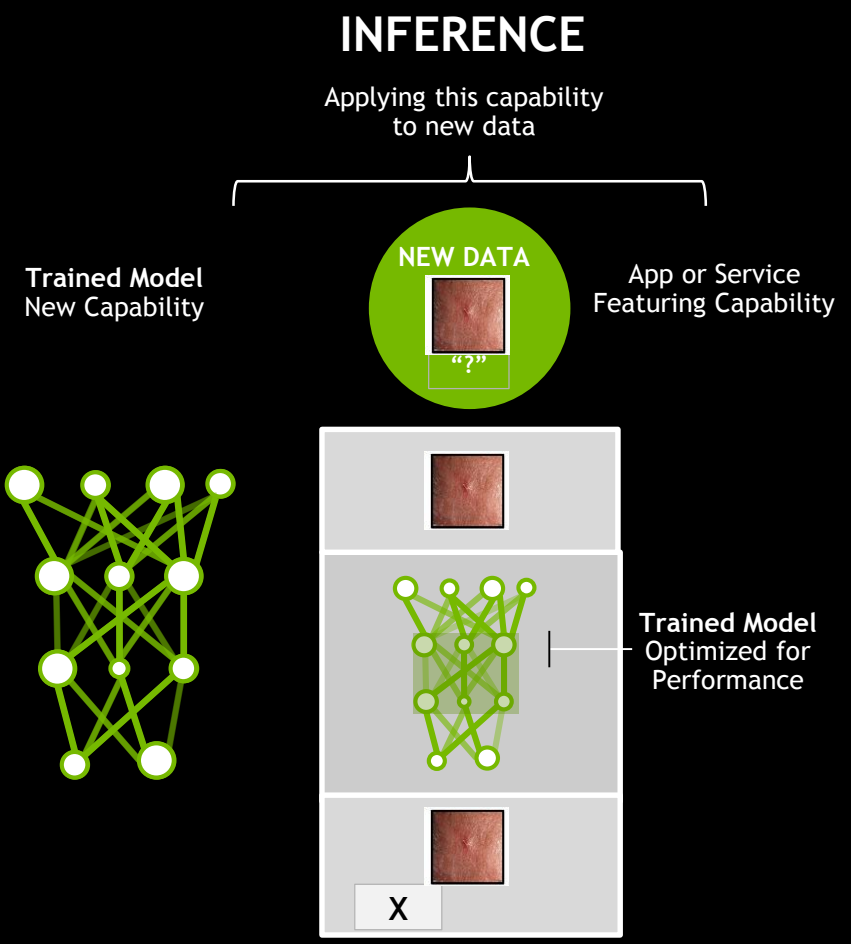
Trained Model New Capability







HOW DOES IT WORK?



NVIDIA DEEP LEARNING EVERYWHERE, EVERY PLATFORM

TITAN X
PC Development

DGX-1
AI Supercomputing
Optimized Deep Learning Software

TESLA
Servers in every shape and size

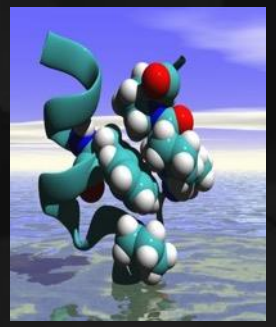
CISCO · CRAY · DELL · hp · IBM · Lenovo · Quanta Computer

