



# Real Intelligence AI in GU Pathology

A/Prof Fiona Maclean



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SONIC  
HEALTHCARE



The 48th Annual Scientific Meeting *of the*

Australasian Division of the  
International Academy of Pathology

# Disclosure of Relevant Financial Relationships

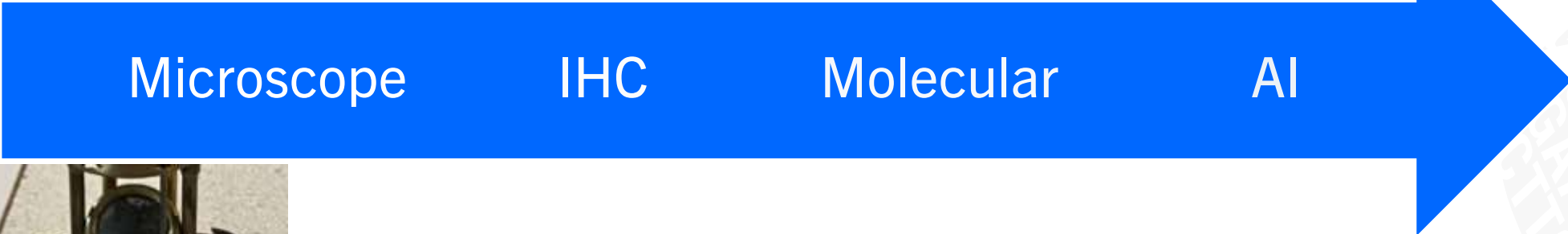
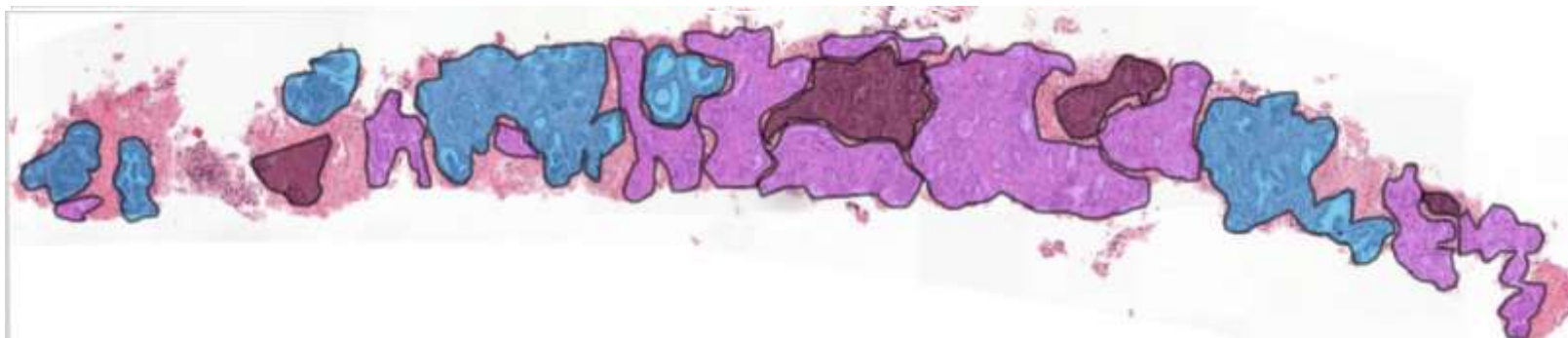
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Sonic Healthcare

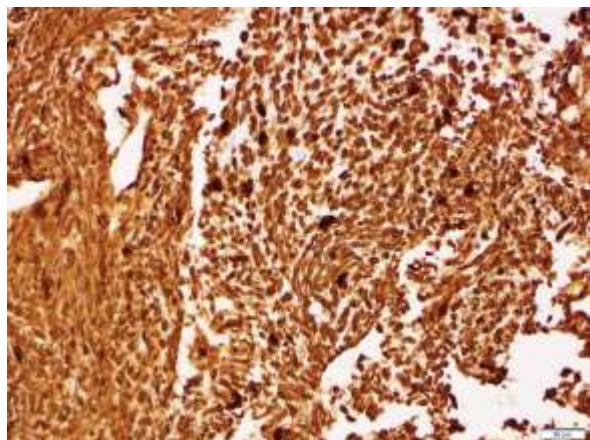
Franklin.ai – 1/2 FTE 2 1/2 yrs



# Pathology – a Timeline



An integrated diagnostic approach



# Our First Experiences with AI in Medicine...

**DIAGNOSIS:**

**GASTRIC BIOPSIES - ACTIVE CHRONIC COITUS**



# The Problem to Solve

- Demand Drivers
  - Aging population
  - More screening programs
  - Higher reporting requirements (synoptics)
- Supply Inhibitors
  - Chronic shortages
  - No. of trainees not increasing with demand



