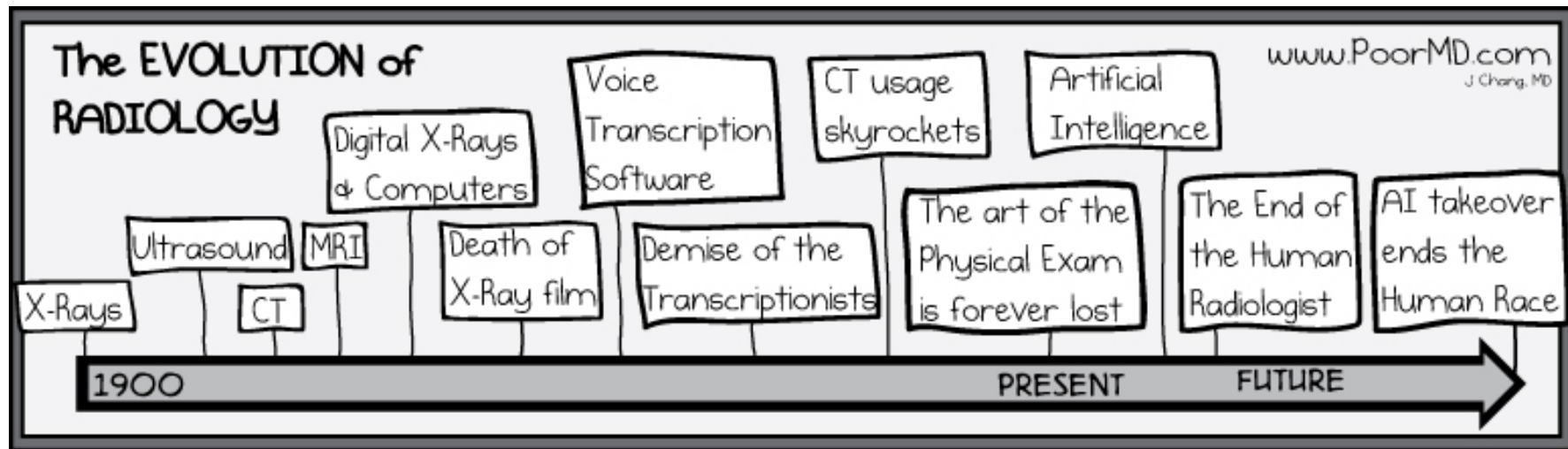# AI IN IMAGING
YOUR DATA AS A STRATEGIC ASSET

ESTEBAN RUBENS
GLOBAL ENTERPRISE IMAGING PRINCIPAL

PURE STORAGE

@PUREESTEBAN

PURESTORAGE®

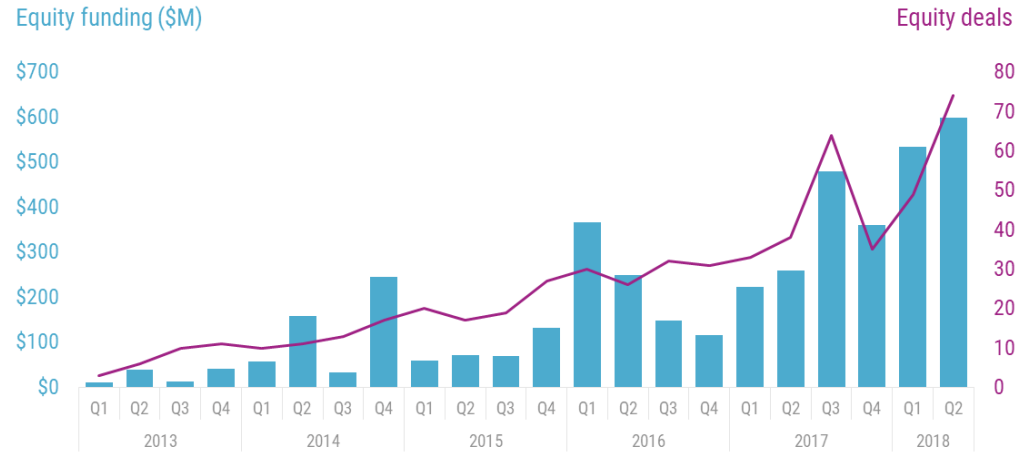# AI IN ENTERPRISE IMAGING: HYPE OR NOT?

