



# Fear, Hype, and Challenges of AI in Radiology

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# Speaker Introduction



Woojin Kim, MD  
Chief Medical Information Officer  
Nuance Communications

## Stronger together: AI performs better with radiologist input

October 15, 2018 | [Michael Walter](#) | [Artificial Intelligence](#)

NEWS | **ARTIFICIAL INTELLIGENCE** | OCTOBER 26, 2018

## ACR Data Science Institute Releases Medical Artificial Intelligence Use Cases

## Artificial intelligence in radiology: Friend or foe?

By Whitney J. Palmer

Oct 4, 2018

[DI Executive](#), [Technology](#)

## C-MIMI: 8 myths about AI in radiology -- and why they're wrong

By Brian Casey, AuntMinnie.com staff writer

September 10, 2018 -- SAN FRANCISCO - Although radiology has finally warmed

## AI and the Future of Radiology

By Ajay Kohli, MD and Max Henderson, PhD

Oct 22, 2018

## Ethical AI in radiology is focus of draft statement

By Erik L. Ridley, AuntMinnie staff writer

March 5, 2019 -- The rapid development of artificial intelligence (AI) [March 05, 2019](#)

[Radiology](#) > [Diagnostic Radiology](#)

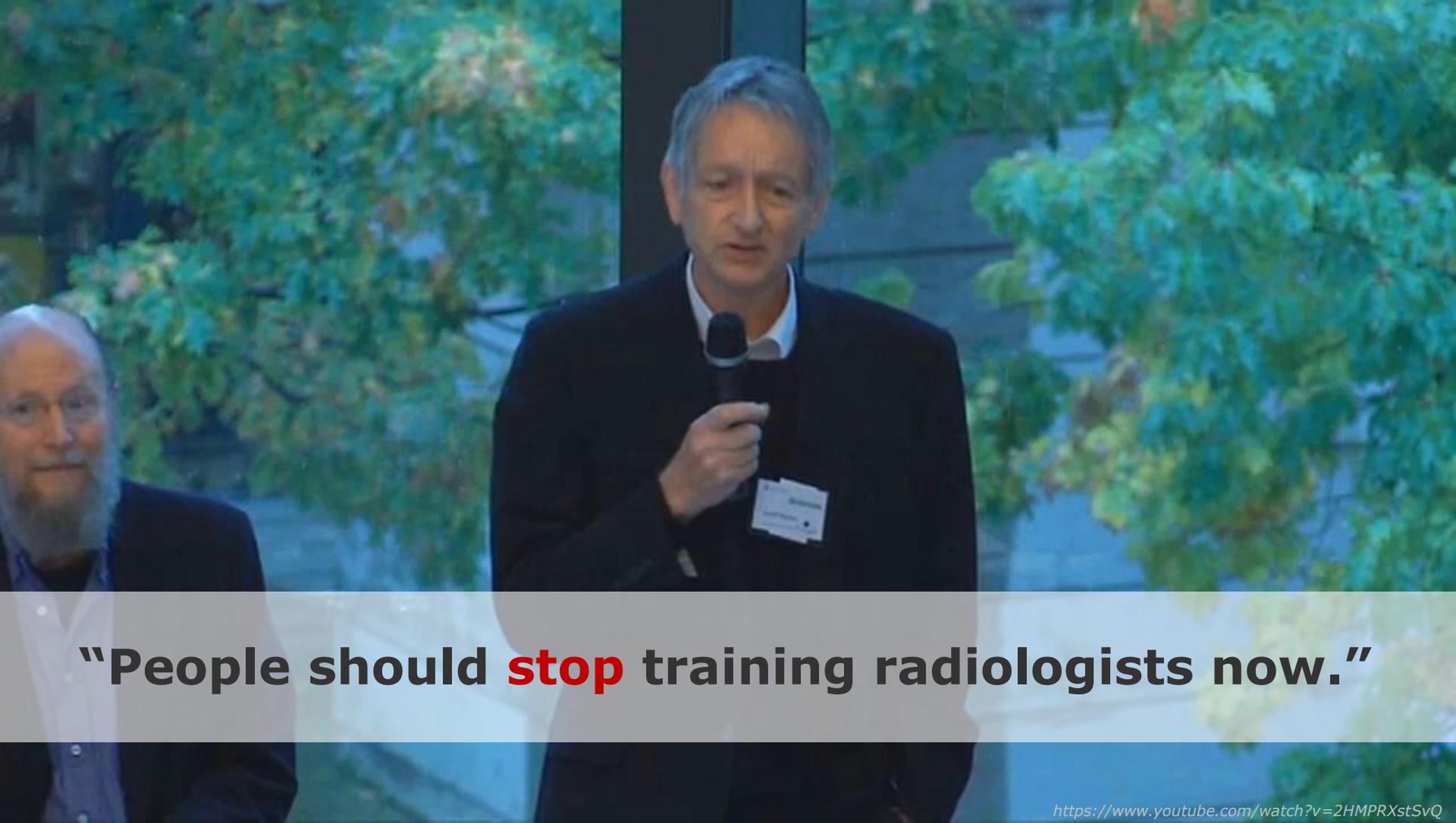
## AI Goes Head-to-Head With Radiologists for Mammography

— Automation found non-inferior, but many questions remain

by Diana Swift, Contributing Writer

# Fear Hype Challenges

# Fear Hype Challenges



“People should **stop** training radiologists now.”

# The End of Radiology? Three Threats to the Future Practice of Radiology

Katie Chockley, BA<sup>a</sup>, Ezekiel Emanuel, MD, PhD<sup>a</sup>

## Abstract

Radiology faces at least three major, potentially fatal, threats. First, as care moves out of the hospital, there will be a decrease in demand for imaging. More care in patients' homes and in other nonhospital settings means fewer medical tests, including imaging. Second, payment reform and, in particular, bundled payments and capitation mean that imaging will become a cost rather than a profit center. These shifts in provider payment will decrease the demand for imaging and disrupt the practice of radiology. Potentially, the ultimate threat to radiology is machine learning. Machine learning will become a powerful force in radiology in the next 5 to 10 years and could end radiology as a thriving specialty.

**Key Words:** Machine learning, payment reform, technology, future of health care

*J Am Coll Radiol 2016;13:1415-1420. Copyright © 2016 American College of Radiology*

“**Indeed, in a few years there may no specialty called radiology.**”



## Analytics

# Machine learning will replace human radiologists, pathologists, maybe soon

As artificial intelligence, cognitive computing and machine learning systems become better than humans at medicine and cost less, it might even become unethical not to replace people.

By **Tom Sullivan** | May 15, 2017 | 03:46 PM



Tweets  
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Followers  
**152K**

Likes  
**403**

Following



**Andrew Ng**  @AndrewYNg · Jul 11

Posting with permission. AI people: What would you say to him? I will share my thoughts later.

From: [REDACTED]  
Date: Sun, Jul 9, 2017 at 3:23 PM  
Subject: Radiology  
To: Andrew Ng

Dear Andrew Ng,

I'm 3 years into specialist radiology training. Should I quit and do something else? I.e. How close are radiologists to being replaced?

Many thanks

Dr [REDACTED]

 367

 721



 1.2K



## SPECIAL REPORT

Artificial intelligence: The impact on jobs

## Automation and anxiety

*Will smarter machines cause mass unemployment?*

As a result, says Andrew Ng, a highly trained and specialised radiologist may now be in greater danger of being replaced by a machine than his own executive assistant:

***"She does so many different things that I don't see a machine being able to automate everything she does any time soon."***

## SPECIAL REPORT

Artificial intelligence: The impact on jobs

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*Will smarter machines cause mass unemployment?*

Save



As a result, says Andrew Ng, a highly trained and specialised radiologist may now be in greater danger of being replaced by a machine than his own executive assistant:

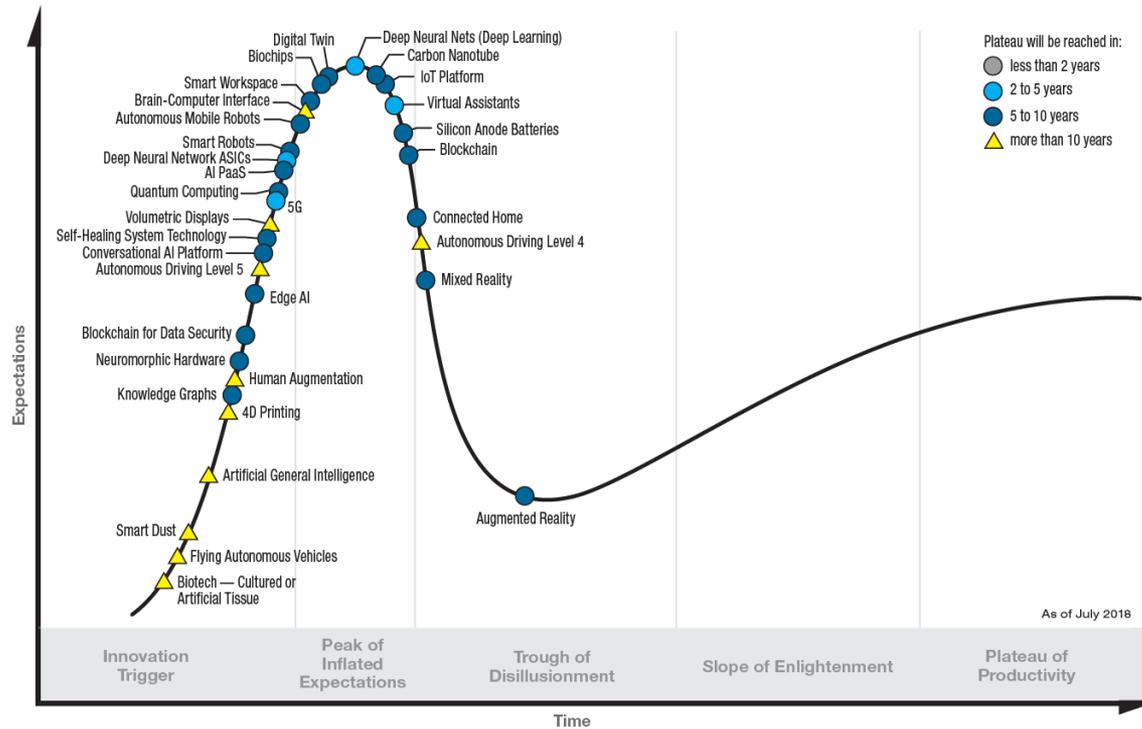
***"A radiologist does so many different things that I don't see a machine being able to automate everything she does any time soon."***