CLOUD
Everywhere

Alibaba.com · amazon · Bai百度 · Google · IBM · Microsoft

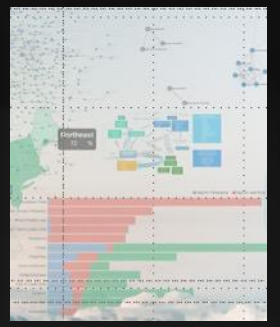
FUELED BY HEAPS OF INNOVATION

Aligned to Market Shifts and Pain Points

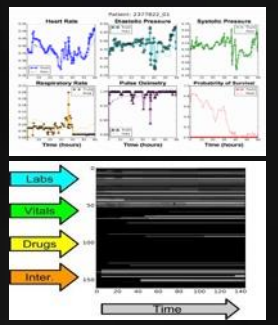


Molecular Energetics For Drug Discovery

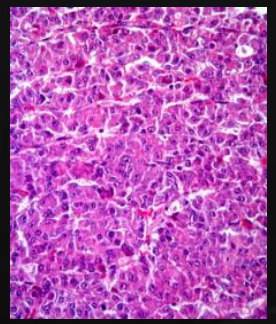
AI for Drug Discovery



Medical Decision Making



Treatment Outcomes

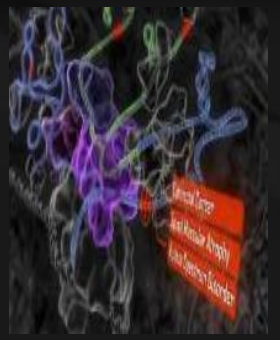


Reducing Cancer Diagnosis Errors by 85%

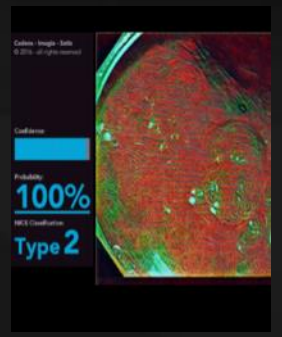
Predicting Toxicology

Predicting Growth Problems

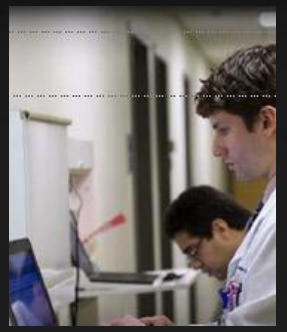
Image Processing



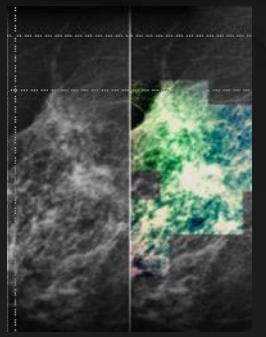
Gene Mutations



Detect Colon Polyps



Predicting Disease from Medical Records



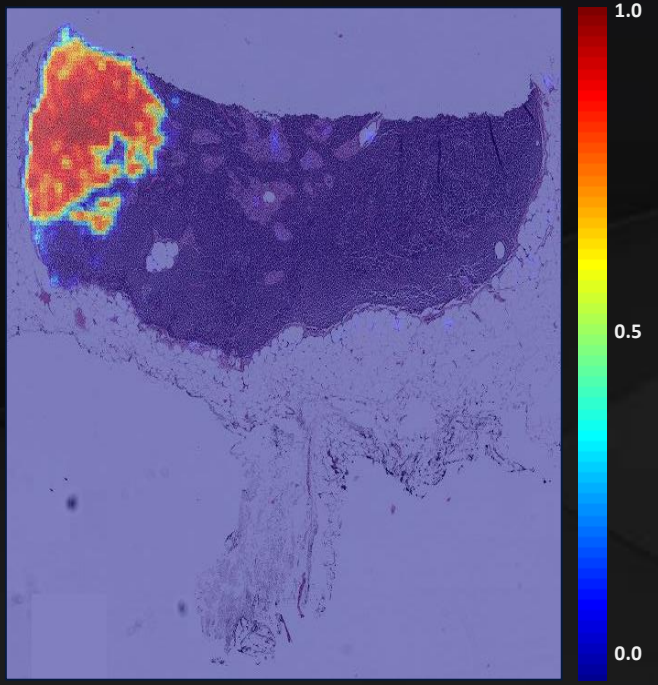
Enabling Detection of Fatty Acid Liver Disease