AI IN HEALTHCARE: HYPE OR NOT?

What is necessary for AI to become a reality in healthcare?

– Support by funding agencies

  – NIH is funding AI

– Recognition by regulators

  – FDA approvals for CADe & CADx

  – FDA *De Novo* process

– Investment by industry

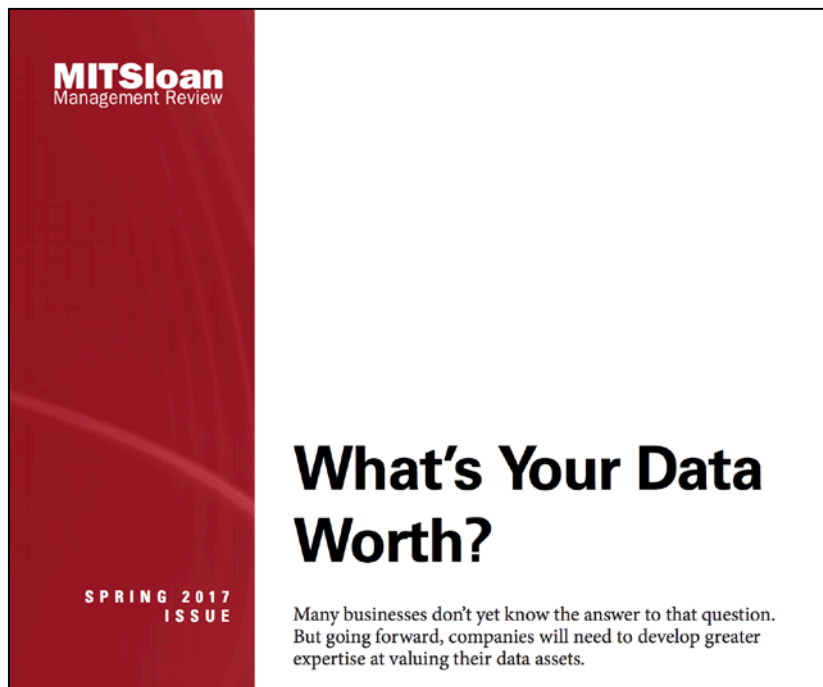## AI in healthcare funding hit a historic high in Q2'18

Disclosed equity funding, Q1'13 – Q2'18

Source: cbinsights.com

CB INSIGHTS

PURESTORAGE®

IMAGING DATA IS AN ASSET

MITSloan
Management Review

What's Your Data Worth?

SPRING 2017
ISSUE

Many businesses don't yet know the answer to that question. But going forward, companies will need to develop greater expertise at valuing their data assets.
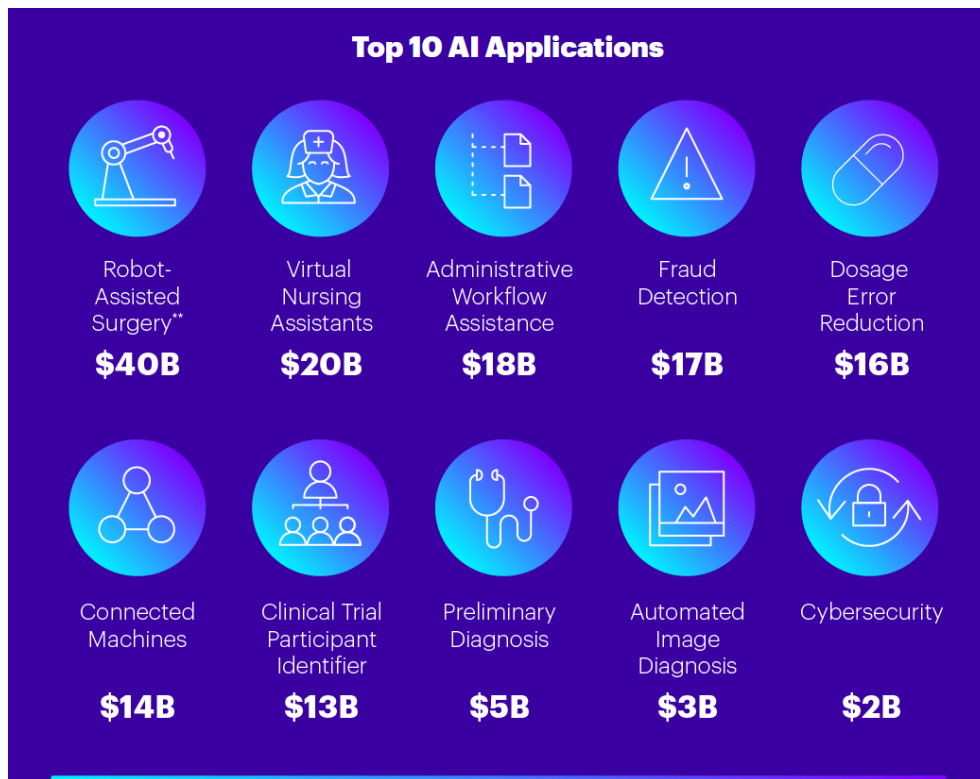
The Economist