# The U Prosta

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## The Lancet Commissions

...: planning for the



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...Sculpher, Howard Soule, Matthew R Sydes,

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Total	
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# Large Language Models

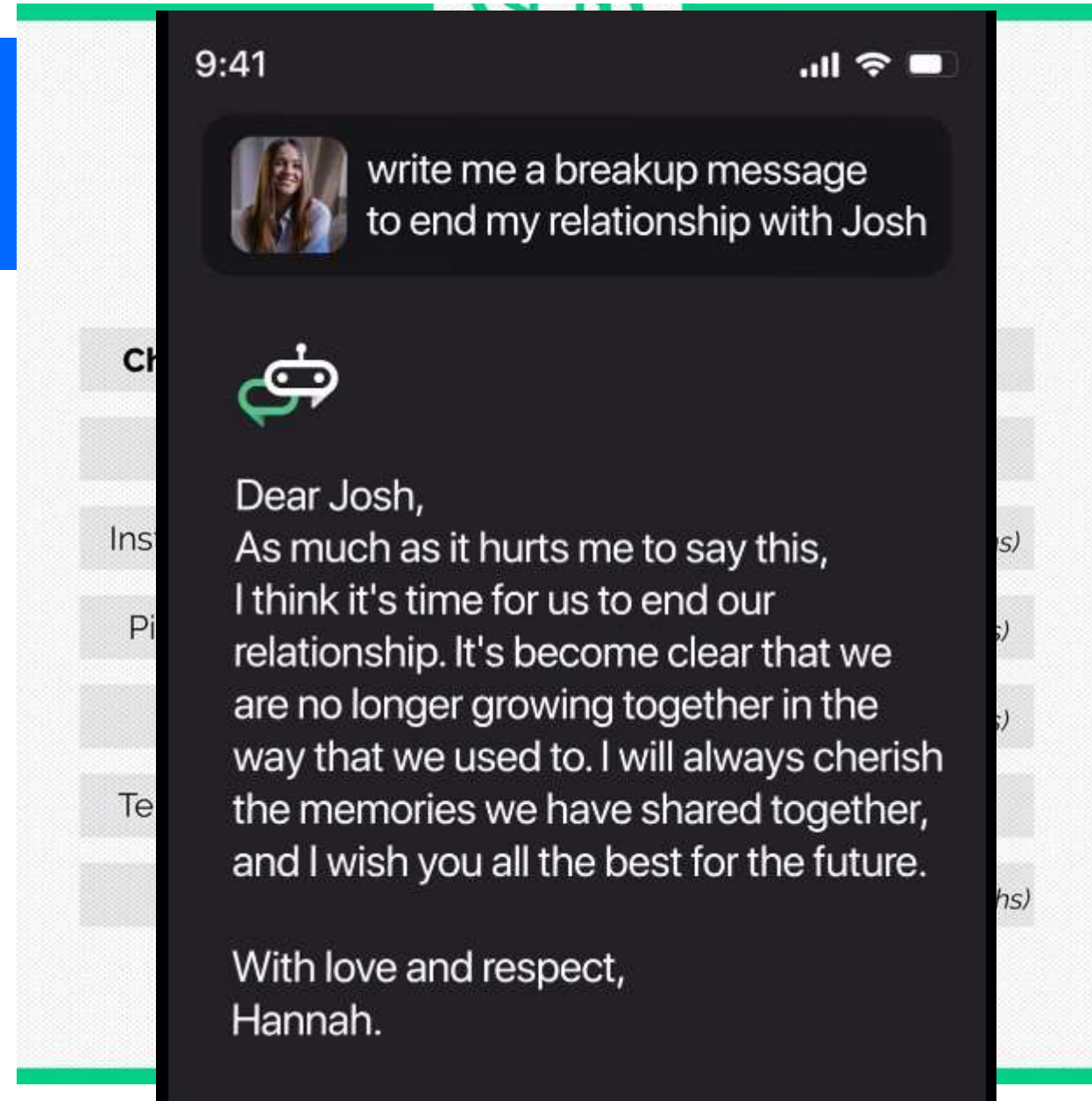


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# Chat GPT

- Nov 30 2022 – Open AI launches Chat GPT
- December 4 2022 – 1 million users
- By Jan 2023 – reaches 100 million active monthly users
- The fastest growing consumer application in history



# Chat GPT

- 'Generative Transformer

Write a talk about AI

Write a talk about AI  
poem

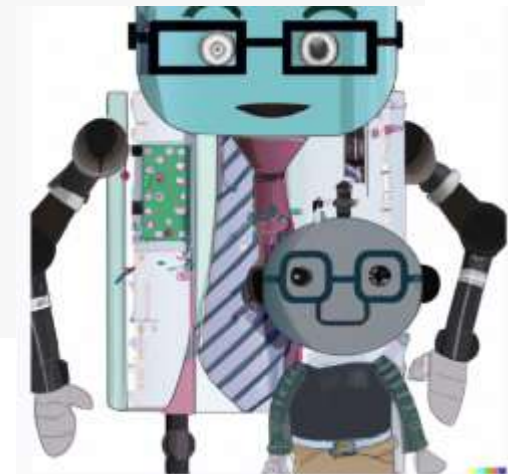
Write a talk about AI  
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athology



gy cross the



# Hallucinations... Not “Lies”



Title: Review of Management of Retroperitoneal Liposarcoma

## Introduction:

Retroperitoneal liposarcoma (RPLS) presents a formidable challenge to sarcoma surgeons and oncologists due to its unique anatomical location and potential for aggressive behavior. With over two decades of experience in the field, this review aims to provide a comprehensive overview of the current state of management strategies for RPLS, drawing upon evidence from peer-reviewed journals.

## Epidemiology and Classification:

RPLS is a rare entity, accounting for approximately 15% of all soft tissue sarcomas. It exhibits considerable heterogeneity, primarily classified into four histological subtypes: well-differentiated, dedifferentiated, myxoid, and pleomorphic. Accurate classification is essential for tailored treatment approaches.