DEEP LEARNING IS ENTERING THE CLINIC

Cooperation with the Regulators

DL DIAGNOSTIC DEVICES
SAMSUNG & GEHC

1st FDA DL CLOUD ALGORITHM
ARTERYS

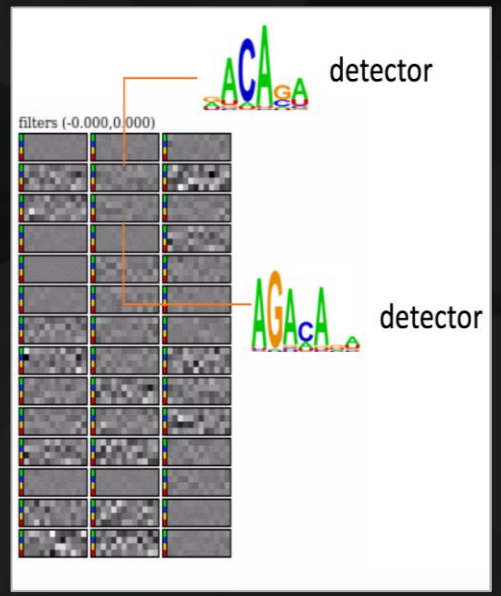


tumor prob. map

DL PATHOLOGY
PHILIPS & PATHAI

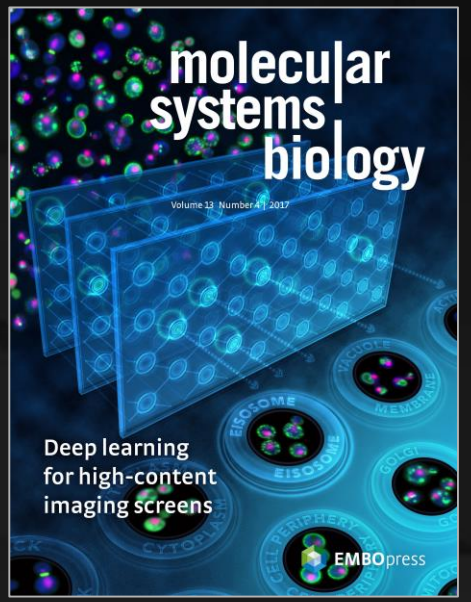
DEEP LEARNING IN DRUG DEVELOPMENT

4 Key Use Cases: Inflection from ML to DL



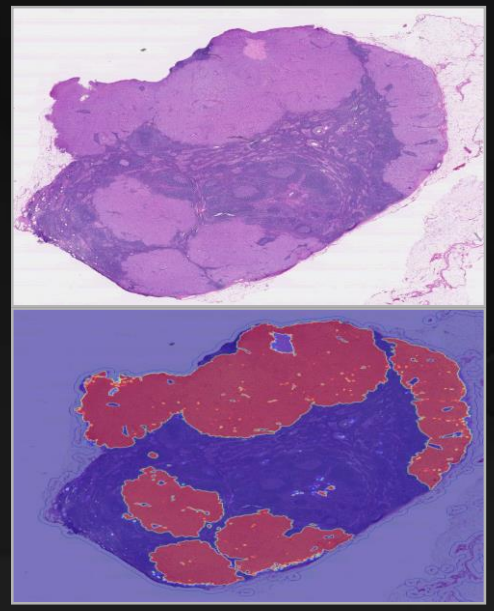
deep genomics

DISCOVERY
VARIANT CALLING



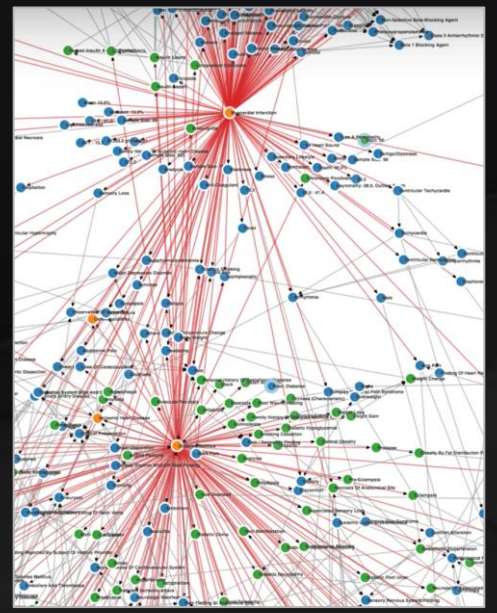
PHENOMIC AI
BIOIMAGE INFORMATICS

DISCOVERY
HIGH CONTENT
SCREENING



PathAI

PRE & CLINICAL
PATHOLOGY

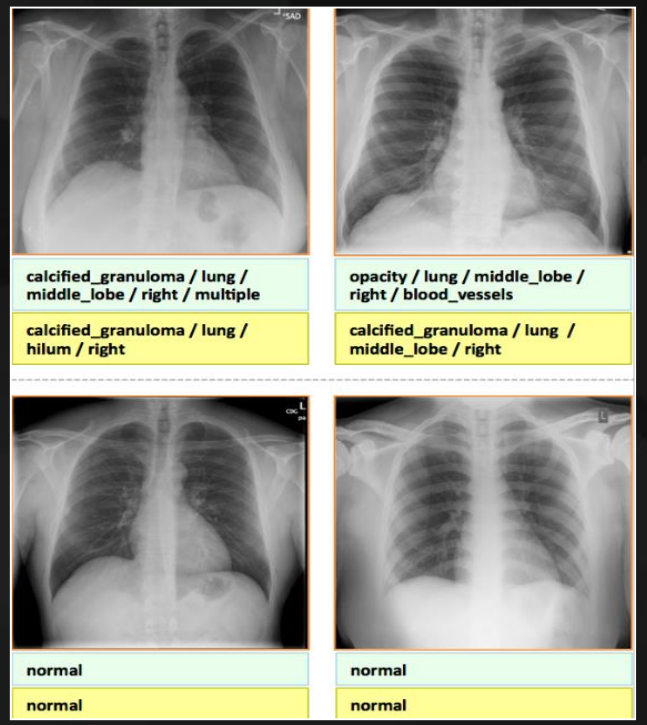


CLOUDMEDX

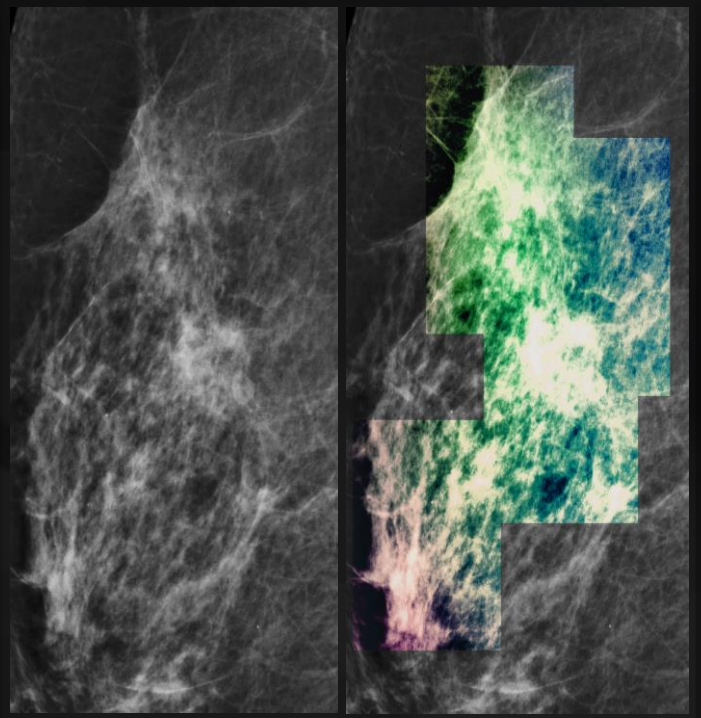
REAL WORLD EVIDENCE
DATA ANALYTICS

DEEP LEARNING IS VITAL TO CANCER CARE

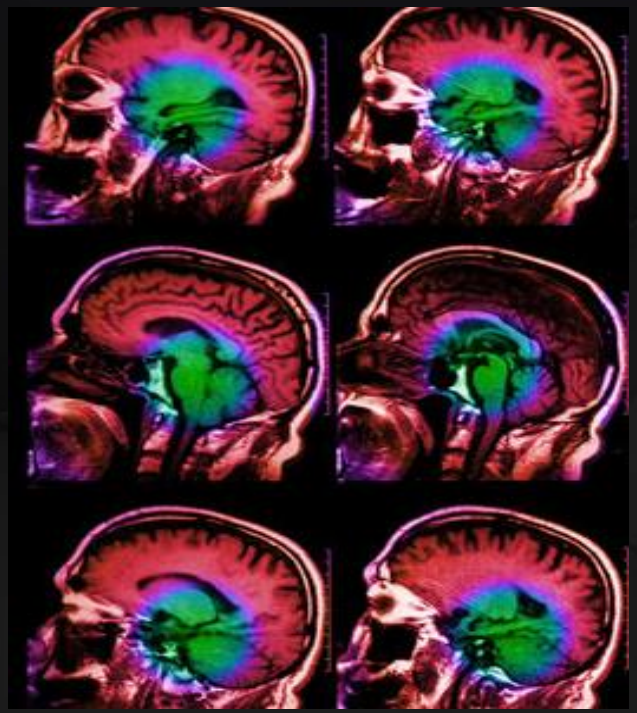
Promise Of Integrated Personalized Care



EARLY DETECTION
TRIAGE & SCREENING



DIAGNOSIS
QUANTITATIVE ANALYSIS



TREATMENT
PLANNING & ONGOING

GLOBAL CANCER TRENDS TO 2030

21.7M

NEW CASES
2030

13M

DEATHS
2030

SOURCE: https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/global-cancer-facts-and-figures/global-cancer-facts-and-figures-3rd-edition.pdf

SKIN CANCER INCIDENCE

1 in 3 cancers are skin cancers

5% are Melanomas

New Cases
5.4M a year
America

75% of the Deaths

AI AND YOUR SKIN

Globally, one in every 3 cancers is a skin cancer. In America, approximately 5.4M new skin cancer patients seek treatment each year.

Using NVIDIA Titan GPUs and transfer learning, researchers at Stanford developed a CNN that matches the performance of 21 dermatologists at three diagnostic tasks: melanoma classification, melanoma classification using dermascopy and carcinoma classification.