#FOMO



# Fear Hype Challenges

# Hype Cycle for Emerging Technologies, 2018



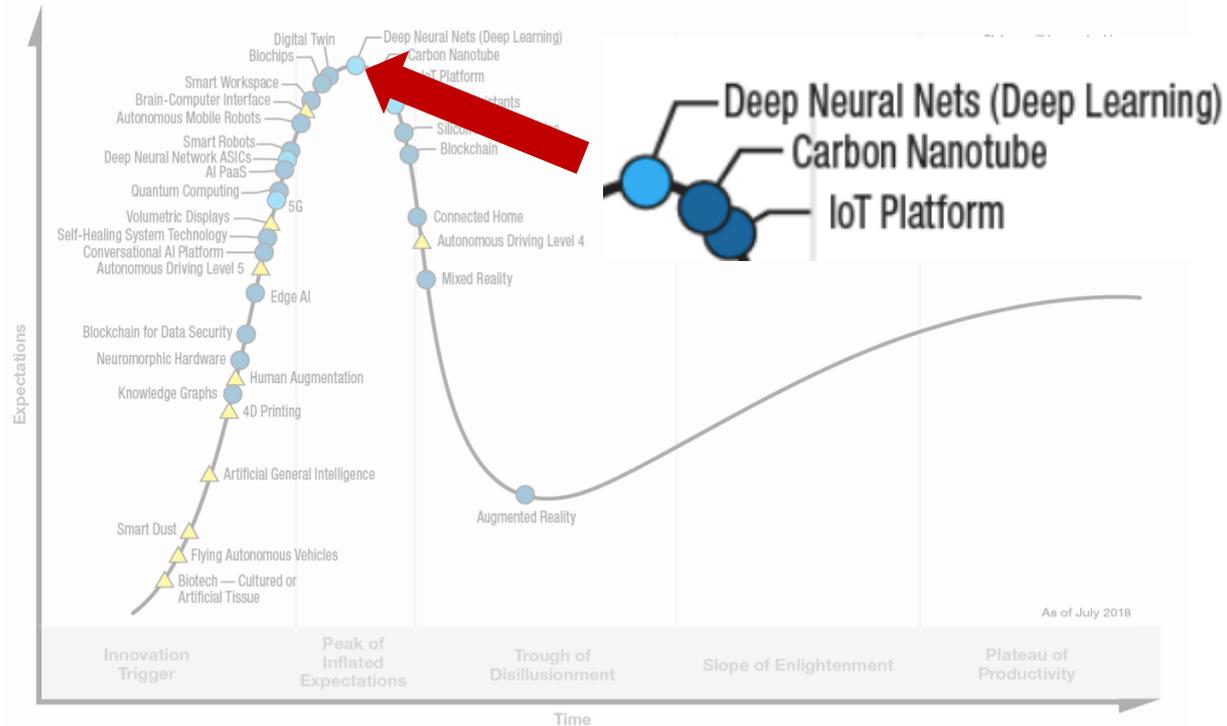
[gartner.com/SmarterWithGartner](https://www.gartner.com/SmarterWithGartner)

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# Hype Cycle for Emerging Technologies, 2018



[gartner.com/SmarterWithGartner](https://www.gartner.com/SmarterWithGartner)

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**Gartner**

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## General Imaging



## Cardiovascular Imaging



## Neurological Imaging



## Breast Imaging



## Lung Imaging



Company	Country	Funding (\$m)	Application
<b>Americas</b>			
HeartFlow	USA	476.6	Cardiovascular
VoxelCloud	USA	80.5	General Imaging
Arterys	USA	43.7	General Imaging
<b>EMEA</b>			
Zebra Medical	Israel	50	General Imaging
Ultromics	UK	16.2	Cardiovascular
Brainomix	UK	15.8	Neurological
<b>Asia</b>			
Infervision	China	73.1	General Imaging
Deepwise	China	50.6	General Imaging
12 Sigma	China	31.8	General Imaging

Other key findings from our analysis show:

- There are over 120 start-ups developing artificial intelligence solutions for medical imaging.
- Since 2014, these companies have received investments of more than \$1.2 billion.
- Funding continues to rise each year, with \$580 million invested in 2018.

# Deep learning algorithm detects malignant pulmonary nodules better than radiologists

September 25, 2018 | [Michael Walter](#) | [Artificial Intelligence](#)



NOVEMBER 15, 2017

## Stanford algorithm can diagnose pneumonia better than radiologists

*Stanford researchers have developed a deep learning algorithm that evaluates chest X-rays for signs of disease. In just over a month of development, their algorithm outperformed expert radiologists at diagnosing pneumonia.*

## Lightning-fast AI detects disease in CT scans faster than radiologists

August 14, 2018 | [Michael Walter](#) | [Artificial Intelligence](#)

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September 25, 2018 | [Michael Walter](#) | [Artificial Intelligence](#)



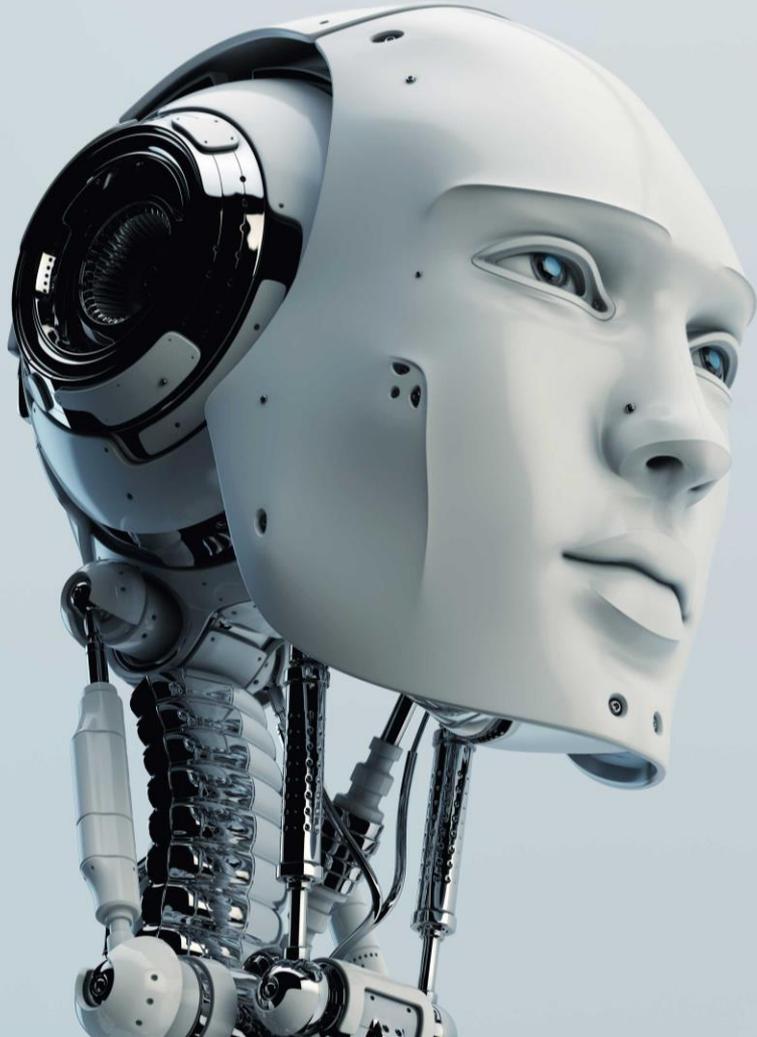
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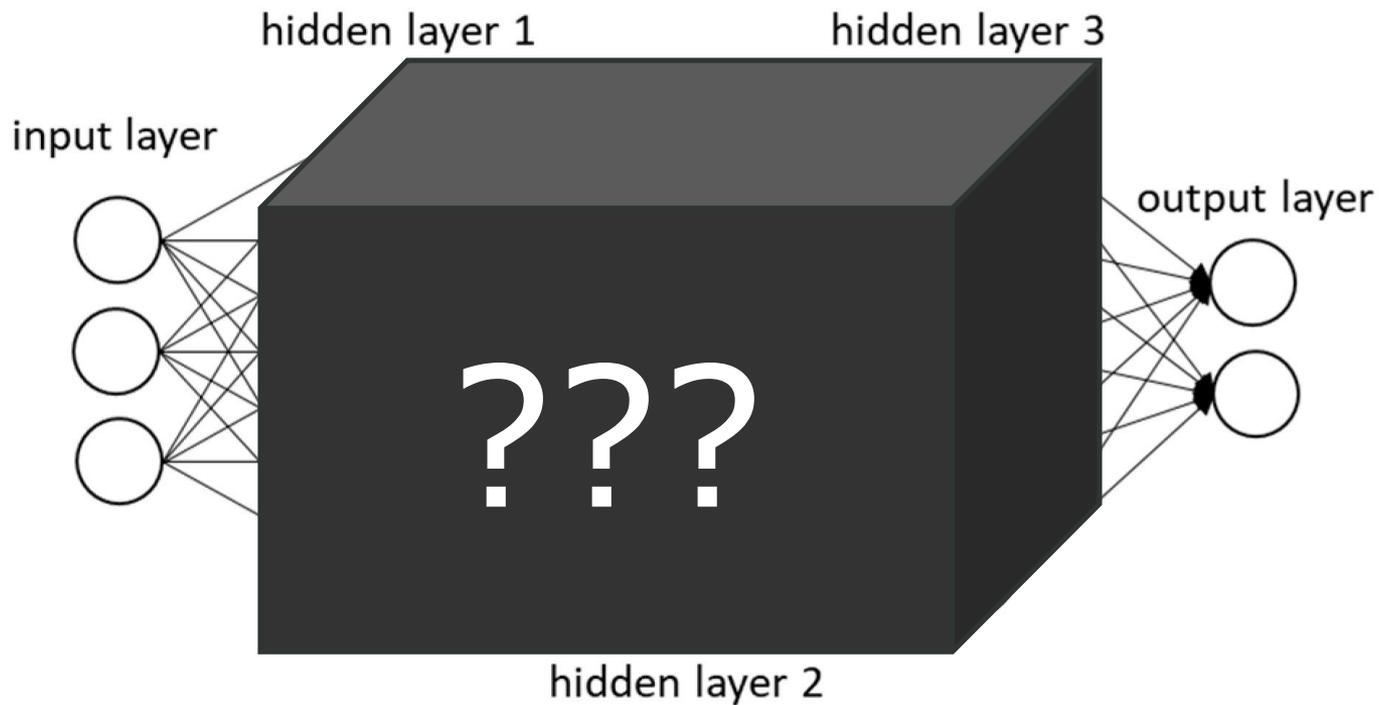
# **Hype vs Reality**