## Diagnostic Modalities:

Accurate diagnosis relies on a multimodal approach, including radiological imaging (CT, MRI), core needle biopsy, and molecular testing. Accurate preoperative assessment of tumor size, location, and extent is paramount for surgical planning.

## Surgical Intervention:

Surgery remains the cornerstone of treatment for RPLS, and complete resection with negative margins is the primary goal. En bloc resection of adjacent structures, such as kidney, colon, or pancreas, may be necessary to achieve R0 margins. Consideration of organ preservation and reconstruction techniques is vital.

## References:

1. Singer S, et al. (2015). Retroperitoneal soft-tissue sarcoma: analysis of 500 patients treated and followed at a single institution. *Annals of Surgery*, 261(4), 739-746.
2. Gronchi A, et al. (2017). Myxoid/round cell and pleomorphic liposarcomas: prognostic factors and survival in a series of patients treated at a single institution. *Cancer*, 123(3), 398-406.
3. Strauss DC, et al. (2016). Retroperitoneal soft tissue sarcomas: a review of the literature and a framework for a multidisciplinary approach in the era of targeted therapies. *The Lancet Oncology*, 17(2), e64-e77.
4. Dei Tos AP. (2020). Liposarcomas: diagnostic pitfalls and new insights. *Histopathology*, 76(1), 161-175.

# Hallucinations... Not “Lies”

## References:

1. Singer S, et al. (2015). Retroperitoneal soft tissue sarcoma: a retrospective study of 100 patients and followed at a single institution. *Annals of Oncology*, 26(12), 2500-2506.
2. Gronchi A, et al. (2017). Myxoid/round cell liposarcoma: clinicopathologic features, prognostic factors and survival in a series of patients. *Annals of Oncology*, 28(12), 2000-2006.
3. Strauss DC, et al. (2016). Retroperitoneal sarcoma: a framework for a multidisciplinary approach. *Annals of Oncology*, 27(12), 2000-2006.
4. Dei Tos AP. (2020). Liposarcomas: diagnosis and treatment. *Annals of Oncology*, 31(1), 161-175.