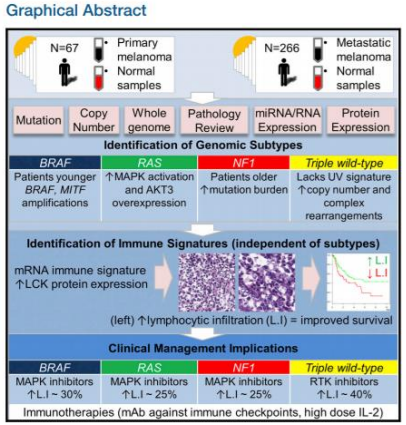
With a dataset of 129,450 skin lesions, researchers fine tuned a Google Inception v.3 CNN architecture that had been pre-trained on the ImageNet dataset of 1.28M images.

The algorithm achieved 94% accuracy in lesion classification.

In the future, technology of this sort can be deployed on mobile devices to detect lethal cancers.

A BETTER *FUTURE* FOR PATIENTS

With Convolutional Neural Networks and GPUs



Cell: June 2015

PRECISE

Early Detection

Diagnosis

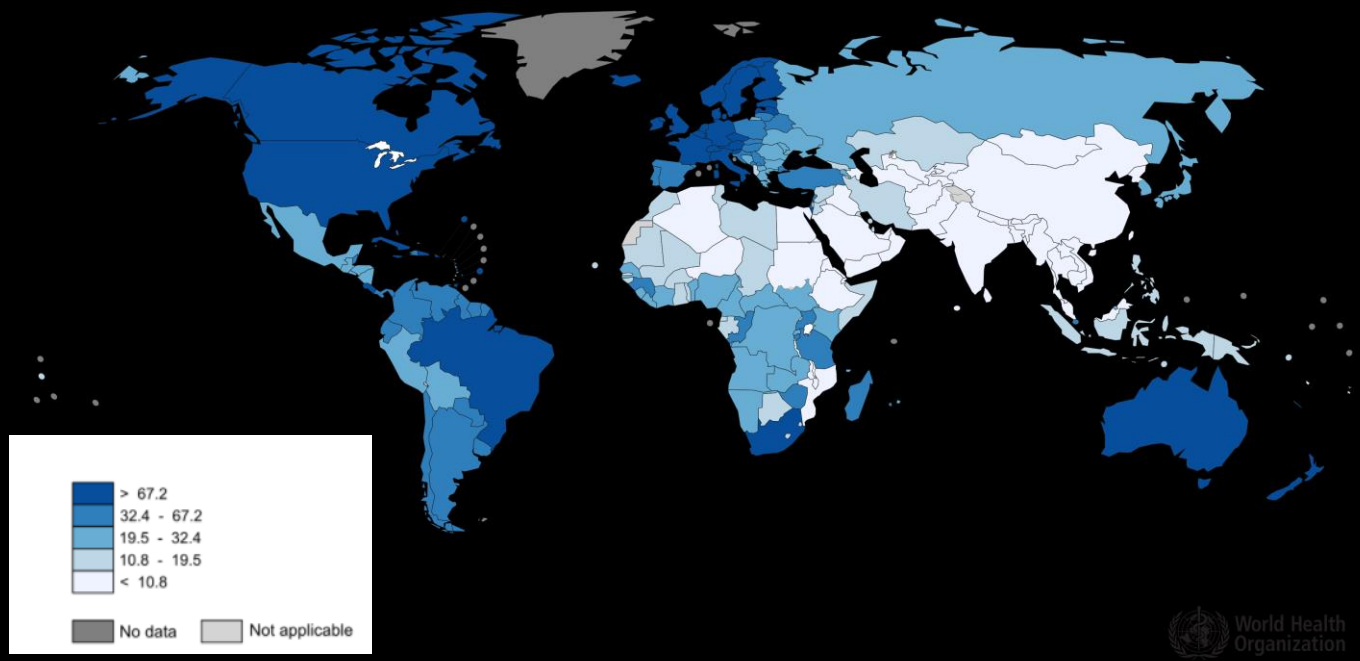
Treatment

PROSTATE CANCER INCIDENCE 2012

15% of cancers in men | 2nd most common

1.1M