**PROMISE**



**REALITY**



## **IBM's Watson assigns patients to MRI contrast**

By Abraham Kim, AuntMinnie.com staff writer

October 3, 2017 -- Determining which patients need contrast for musculoskeletal MRI scans can soak up a lot of time and resources. What if you could use artificial intelligence instead? Researchers found that IBM Watson could help optimize the process, according to a September 18 paper in the *Journal of Digital Imaging*.

**Table 3** Examples of the 25 classification errors for which Watson disagreed with both the original protocol and second reader

Clinical indication	Original protocol	Second reader	Watson prediction	Confidence
POST OP FOR REMOVAL OF THORACIC TUMOR Reason: POST-OP FOR THORACIC TUMOR	WC	WC	NC	0.53
49 M W/ HX OF TB IN PAST WITH 6 MONTH HISTORY OF GROWING L THIGH 10X10X10 MASS, HARD, PAINFUL; NEEDS L LEG TOO. SEE CT SCAN Reason: 49 M W/ 10X10X10 MASS ON L THIGH	WC	WC	NC	0.8
S/P MIN TRAUMATIC FX LEFT HUMERUS; PLS DO CONTRAST MRI FOR EVAL Reason: EVAL FOR PATHOLOGICAL FX	WC	WC	NC	0.99
W/ SPINOUS PROCESS FRACTURE Reason: W/ SPINOUS PROCESS FRACTURE	NC	NC	WC	0.72
SEA NEW R SCIATICA Reason: L SPINE TTPNEW R SCIATICA	NC	NC	WC	0.77
81M ESRD ON HD, WITH STAPH BACTEREMIA AND NEW CERVICAL SPINE TENDERNESS TO PALPATION Reason: EVALUATE FOR EPIDURAL ABSCESS	NC	NC	WC	0.99

The “black-box” nature of deep learning algorithms made it difficult to ascertain the source of error in many cases. There was one critical error in assigning contrast to a patient with end-stage renal disease, highlighted here. This may be due to the lack of sufficient related training examples

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679 views | Oct 15, 2018, 03:23am

# Is Black Box Human Better Than Black Box AI?



**Kate Levchuk** Contributor

**COGNITIVE WORLD** Contributor Group ⓘ

AI & Big Data

*Futuristic Blogger*



LABORATORY OF  
MEDICAL IMAGING  
AND COMPUTATION



# Real-World Performance of Deep-Learning-Based System for Intracranial Hemorrhage Detection

**Sehyo Yune, MD MPH MBA**

Hyunkwang Lee, Stuart Pomerantz, Javier Romero, Shahmir Kamalian,  
Ramon Gonzalez, Michael Lev, Synho Do

Department of Radiology  
Massachusetts General Hospital



# Model Performance Comparison



## Selected test dataset

		Model Prediction		
		ICH (+)	ICH (-)	
Clinical report + Expert confirmation	ICH (+)	98	2	Sensitivity: 98%
	ICH (-)	5	95	Specificity: 95%
		PPV: 95.1%	NPV: 97.9%	

## Real-world test dataset

		Model Prediction		
		ICH (+)	ICH (-)	
Clinical report	ICH (+)	142	21	Sensitivity: 87.1%
	ICH (-)	1,018	1,425	Specificity: 58.3%
		PPV: 12.2%	NPV: 98.5%	

NPV, negative predictive value; PPV, positive predictive value



# Model Performance Comparison



**Sensitivity 98%** →

Selected test dataset

		Model Prediction		
		ICH (+)	ICH (-)	
Clinical report Expert confirmation	ICH (+)	100	2	Sensitivity: 98%
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Real-world test dataset  
**PPV 95.1%** →

		Model Prediction		
		ICH (+)	ICH (-)	
Clinical report	ICH (+)	142	21	Sensitivity: 87.1%
	ICH (-)	10	100	Specificity: 58.3%
		PPV: 12.2%	NPV: 98.5%	

**NPV 97.9%** →

NPV, negative predictive value; PPV, positive predictive value



# Model Performance Comparison



**Sensitivity 98%** → **87.1%**

Selected test dataset

		Model Prediction		
		ICH (+)	ICH (-)	
Clinical report Expert confirmation	ICH (+)	100	0	Sensitivity: 98% Specificity: 95%
	ICH (-)	5	95	
		PPV: 95.1%	NPV: 97.9%	

**Real-world PPV 95.1%** → **12.2%**

		Model Prediction		
		ICH (+)	ICH (-)	
Clinical report	ICH (+)	142	21	Sensitivity: 87.1% Specificity: 58.3%
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		PPV: 12.2%	NPV: 98.5%	

**NPV 97.9%** → **98.5%**

NPV, negative predictive value; PPV, positive predictive value



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# Artificial Intelligence May Fall Short When Analyzing Data Across Multiple Health Systems

*Study shows deep learning models must be carefully tested across multiple environments before being put into clinical practice.*

**New York, NY (November 06, 2018)** – Artificial intelligence (AI) tools

## Most radiology AI studies lack proper validation

By Erik L. Ridley, AuntMinnie staff writer

March 8, 2019 -- Radiology artificial intelligence (AI) algorithms must be properly validated on external image data before being used clinically for image analysis tasks. But most studies in the literature haven't performed this crucial step, according to research published in the March issue of the *Korean Journal of Radiology*.

Original Article | Artificial Intelligence

eISSN 2005-8330

<https://doi.org/10.3348/kjr.2019.0025>

Korean J Radiol 2019;20(3):405-410

Korean Journal of Radiology

KJR



# Design Characteristics of Studies Reporting the Performance of Artificial Intelligence Algorithms for Diagnostic Analysis of Medical Images: Results from Recently Published Papers

Dong Wook Kim, MD<sup>1\*</sup>, Hye Young Jang, MD<sup>2\*</sup>, Kyung Won Kim, MD, PhD<sup>2</sup>, Youngbin Shin, MS<sup>2</sup>, Seong Ho Park, MD, PhD<sup>2</sup>

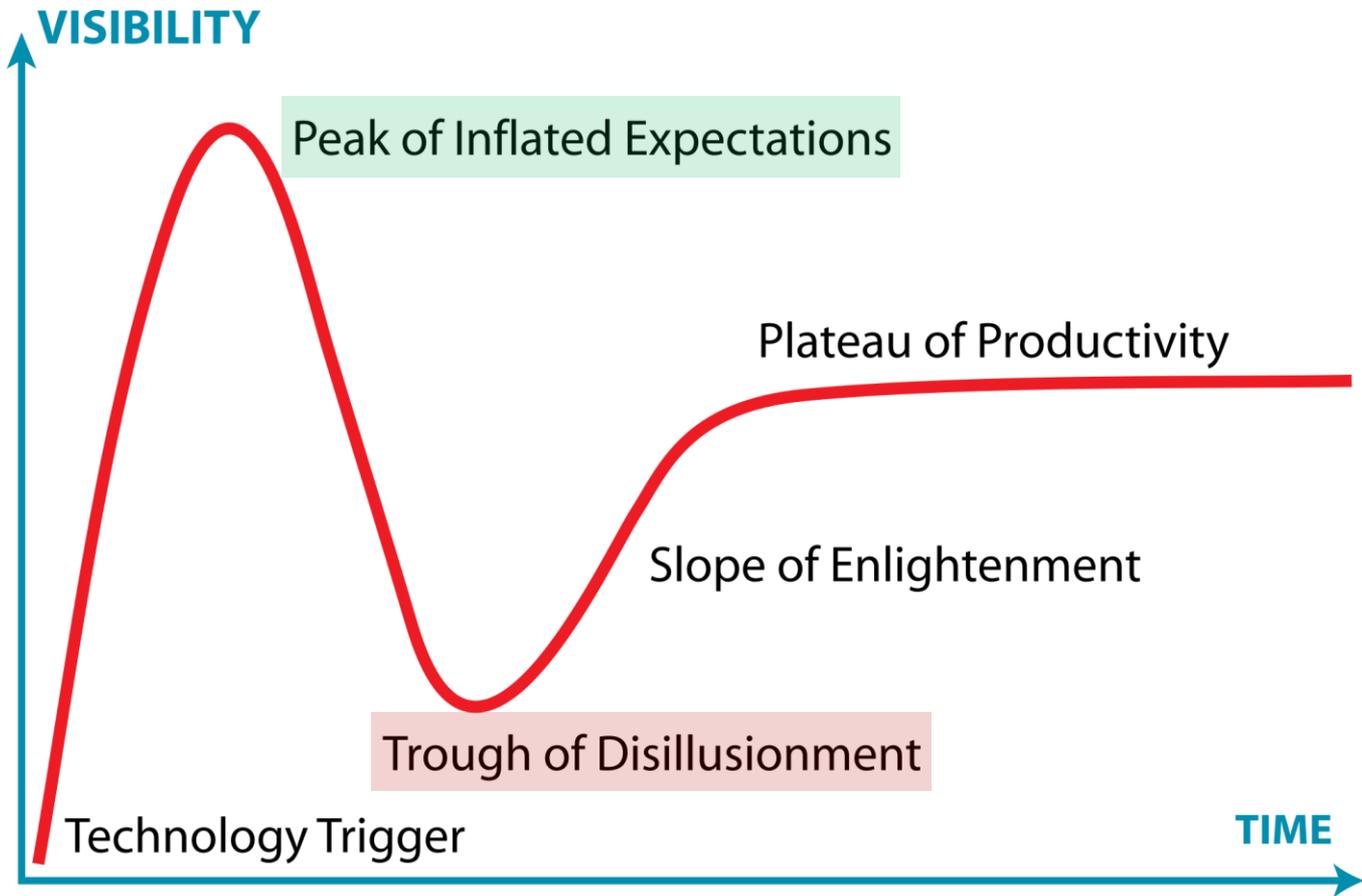
<sup>1</sup>Department of Radiology, Taeon-gun Health Center and County Hospital, Taeon-gun, Korea; <sup>2</sup>Department of Radiology and Research Institute of Radiology, University of Ulsan College of Medicine, Asan Medical Center, Seoul, Korea