MAY 6TH–12TH 2017

Theresa May v Brussels
Ten years on: banking after the crisis
South Korea's unfinished revolution
Biology, but without the cells

The world's most valuable resource

Data and the new rules of competition

PURESTORAGE®

IMAGING DATA IS AN ASSET

Top 10 AI Applications

Application	Value
Robot-Assisted Surgery**	$40B
Virtual Nursing Assistants	$20B
Administrative Workflow Assistance	$18B
Fraud Detection	$17B
Dosage Error Reduction	$16B
Connected Machines	$14B
Clinical Trial Participant Identifier	$13B
Preliminary Diagnosis	$5B
Automated Image Diagnosis	$3B
Cybersecurity	$2B

Accenture

PURESTORAGE®

IMAGING DATA IS AN ASSET
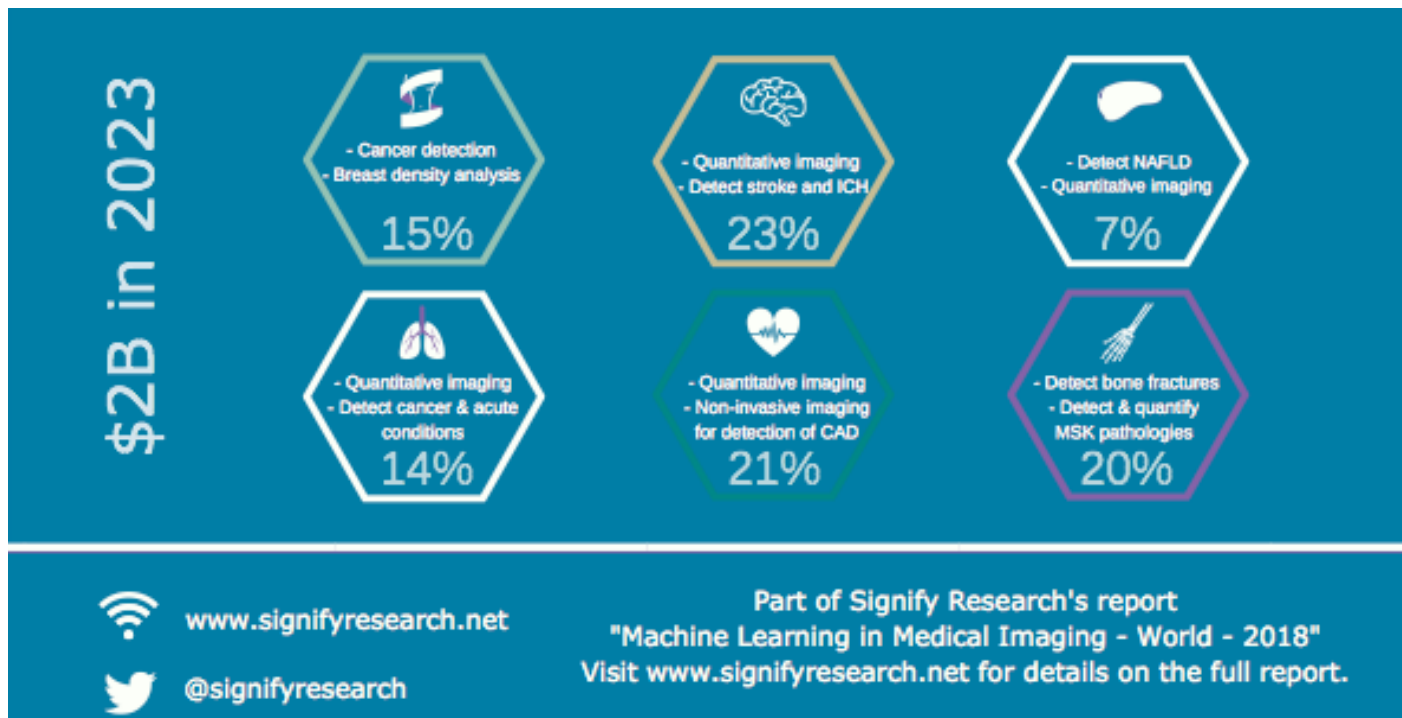
AI IN HEALTHCARE

RADIOLOGIST BURNOUT

Physician burnout is a serious problem, particularly in radiology.

RSNA News

Unique Stressors Lead to Burnout in Radiology

Income and reimbursement issues are among the top reasons radiologists are experiencing high levels of stress and burnout, experts say. BY MARY HENDERSON

Journal of the American College of Radiology

Available online 16 October 2018

In Press, Corrected Proof ⓘ

Case Studies in Leadership

Prevalence of Burnout Among Pediatric Radiologists

Rama S. Ayyala MD [a] ⌂ ✉, Firas S. Ahmed MD, MPH [d], Carrie Ruzal-Shapiro MD [b], George A. Taylor MD [c]

[a] Department of Diagnostic Imaging, Rhode Island Hospital–Hasbro Children's Hospital, Warren Alpert Medical School of Brown University, Providence, Rhode Island

[b] Department of Radiology, Columbia University Medical Center, Morgan Stanley Children's Hospital, New York, New York

[c] Department of Radiology, Columbia University Medical Center, New York, New York

[d] Department of Radiology, Boston Children's Hospital, Harvard Medical School, Boston, Massachusetts

Available online 16 October 2018.

⊟ Show less

https://doi.org/10.1016/j.jacr.2018.08.016

Get rights and content

Bulletin
ACR Bulletin February 2017

Battling Burnout and Its Consequences