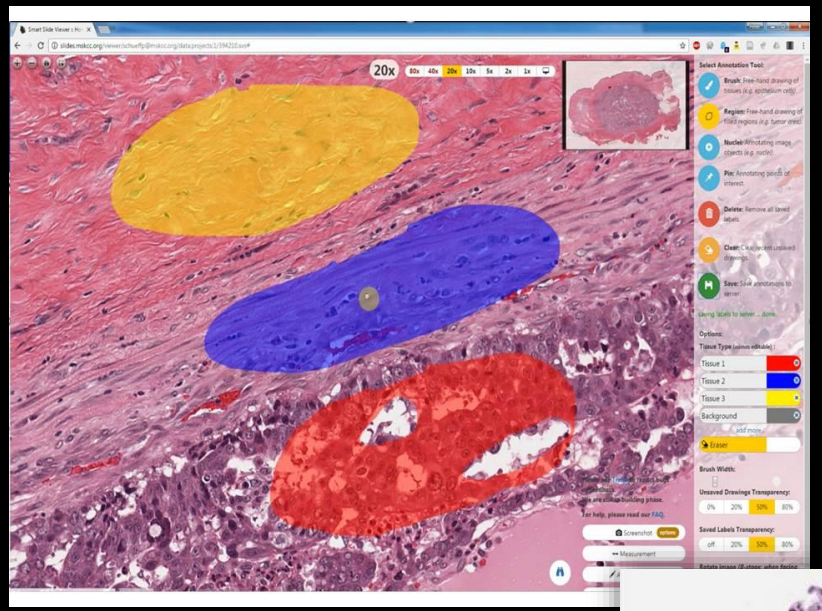
NEW CASES
2012



307K

DEATHS
2012

SOURCE: http://globocan.iarc.fr/old/FactSheets/cancers/prostate-new.asp



AI ASSISTS CLINICAL PRACTICE IN PATHOLOGY

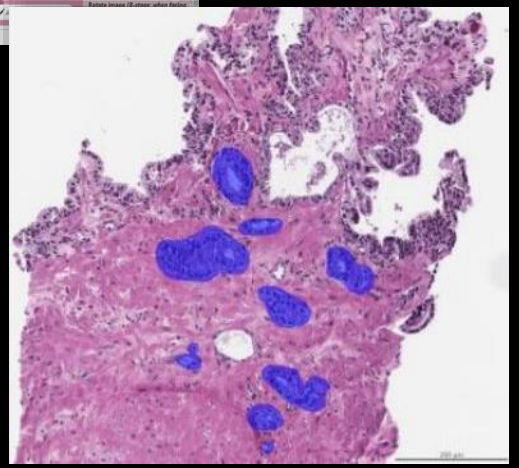
Paige.ai, a spin-off from Memorial Sloan Kettering Cancer Center (MSKCC), is developing the first AI-assisted clinical grade pathology model for prostate cancer.

Drawing on the medical expertise of MSKCC as a world renowned leading hospital, they have trained DL models using 15,000 prostate needle biopsies. Pathologists have annotated the images using the Paige.AI interface and their GPU enabled HPC cluster