**Only 31 (6%) of the 516 eligible published studies performed external validation of the algorithms, and none met the recommended criteria for clinical validation of AI in real-world practice.**

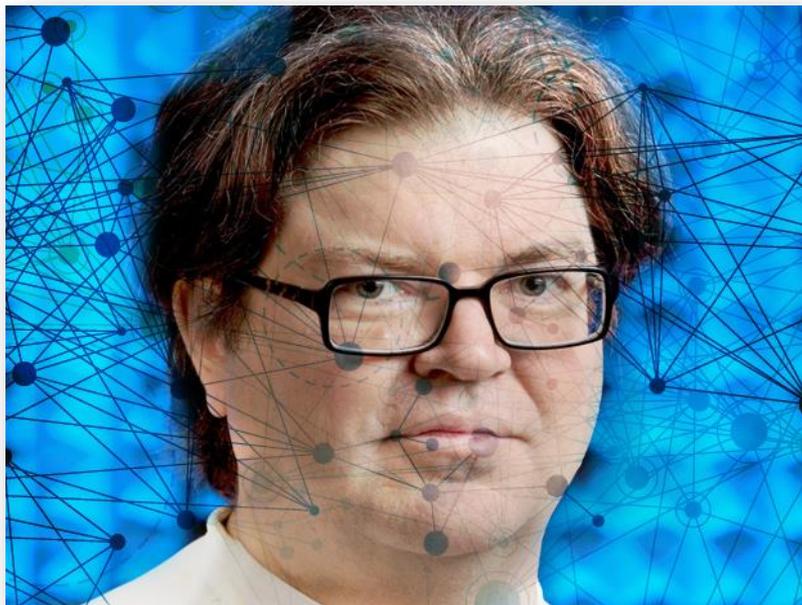
Dong Wook Kim,  
Seong Ho Park, MD, PhD<sup>2</sup>

<sup>1</sup>Department of Radiology, Seoul National University Hospital, Seoul, Korea; <sup>2</sup>Department of Radiology and Research Institute of Radiology, University of Ulsan College of Medicine, Asan Medical Center, Seoul, Korea





WINTER IS COMING



“ AI has gone through a number of **AI winters** because people claimed things they couldn't deliver.

*Yann LeCun  
Director of AI Research, Facebook*



Mateo Restrepo Follow

Head of Data Analytics at Yuxi Global (<https://www.yuxiglobal.com/>) Ph.D. in Applied Mathematics  
Machine Learning and Programming enthusiast.

Oct 12 · 7 min read

## Impressions and Lessons from the O'Reilly AI Conf 2018



AI superstar and the author's personal hero, Peter Norvig, giving his keynote at the AI Conf 2018

“ Many of the AI things that we do have no business value beyond marketing

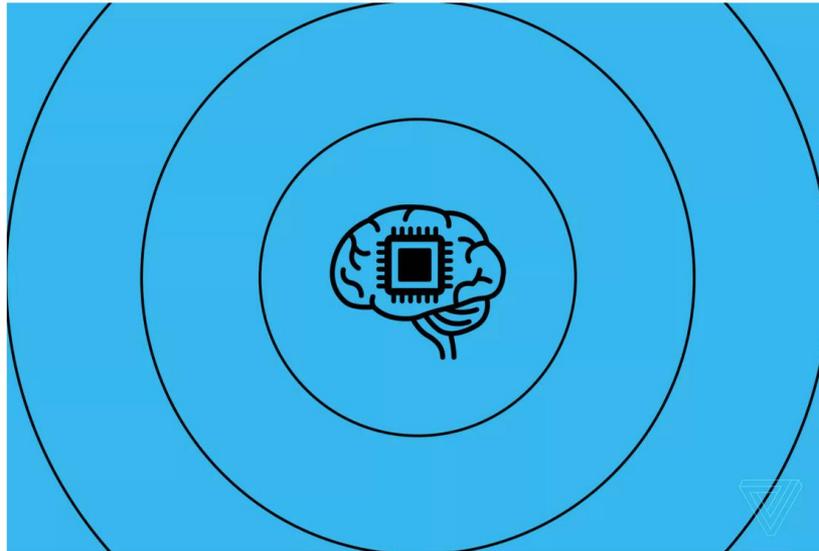
*Ben Taylor*

# Forty percent of 'AI startups' in Europe don't actually use AI, claims report

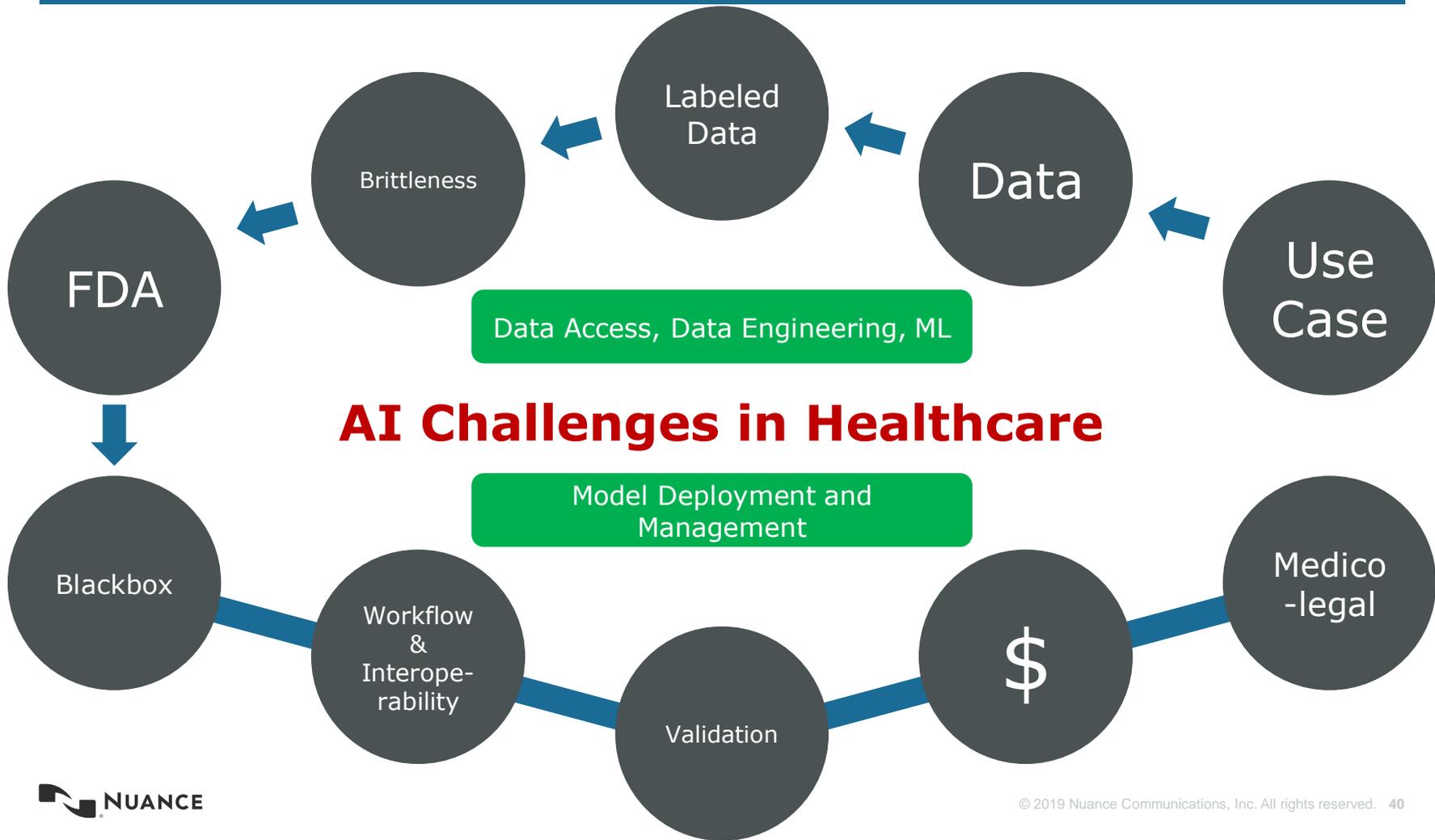
*Companies want to take advantage of the AI hype*