How can we tackle the increasing incidence of physician stress, anxiety, and depression?

Radiologist burnout: Worse than we thought?
By Kate Madden Yee, AuntMinnie.com staff writer

December 28, 2016 -- It's no secret that physicians are susceptible to workplace burnout, and radiologists are no exception. The syndrome can be dangerous, affecting the well-being of physicians and also the quality of care provided to patients. But how common is burnout?

03/29/2017 | 🖻 Partners in News

Partners HealthCare President and CEO David Torchiana, MD, joins group of health system leaders in recognizing physician burnout as a public health crisis

■ Workforce Development ■ Medical Education

PURESTORAGE®

AI IN EI FILLS THE GAPS

DATA DELUGE

Shortage of radiologists

"There are only **650 registered radiology specialists for Indonesia's 235 million population**. A similar trend is seen as well in densely populated countries such as **Malaysia** and **Thailand**."

Dr Shih-chang Wang, University of Sydney

Radiologist shortage 'affecting cancer care' in the UK

By Hugh Pym
Health editor

22 August 2018

BBC Sign in   News Sport Weather Shop Earth Travel

NEWS

Home Video World US & Canada UK Business Tech Science Stories Ente

Scotland Scotland Politics Scotland Business Edinburgh, Fife & East Glasgow & West

Radiologist shortage in Scotland 'red alert' warning

14 August 2018

The Tribune
VOICE OF THE PEOPLE
HOME | NATION | WORLD | PUNJAB | HARYANA | HIMACHAL | J & K | UTTARAKHAND | CITIES | C

Amritsar
Posted at: Feb 9, 2017, 12:55 AM; last updated: Feb 9, 2017, 12:55 AM (IST)
Shortage of radiologists aggravates patients' misery

Bengaluru solves crippling radiologist shortage through teleradiology, e-lectures

By Nirad Mudur, Bangalore Mirror Bureau | Updated: Oct 3, 2016,

6,590 views | Nov 8, 2014, 09:10pm

Philippine Startup Takes On Global Radiologist Shortage

TE Techonomy Contributor
Techonomy Contributor Group
Techonomy

Shortages of radiologists and pathologists? Alberta Health Services responds.