DATA: 40K slides/month
1 PB by end 2018

ALGORITHMS: ML, CNN, GANs

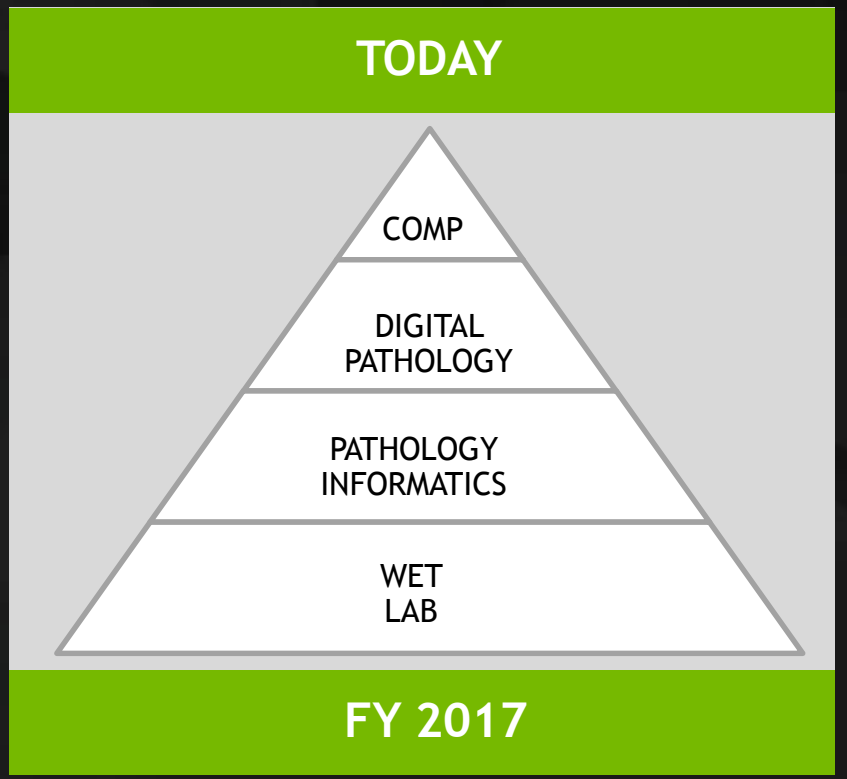
COMPUTE: GPU HPC CLUSTER



paige.AI

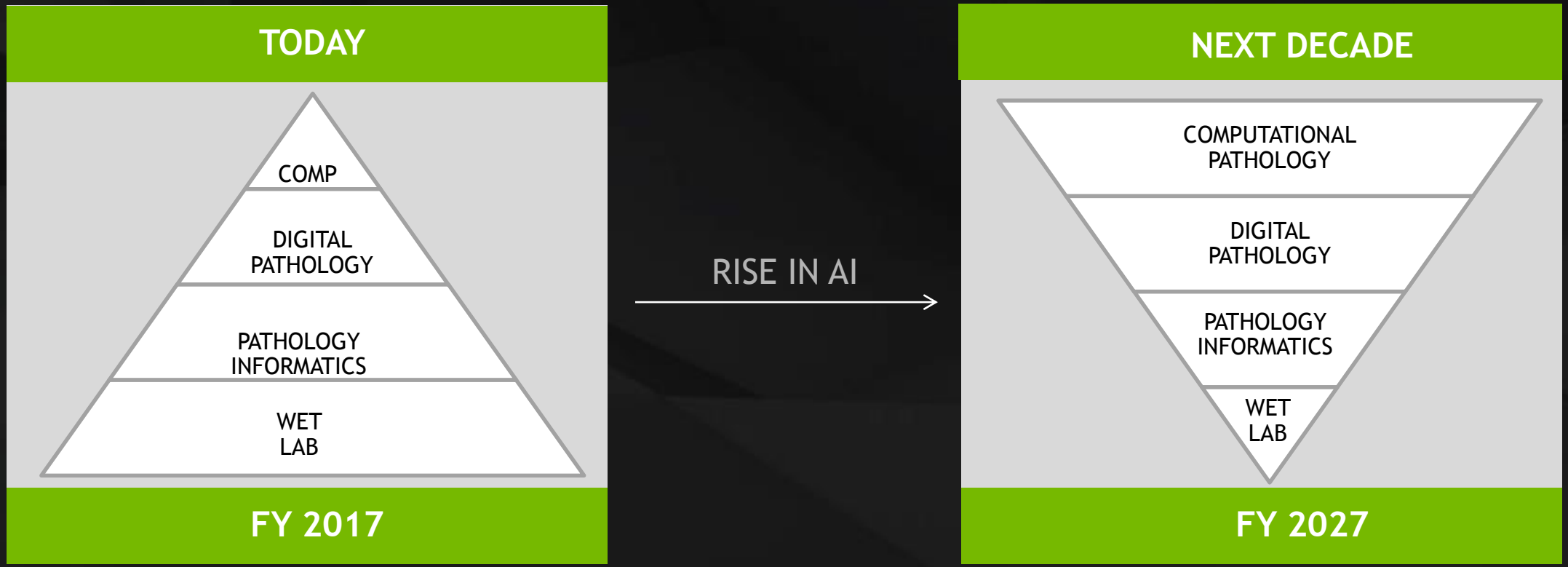
CLINICAL GRADE PATHOLOGY

Man and Machine: End to End Workflow



CLINICAL GRADE COMPUTATIONAL PATHOLOGY

Man and Machine: End to End Workflow

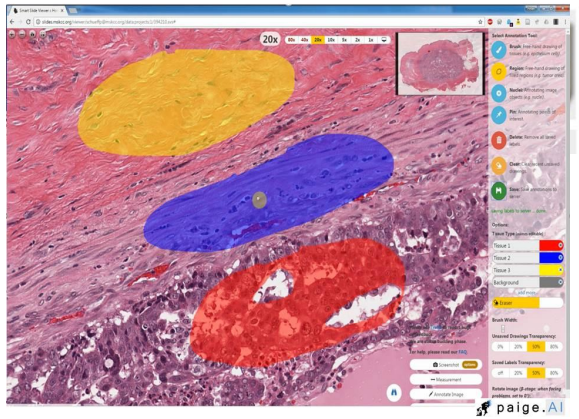


LEADERSHIP ACROSS THE ECOSYSTEM

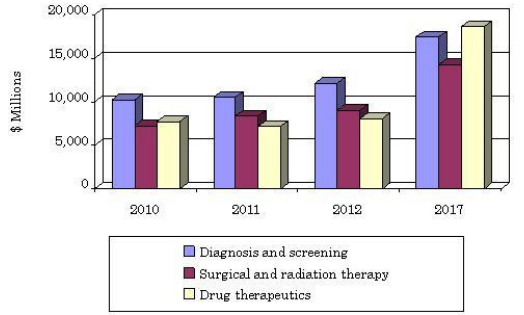
Prostate Cancer: $50B Market

Thomas Fuchs Lab

P AI G E



DL for Healthcare



Medical Research

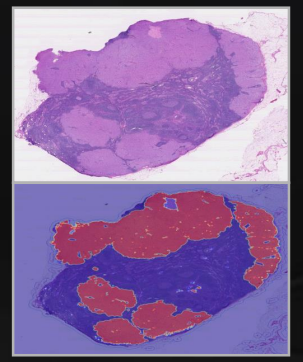
Start-up

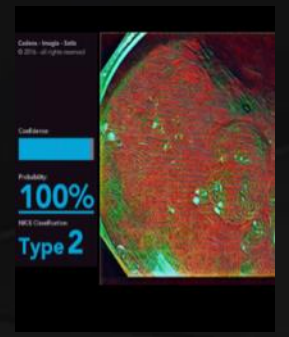
Enterprise

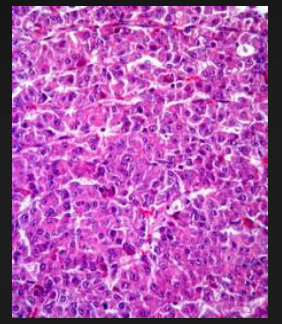
AI BRIDGING THE GAP

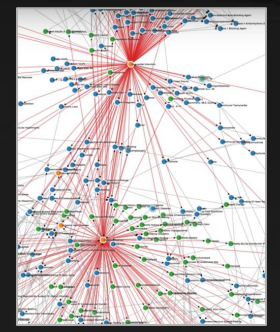
Aligned to healthcare market shifts

Drug Discovery | Development | Commercialization









DATA

IMAGES

SEARCH

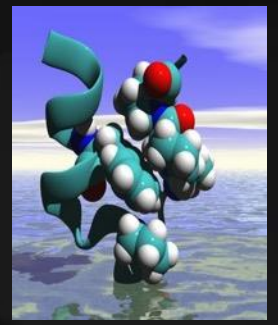
PREDICT