By James Vincent | Mar 5, 2019, 8:14am EST

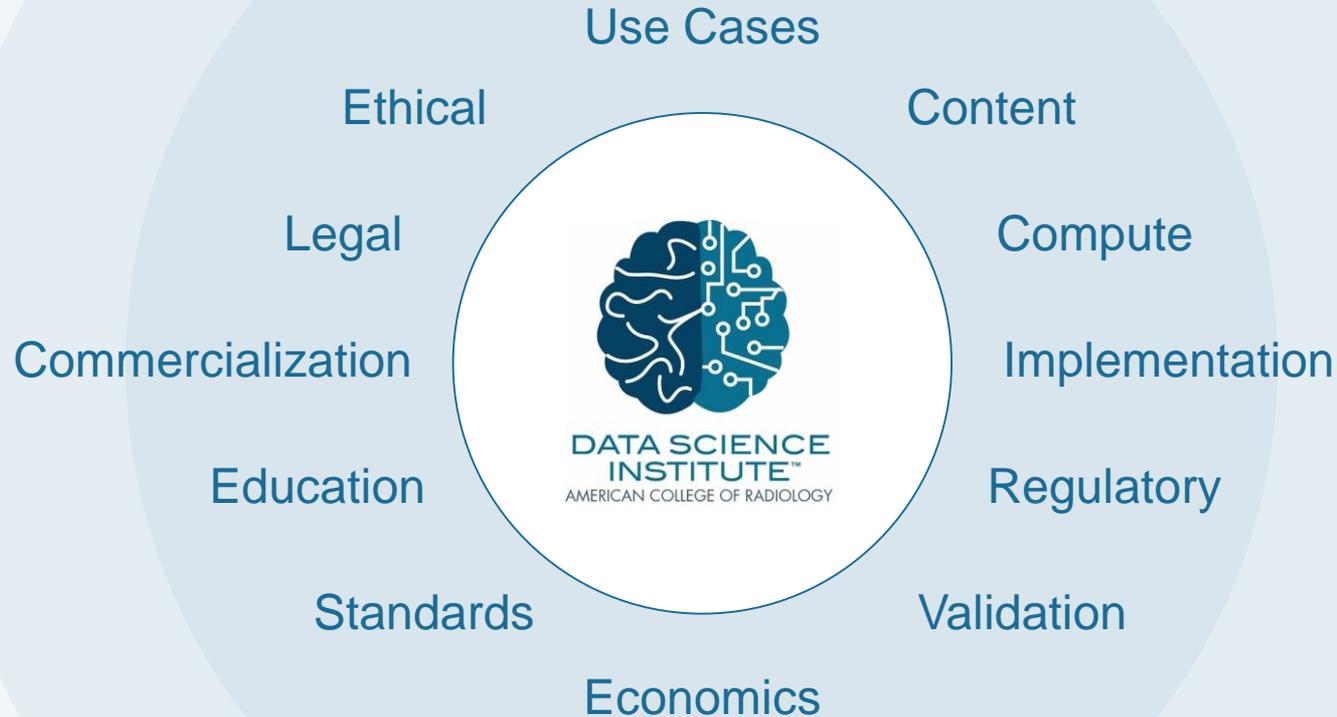
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# Fear Hype Challenges



# Clinical Data Science: Considerations



## How will radiology providers be reimbursed for investing in AI?

July 19, 2018 | [Michael Walter](#) | [Policy](#)



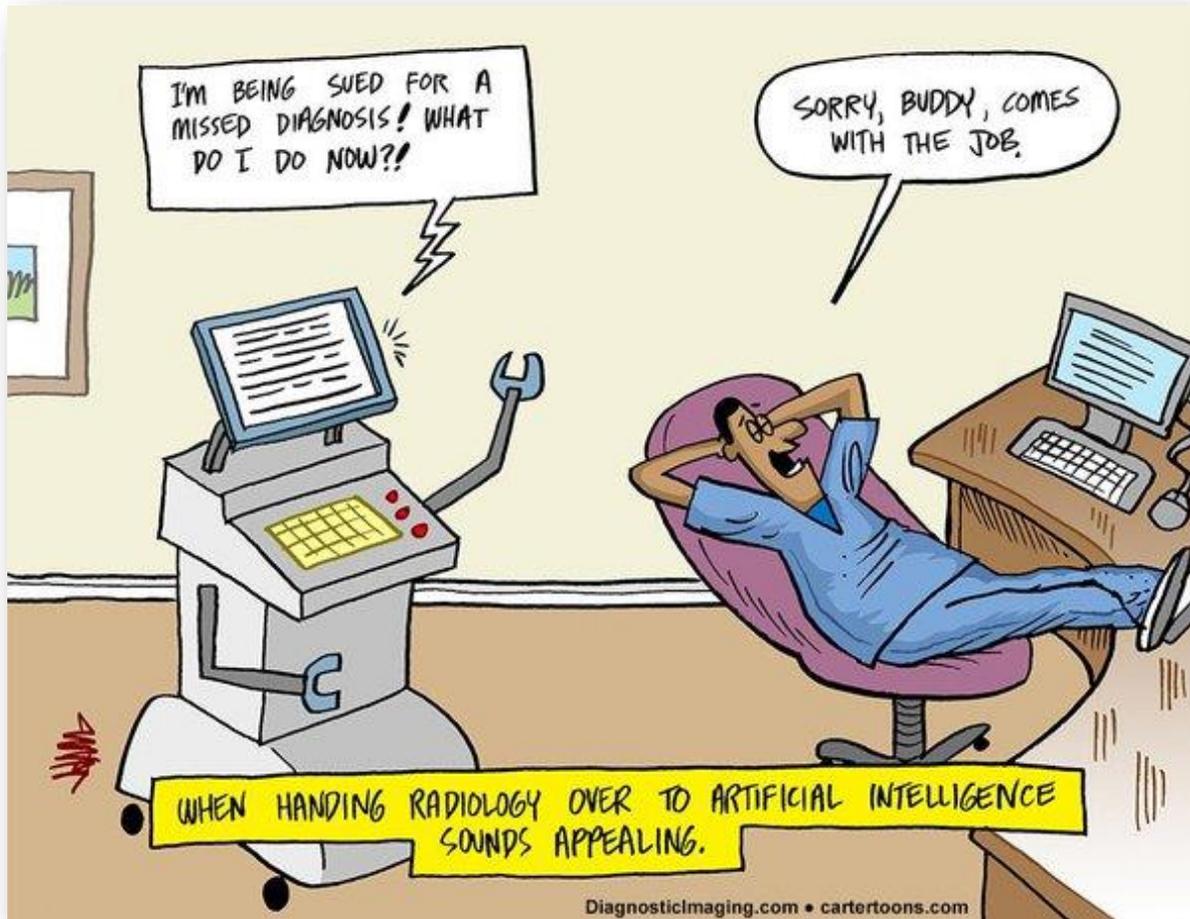
## **Mammo AI software yields workflow, economic benefits**

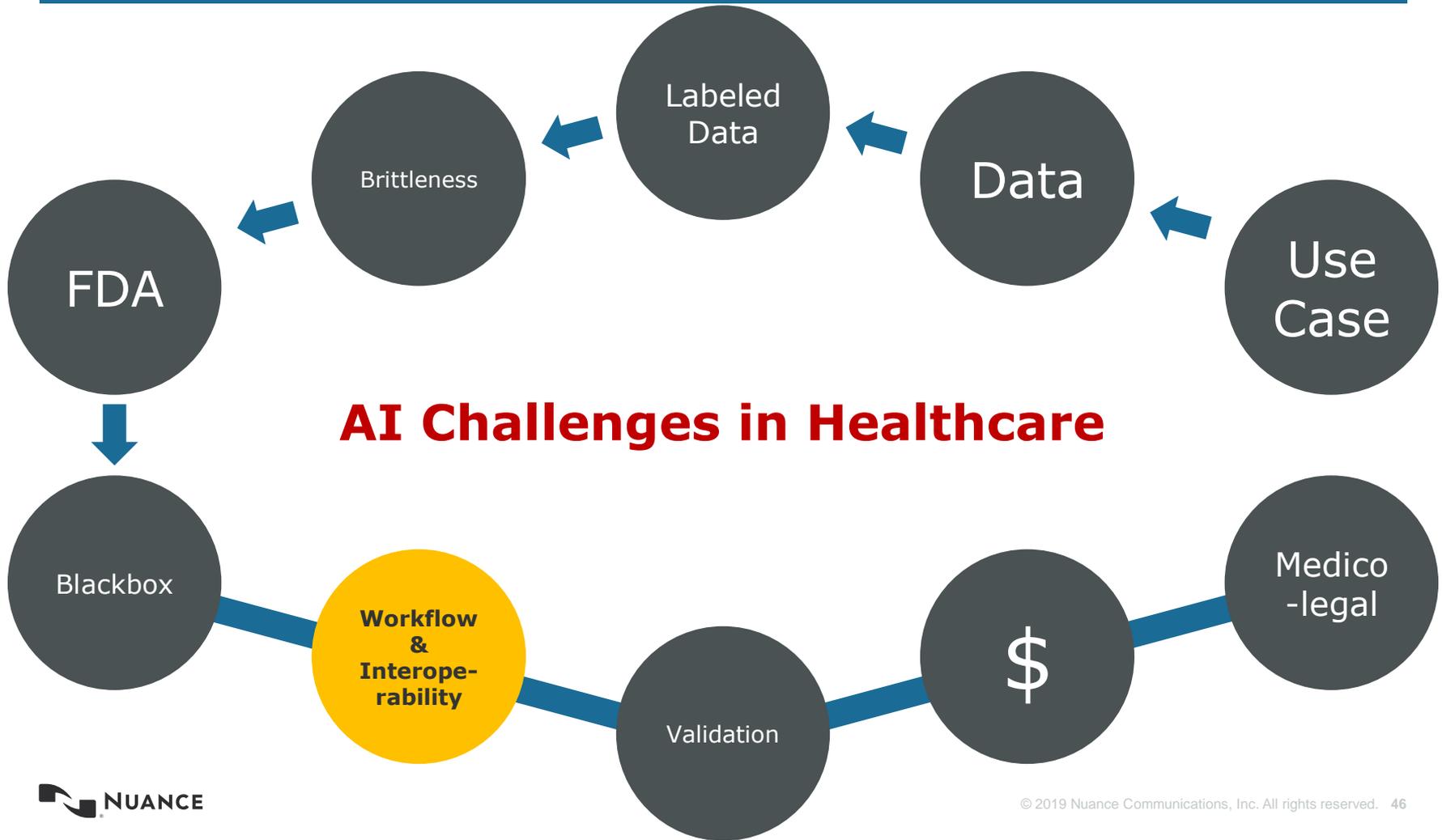
By Erik L. Ridley, AuntMinnie staff writer

March 12, 2019 -- A computer-aided detection (CAD) algorithm based on artificial intelligence (AI) proved to be better than traditional CAD in helping radiologists detect breast cancer. The AI-based CAD could also improve efficiency and increase revenues, according to research presented at ECR 2019 in Vienna.