PURESTORAGE
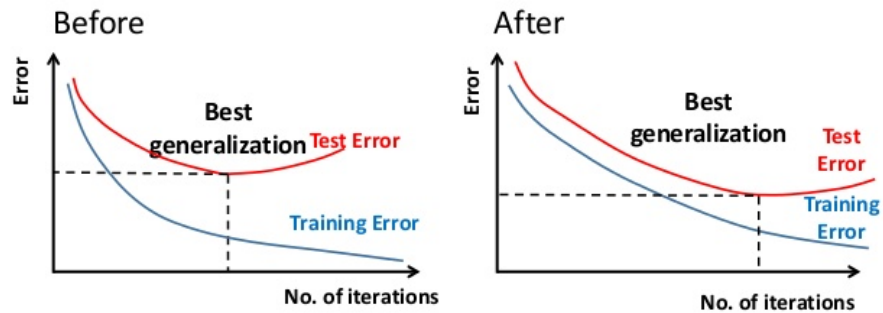
IMAGING DATA IS AN ASSET

Vast amounts of annotated data

+

Multiple training runs

Increase model inference accuracy

Solution: Increase amount of training data

Before

After

Microsoft

PURESTORAGE®

LOCAL MODEL TRAINING IS NECESSARY

Variable generalization performance of a deep learning model to detect pneumonia in chest radiographs: A cross-sectional study

https://doi.org/10.1371/journal.pmed.1002683

Conclusion

Pneumonia-screening CNNs achieved better internal than external performance in 3 out of 5 natural comparisons. When models were trained on pooled data from sites with different pneumonia prevalence, they performed better on new pooled data from these sites but not on external data. CNNs robustly identified hospital system and department within a hospital, which can have large differences in disease burden and may confound predictions.

10

PURESTORAGE®

LOCAL MODEL TRAINING IS NECESSARY

"If a given hospital, clinic, or practice has significant variation in their population's makeup or imaging protocols, then it is highly likely that this model doesn't do 'X' and perform as it is supposed to. **Don't trust any algorithms without validating them on your local data, patients, or protocols!**"

https://www.auntminnie.com/index.aspx?sec=sup&sub=aic&pag=dis&ItemID=123535

PURESTORAGE®

LOCAL MODEL TRAINING IS NECESSARY

Better medicine through machine learning: What's real, and what's artificial?

https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1002721

"Irrational extrapolation"—the assumption that algorithms trained on an easy-to-obtain set of patients or data will lead to accurate models that act in each patient's best interest—**must be stringently avoided** until algorithms can correct for such biases and use clinical data to reason about disease severity and trajectory.

PURESTORAGE®

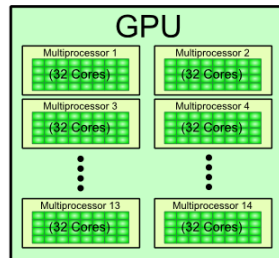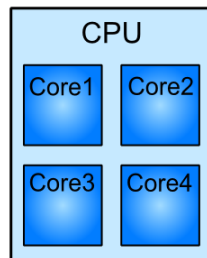# INFRASTRUCTURE MATTERS

- **What is GPU starvation anyway?**
- **Why do we care?**
- **How is this related to AI in healthca**

FEED ME

PURESTORAGE®

INFRASTRUCTURE MATTERS

CPU/GPU Architecture Comparison

- **Fast compute**
  - o **GPUs for highly parallel workloads**

- **Fast networks**
  - o **100 Gbps!**

- **Fast storage**
  - o **Highly-scalable, low-latency storage optimized for parallel access**
  - o **Scale-out all-flash arrays**

PURESTORAGE®

INFRASTRUCTURE MATTERS

- **Bring AI from the lab to the bedside**
- **Is your IT infrastructure ready?**
- **What may have worked yesterday ~~may not~~ will not work tomorrow**
- **Retrofitting is not always a good idea**