## Review Article

 Free Access

**Non-muscle-invasive bladder cancer: Intravesical treatments beyond Bacille Calmette-Guérin**

Vignesh T. Packiam MD, Scott C. Johnson MD, Gary D. Steinberg MD

Pages: 390-400 | First Published: 02 November 2016

An unmet need continues to exist for patients with high-risk non-muscle-invasive bladder cancer for whom Bacille Calmette-Guérin has failed and who seek further bladder-sparing approaches. This review explores the role of emerging intravesical therapies.

## Targeted therapies in gynaecological cancers

Shanthini M Cruz, Rowan E Miller

Pages: 157-170 | First Published: 17 December 2019

[Abstract](#) | [Full text](#) | [PDF](#) | [References](#) | [Request permissions](#)



**Brett Baskovich, MD** @drdoubleb · 1h



"Successful treatment of a lipoma with EML4-ALK fusion by crizotinib: a case report"

"only a few cases of prostate cancer metastasis to women have been reported in the literature..."

What's the most bizarre case report you can get #ChatGPT to make up? #medtwitter #pathtwitter



Tweet



**Brett Baskovich, MD**  
@drdoubleb

Pathologist performing a frozen section,  
generated by @midjourney\_ai ... kinda cool 😄  
#pathologists #pathtwitter #medtwitter



6:00 am · 29/3/2023 · 1,314 Views



**Brett Baskovich** @drdoubleb · 1d

Pathology reports in Shakespearean language:

"Its color is as a golden yellow, akin to the hue of a summer's sun"

"It could be this or that, or perchance, a combination of both"

"Let it be known to all those who do read this report, that the diagnosis of TA hath been duly noted"

# LLM

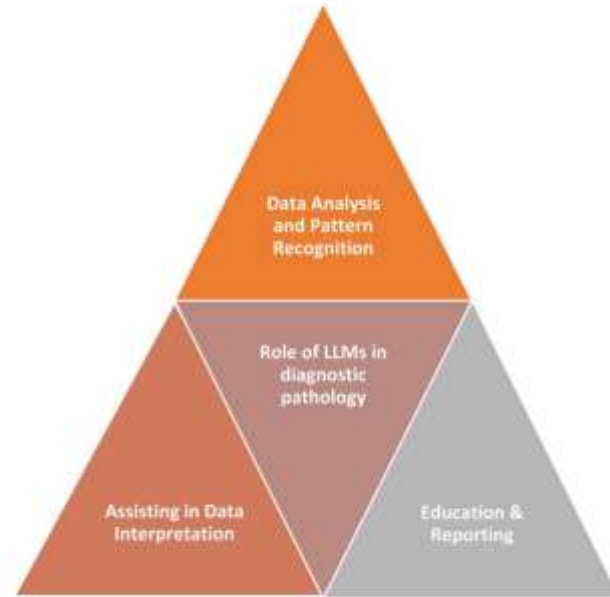


Fig. 1 A schematic diagram illustrating the role of LLMs in diagnostic pathology



## Opportunities

- Knowledge Access
- Diagnostic Support
- Accessibility & Scalability
- Continuous Learning

## Challenges

- Lack of Contextual Understanding
- Limited Interpretation
- Ethical & Legal Concerns
- Overreliance & Dependency
- Bias & Error Propagation