As a result, the AI CAD software could **reduce reading time by 64%** and enable radiologists to interpret up to **10% more screening exams per year**, according to the researchers. “That could translate -- in a place like MD Anderson that does **100,000** mammograms per year -- to **over \$1 million in increased revenues.**”

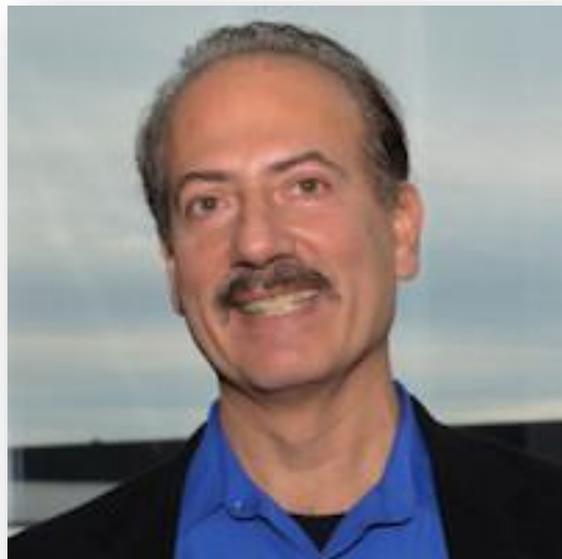






**I would say that if you are an AI vendor, **focus on workflow**. The algorithm is critically important to get right, and validate, but spend time on the radiologist. How do we incorporate these fantastic tools, validated algorithms into the **workflow for the radiologist**.**

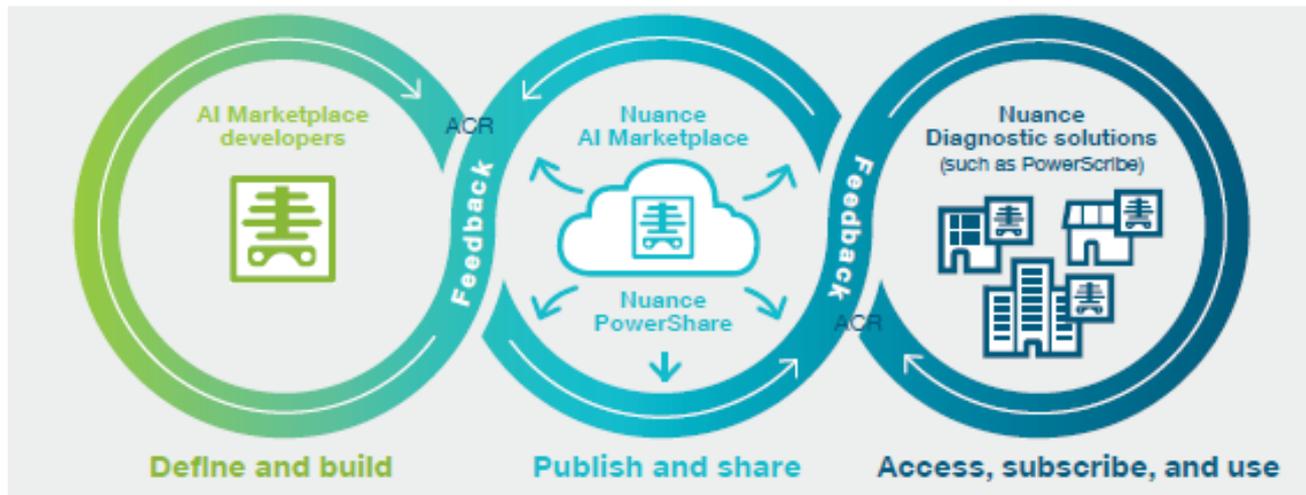
***Dr. Greg Moore – VP, Google***



**We need ways to take the systems that we're using currently - like our PACS and advanced visualization workstations - and allow [the radiologist] to be able to consume a **marketplace** that lets me go to the equivalent of an **app store**.**

***Eliot Siegel, MD***  
***University of Maryland/Baltimore VA***

# Welcome to the Nuance AI Marketplace



AI at scale with the industry's first **workflow-integrated market** for diagnostic imaging algorithms

[nuance.com/healthcare/diagnostics-solutions/ai-marketplace.html](https://nuance.com/healthcare/diagnostics-solutions/ai-marketplace.html)



**Nuance Healthcare Diagnostics**

# **NVIDIA – CLARA Framework for Inferencing**

Raghu Vemula  
VP Engineering R&D Diagnostics  
Nuance Communications  
Raghu.Vemula@nuance.com

# Speaker Introduction

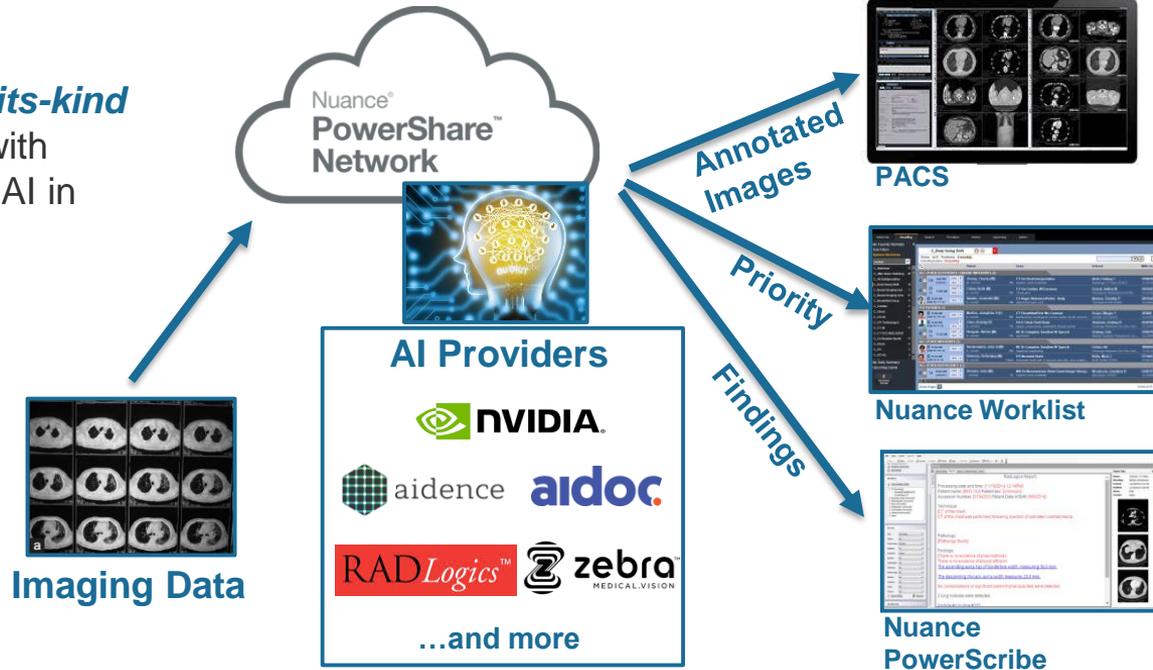


Raghu Vemula  
Vice President, Engineering R&D Diagnostics  
Nuance Communications

# Nuance's AI Marketplace

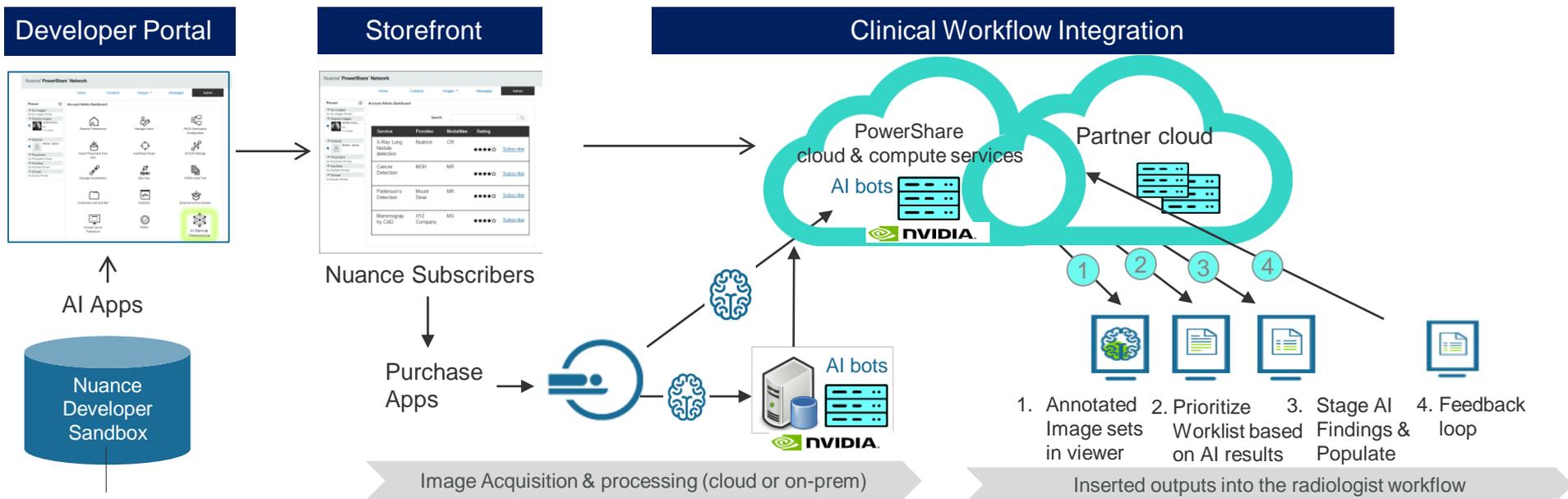
Nuance introduces a *first-of-its-kind AI initiative* in collaboration with industry leaders to proliferate AI in radiology.