© Getty Images

PURESTORAGE®

INTEGRATING AI TO EXISTING WORKFLOWS

- **Train models appropriately**
- **Clinical use requires:**
  - **High accuracy**
  - **Specificity & sensitivity depending on use**
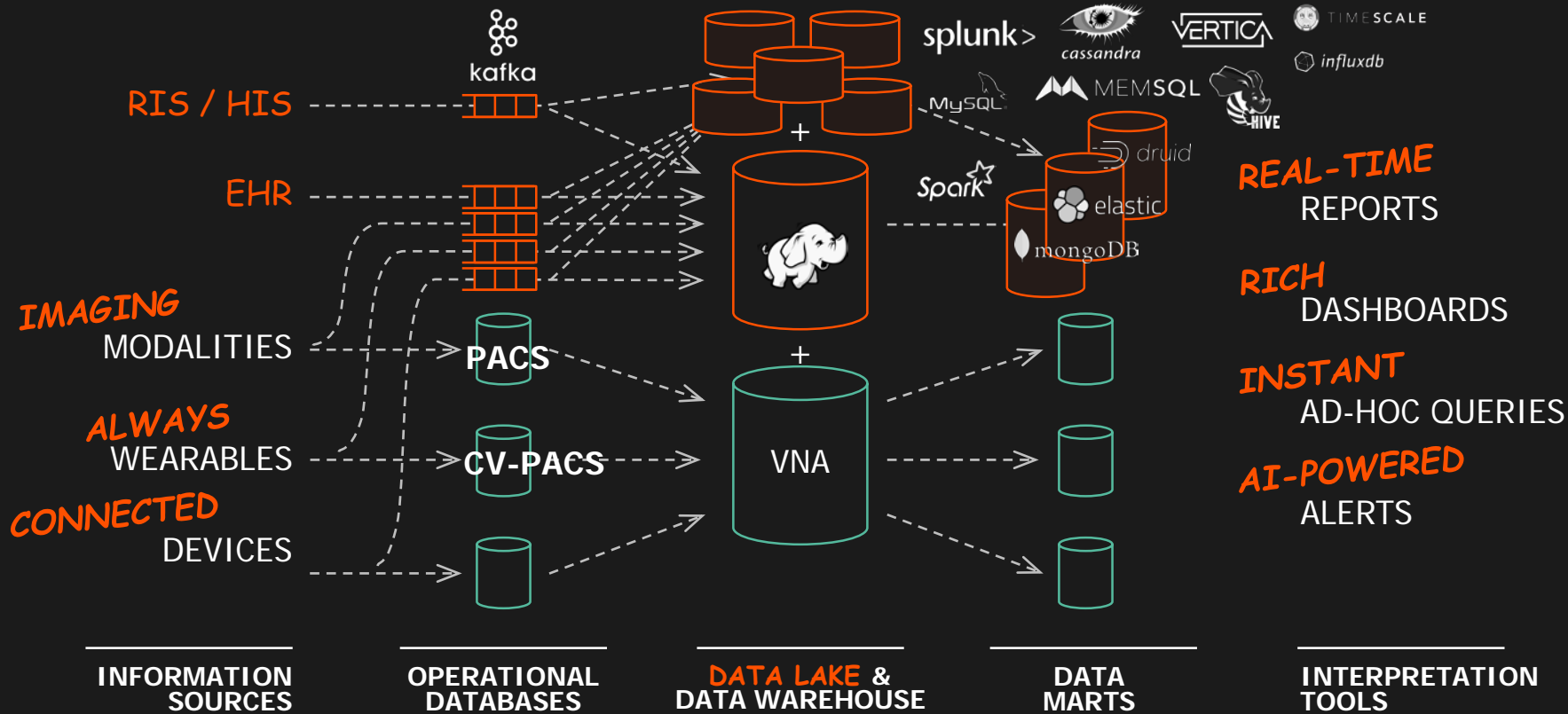- **Low latency**
  - **Even under heavy load**

PURESTORAGE®

DATA HUB: CLINICAL & RESEARCH IMAGING

- **Most organizations have data silos**
  - **Silo for clinical data (PACS, VNA)**
  - **Silo for research**
- **Moving data between silos is slow and annoying**

PURESTORAGE®

KEY TAKEAWAYS

- **Data is valuable in general, more so in healthcare**
  - Healthcare data is extremely valuable to train AI/DL models
- **Everyone should be involved in training models**
  - No one can expect to rely on shrink-wrapped models or products for AI in Imaging
- **Infrastructure Matters for AI in Imaging**
  - GPU compute, fast networks, fast storage
- **It is possible to start small**
  - Anyone can do this
  - Everyone should
  - Open source software, online courseware, simple infrastructure

PURESTORAGE®