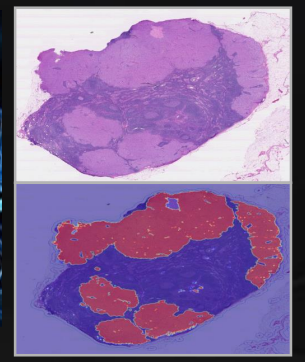
2012 2013 2014 2015 2016 2017 2018

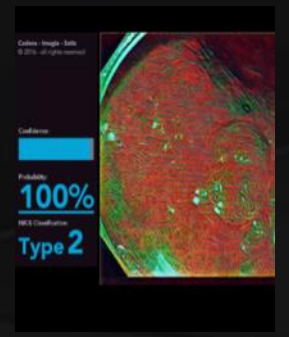
INNOVATE WITH AI AND HPC

Further Understand Cancer Biology and Bridge the Translational Gap

Drug Discovery | Development | Commercialization





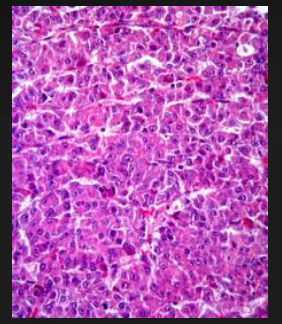


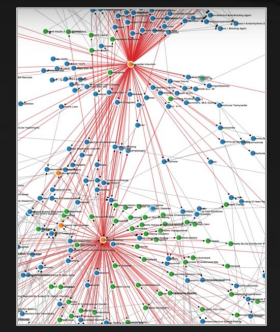
DATA

IMAGES

SEARCH

PREDICT





2012 2013 2014 2015 2016 2017 2018

LESSONS LEARNED

Healthcare and Biopharma Embrace AI

	KEY THEME
EXTERNAL CONSIDERATIONS	RISING HEALTHCARE COSTS PRESENT AN OPPORTUNITY FOR AI
NEEDS ANALYSIS	ALIGN APPS AND USE CASES WITH STRATEGIC IMPERATIVES
MANAGEMENT	**MAN AND MACHINE** **REGIONAL ECOSYSTEMS**
IMPLEMENTATION	C0-SOURCE, COLLABORATE, CO-CREATE, COOPERATE **ACROSS ECOSYSTEM**
RESULTS	FAIL FAST VIA EXPERIMENTATION, NEW VALUE BEST RESULTS and ROI WHEN ***BUSINESS AND IT ALIGNED*** ***EXECUTIVE SPONSORSHIP FROM BUSINESS CRITICAL***

“I AM AI” VIDEO