The AI Marketplace facilitates the *adoption* and use of AI using *practical uses cases*, embedded in the *day-to-day workflow* of radiologists, through unrivaled industry relationships.



Propel the development, access and usefulness of powerful AI based diagnostic tools for added insights and improved patient outcomes

# Enabling the adoption of AI in the day to day workflow of radiologists



Nuance Subscribers

Purchase Apps

Image Acquisition & processing (cloud or on-prem)

Inserted outputs into the radiologist workflow

- > 5,000 Hospitals connected on the PowerShare Network
- Signed BAAs and established contracts in place
- Capacity to handle large volumes of imaging studies sent to the cloud
- 7 out of 10 radiologists use PowerScribe 360
- More customers using the Nuance worklist everyday

# Developer Portal



HOME RESOURCES PLATFORM AI COMMUNITY CONTACT US

Sign in

Nuance AI Marketplace for developers

## Let Nuance bring you to market

Calling all radiology AI developers, data scientists, researchers, vendors, and subscribers. Join a growing movement to foster the widespread adoption of AI algorithms by and for the global radiology community.

Register now for your free developer account

Get noticed at RSNA. Click here to know more



- 46 Developers / Vendors
- 60 Active Apps
- 12 FDA Approved Apps.

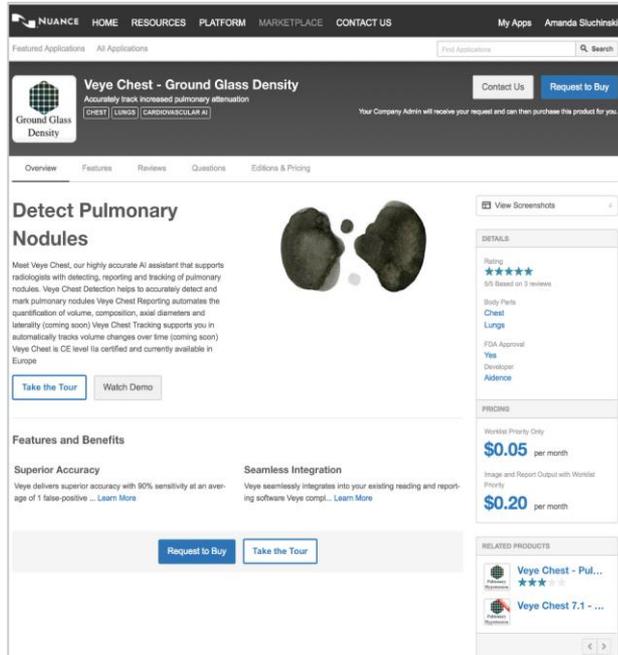
## Imagine the unlimited potential of AI algorithms

Turn your AI potential into a practical reality. Leverage a platform to develop, test, validate, and refine. Make your algorithm a seamless part of a radiologist's existing workflow. Become a developer on the Nuance AI Marketplace for Diagnostic Imaging.

<https://aimarketplace.portal.azure-api.net/>



# Subscriber Portal (“Storefront”)



The screenshot shows the Nuance Subscriber Portal interface. At the top, there is a navigation bar with links for HOME, RESOURCES, PLATFORM, MARKETPLACE, and CONTACT US. Below this is a search bar and a featured application section for "Veye Chest - Ground Glass Density". The main content area is titled "Detect Pulmonary Nodules" and includes a 3D visualization of a lung with nodules. The page is divided into sections for "Features and Benefits", "Details", "Pricing", and "Related Products". The "Pricing" section shows two options: "Worklist Priority Only" for \$0.05 per month and "Image and Report Outset with Worklist Priority" for \$0.20 per month. The "Related Products" section lists "Veye Chest - Pul..." and "Veye Chest 7.1 - ...".

*Partnering with AppDirect*

The Subscriber Portal is where our customers go to find and subscribe to AI algorithms

- Algorithm descriptions, ratings, pricing
- Ability to sort and filter
- Informational content is provided by AI vendor
- Supports multiple licensing/pricing models (e.g. per use, fixed subscription, bundles)

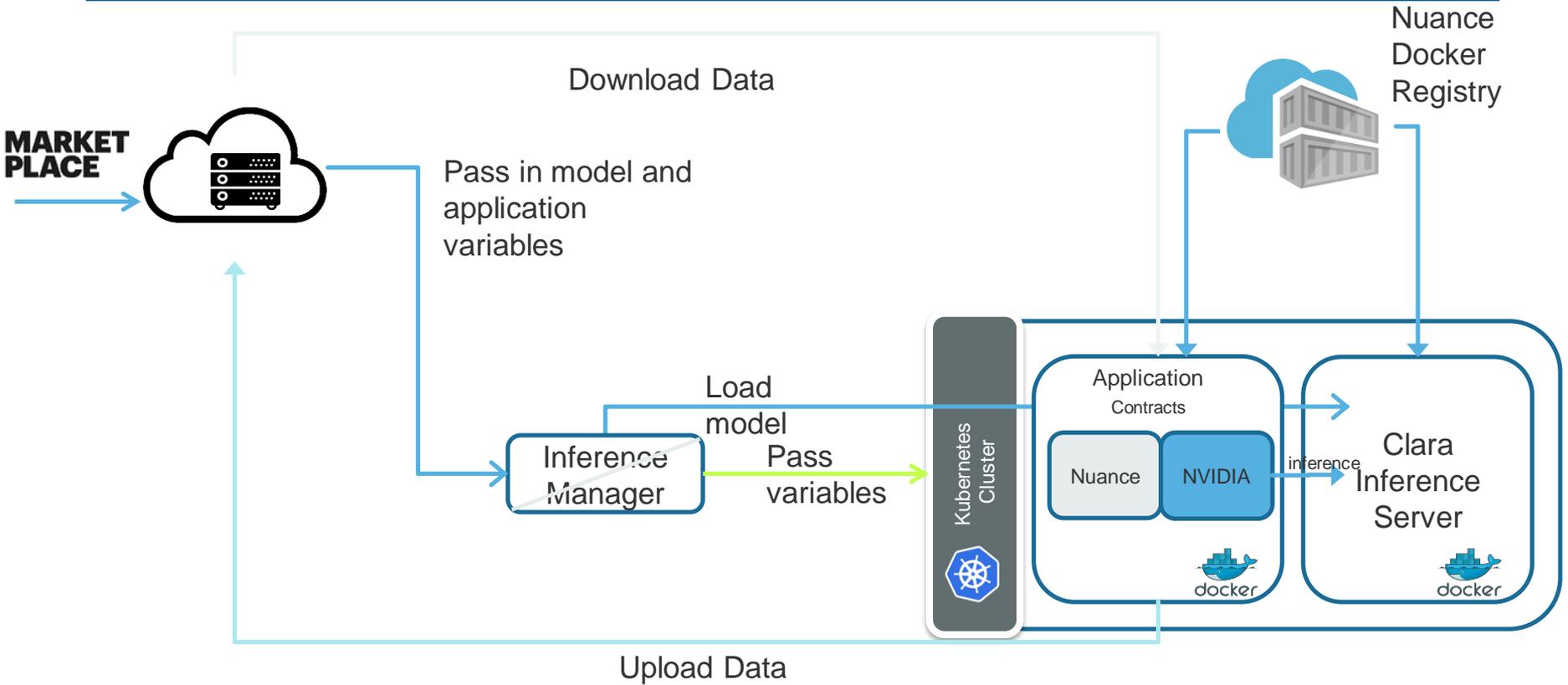
Subscriber Portal

<https://nuance.byappdirect.com/home>

PowerShare

<https://rsna.nuancepowershare.com>

**MARKET PLACE**



# Application Contracts

- Nuance
  - Environment variables
    - aiMktURL = os.environ['aimktpUrl']
    - service\_key = os.environ['serviceKey'] = ""
    - headers = {'Content-Type': 'application/json', 'Ocp-Apim-Subscription-Key': service\_key}
    - input\_directory = os.environ['INPUT\_FILE\_BASE\_PATH']
  - Contracts
    - self.downloadFiles = DownloadInputFiles()
    - self.uploadResultFiles = UploadOutputFiles()



```
class DownloadInputFiles(object):
    """ This class is responsible to provide the function which do
    """

    def __init__(self):
        self.logger = logging.getLogger(__name__)

    def __call__(self, transaction_id, uris):
        """
        This method is called to download all files associated with
        The transaction id comes from the environment.
        The Uris are a list of comma delimited Urls associated with
        """
        self.logger.info('Download files called.')
        if transaction_id is None:
            raise Exception("transaction id is not set: %s" % transa

        # Make the subdirectory for the transaction
        transaction_file_dir = input_directory# + '/' + str(transa
        if not os.path.isdir(transaction_file_dir):
            os.makedirs(transaction_file_dir)

        # For each file in the AI Marketplace manifest, retrieve t
        for url in uris.split(","):
            self.logger.info('Downloading file %s.' % url)
            # print(url)
            get_file(transaction_file_dir, url)
```

# Application Contracts

- NVIDIA Clara
  - Contracts
    - Input/Output Transform
    - Perform Inference

```
self.clara_app = ClaraApplication(self.A
self.clara_app.get_work(self.processRequ

def processRequest(self, workRequest):

    transformedData = self.inputTransform(w
    results = self.clara_app.perform_inferen

    transformedData,
    self.MODEL_NAME,
    self.MODEL_VERSION,|
    InferenceResultFormat.CLASS,
    self.BATCH_SIZE)

self.resultsTransform(results, workReque
```

# Inference Manager

- Load Model
- Load environment variables
- Submit Inference

```
ModelDescriptor md = new ModelDescriptor();
md.ModelName = "aaa";
md.Version = "0.0.1";
md.ModelContent = new Contracts.File();
md.ModelContent.FileName = "aaa.zip";
using (Stream fs = System.IO.File.Open($"{MODEL_FILE}", FileMode.Open))
{
    md.ModelContent.Content = ByteString.FromStream(fs);
}
request.ModelDescriptions.Add(md);
AddModelsResponse amResponse = modelManagerClient.AddModels(request);

AddApplicationsRequest addApplicationsRequest = new AddApplicationsRequest();
ApplicationDescriptor ad = new ApplicationDescriptor();
ad.ApplicationName = "nuanceaim.azurecr.io/aaa/sample:0.1";
ad.ModelDescriptions.Add(amResponse.ModelDescriptions[0]);
ad.RegistryName = "nuanceaim";
addApplicationsRequest.ApplicationDescriptions.Add(ad);

AddApplicationsResponse aaResponse = appManagerClient.AddApplications(addApplicationsRequest);

SubmitInferenceV0Request submitInferenceV0Request = new SubmitInferenceV0Request
{
    ApplicationId = aaResponse.ApplicationDescriptions[0].ApplicationId,
};

submitInferenceV0Request.EnvironmentVariables.Add(transactionId);
submitInferenceV0Request.EnvironmentVariables.Add(aimktplUrl);
submitInferenceV0Request.EnvironmentVariables.Add(serviceKey);
submitInferenceV0Request.EnvironmentVariables.Add(uris);

var submitInferenceResponse = inferManagerClient.SubmitInferenceV0(submitInferenceV0Request);
```



# AI Results in Clinical Workflows

# AI to prioritize worklist

- AI Partner: **Aidoc**
- Algorithm Target:
  - Brain hemorrhage
  - Spine fracture
- Worklist will show AI badge
- 510K approved
- Live at multiple sites since Aug 6, 2018
- 2 brain bleeds detected in 1<sup>st</sup> two days after go-live

The screenshot displays a medical worklist interface with a table of exams. A red arrow points to a '2' badge on the 'STAT (1)' row, labeled 'Prioritized study with 2-letter badge'. The interface includes a search bar, navigation tabs (Welcome, Reading, Protocolling, Search, Providers, History, Consults, QGerda, Tools), and various filter sections on the left.

Exam	Patient	Exam	Ordered	Identifiers	Techs / Rads
<b>STAT (1)</b>					
<b>C 4h</b> 10:20 AM	Dales, Larry (M) (55y) ED: Trauma Bay - 4	MR Cade Stroke 55 On Attack, Loss of consciousness, Fall	Cohen, Harold N EASTERN POST XRAY	852741 39	By Sean, Conery at Room 3
<b>STAT (3)</b>					
<b>C 15h</b> 11:30 PM	Adams, Jule (F) (55y) ED: 2403P	CR Chest 2 Views LINE PLACEMENT, PNEUMONIA	Harding, Willie H INTENSIVE CARE	07856 4294300	Johnson, P
<b>D 12h</b> 2:28 AM	Lopez, Lambert (M) (55y) ED: Trauma Bay - 1	MR Lumbar Spine HX BACK PAIN; DISK HERNIATION	Pitts, Diego J REGIONAL NORTH	785132 546697	By Jackie, Osborne at Room 9
<b>C 1h</b> 10:37 AM	Angel, Anita (F) (55y) ED: 1102PM	CT Head With Contrast 30 ALTERED MENTAL STATUS; R/O STROKE	Morgan, Danny H Emergency Room	926158 003555320	By JESSICA, Adams at Room 4W
<b>URGENT (2)</b>					
<b>C 1d</b> 1:20 PM	Seals, Alberto (M) (55y) I: West Floor 2 - Rm 33	CR Chest 2 Views LINE PLACEMENT; FEVER	Weaver, Herberto K INTENSIVE CARE	898548 877493	By Jason, Bourne at Room 1
<b>D 9h</b> 6:29 AM	Kharney, Chris (M) (55y) I: West Floor 3 - Rm 5	CT Upper Extremities TRAUMA REPAIR FOLLOW UP	Schneider, Serge B EASTWICK WEST	1254900 02266C	Radologist, Demo Radologist, Demo
<b>ROUTINE (1)</b>					
<b>C 7:20 AM</b>	Locker, Timothy (M) (57y) I: West Floor 2 - Rm 12	CR Abdomen TUBE PLACEMENT; FEVER	Ortega, Denny K SOUTHWEST HANFORD	1002648 3193997	By Amanda, Peterson at Room 2
<b>D 5h</b> 9:28 AM	Balch, Roger (M) (55y) I: East Floor 2 - Rm 7	MR Head POST OP BRAIN SURG	Gordon, Roderick A EASTWICK WEST	963574316 4298732	Radologist, Demo Radologist, Demo
<b>C 1:5h</b> 9:28 AM	Austin, Richard (M) (57y) ED: 12EMERG	MR Renals HYPERTENSION R/O MASS	Stark, Anthony C SOUTHWEST HANFORD	5264983 4292	By Sean, Conery at Room 9

Exam Pages 1

ANGEL  
000355528

A total of 9 exams were returned by this worklist filter.

# Current State: Workflow Orchestration

AI Vendor



AI MARKET PLACE

## AI Routing Rules

Rule Name	Condition	Action
Pneumonia	ascending thoracic aorta caliber:AsDouble() >22	Badge("AI")
Hemorrhage	finding qualifier == "present" AND Name == "intracranial hemorrhage"	Badge("IH")
Hemorrhage	finding qualifier == "present" AND Name == "intracranial hemorrhage"	Priority("R,800")
Hemorrhage	finding qualifier == "present" AND Name == "intracranial hemorrhage"	Worklist("Night Residents")
Aortic Aneurysm	finding qualifier == "present" AND diameter:AsDouble() >= 4 AND Name.Contains("aortic aneurysm")	Badge("AN")

Badges

Prioritization

Worklist Assignment

Custom Fields  
Direct Report Insert

AI Demo Cases			
Status: C or D. Timeframe: 5 month(s).			
Excluding Exams:			
	Patient	Exam	
STAT (12)			
D 1d	6:00 AM 2/11/2019	Detectmodule, 03 (M) O: ED East	CT Guided Lung B Lung screen
D 1d	6:00 AM 2/11/2019	Green, Mary (M) O: ????	UN Ct-Face/Neck/Chest NO RET APPT.
C 1d	6:00 AM 2/11/2019	Green, Mary (M) O: ED North	CT Ct-Face/Neck/Chest NO RET APPT.
C 1d	6:00 AM 2/11/2019	Simpson, Cheryl (M) O: West End	CT Head Wo Iv Contrast NO RET APPT.
C 5:33 PM	(held for 3+ h)	Aidence, Sander (M) O: West End	CT Chest Lung Nodule Follow Up
C 5:33 PM	(held for 3+ h)	219198, Cods (M) O: South-East Campus	CT Abdomen & Pelvis W/Contrast Flank pain

PS360  
Report  
Insert

Study ID  
Series Desc: 1,OPA,SE,VZOOM,B50f,380,2,140,80,40,na

LSS 005272

DOB: 01-May-2018

M

122683

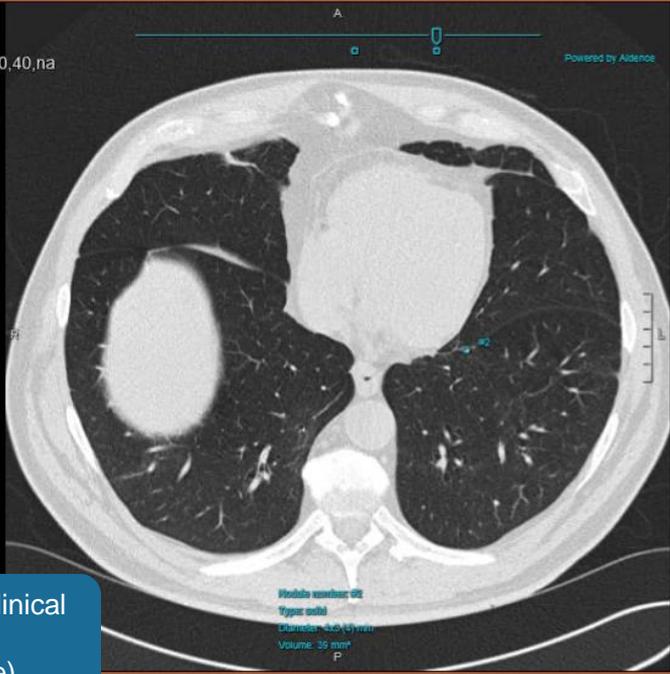
Inst: Aidence

ACCES # 457344

Study Date: 02-Jan-2000

Study Time:

Zoom Factor: 1.06



Size of nodule (mm) (largest):

Single or multiple nodules?

Nodule type:

Nodule Location (multiple):

Patient risk level:

Series:

Image:

# of Findings and Attributes from AI

Finding text auto-generated from AI findings

Impression generated using Clinical Guidance decision support (Fleischner Society in this case)

Findings:  
Multiple non-calcified nodules. The largest one is solid, measuring 4 mm (series 0, image 126), and is indeterminate.

Impression:  
Multiple indeterminate pulmonary nodules. The largest one is solid and measures 4 mm. For multiple nodules <6 mm in a patient of unknown risk, with the largest one being solid, for a low-risk patient, recommend no follow-up. For a high-risk patient, CT at 12 months is optional with stronger consideration if there is suspicious nodule

Accept Decline

After reviewing all findings, click OK to finish AI findings review

OK Cancel

Properties

Attending: Kate K  
Status: Draft  
STAT:

[Insert Contributors...](#)  
[Insert Custom Fields...](#)

- Properties
- Fields (3)
- Notes
- Attachments
- Quality Check

Report - 005272, LSS - 457344

**Aidence CT Chest**

**Clinical information:** [Persistent cough]

**Comparison:** [None]

**Findings:**

Lungs:

Multiple non-calcified nodules. The largest one is solid, measuring 5 mm (series 0, image 92), and is indeterminate

**Impression:**

Multiple indeterminate pulmonary nodules. The largest one is solid and measures 5 mm. In a high-risk patient with multiple nodules, if the most suspicious nodule is solid and measures <6 mm, CT at 12 months is optional with stronger consideration if there is suspicious nodule morphology and/or upper lobe location.