# Other AI Tools



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Increased accuracy



Increased effectiveness/productivity



Creation of biomarkers

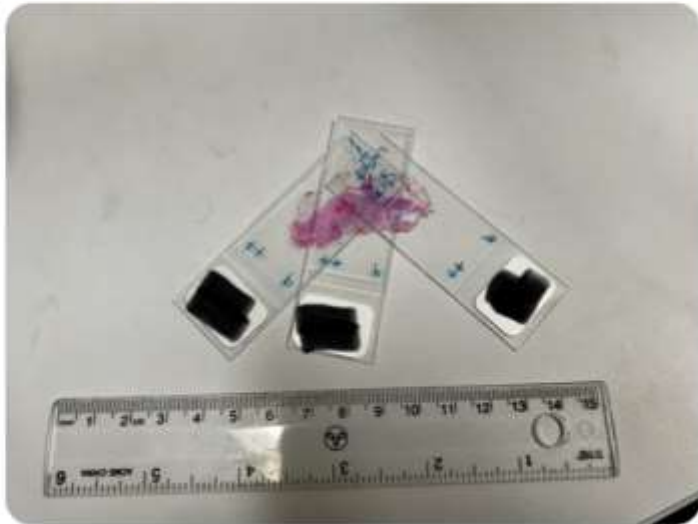
# AI Applications

## Increased accuracy

- Detection
- Classification
- Segmentation
- Quantification



**Adnan Karavelic, MD FRCPC** @K... · 1d ...  
Tumour size assessment. #Science at its finest 😊



Increased effectiveness/productivity



Creation of biomarkers

## Increased effectiveness/productivity



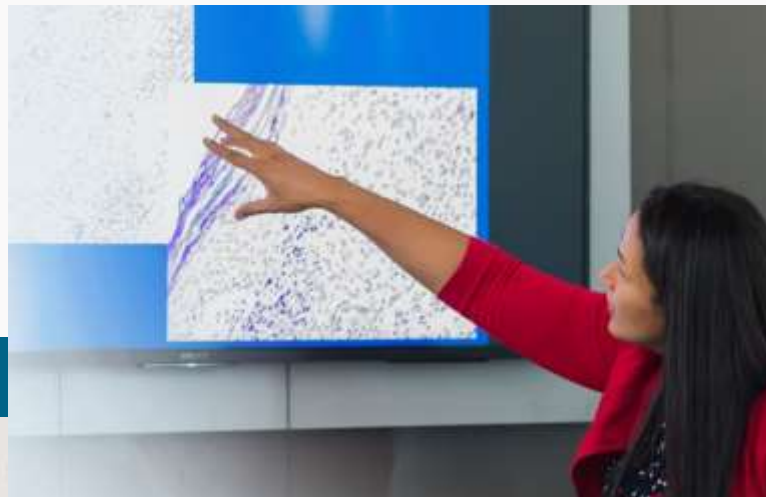
Increased accuracy

- Digital workflow
- Consultations
- Workflow improvements
  - Quality from lab
  - Prioritize cases
  - Order IHC sooner
  - Prepopulate reports



Creation of biomarkers

# AI Applications



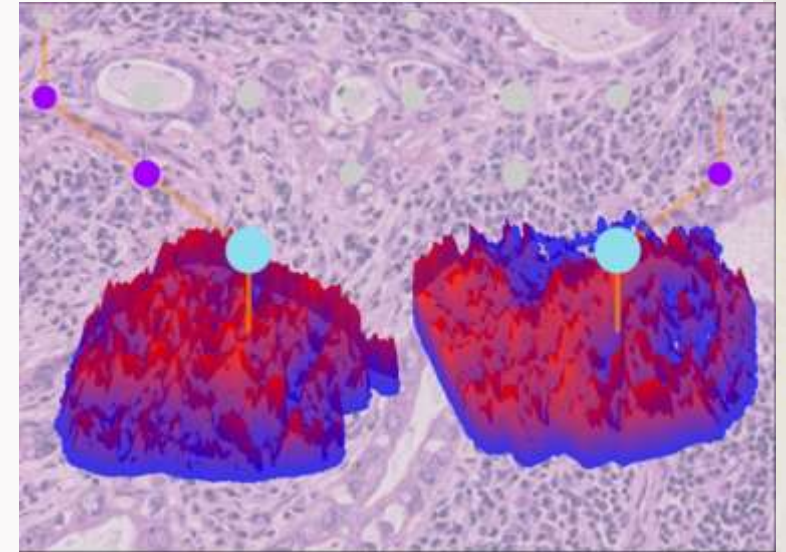


Increased accuracy



Increased effectiveness/productivity

## Creation of biomarkers



- Predictive
- Diagnostic
- Monitoring
- Therapy response
- Prognostic

# AI Applications



# Artificial intelligence in digital pathology: a systematic review and meta-analysis of diagnostic test accuracy

Check for updates

Clare McGenity <sup>1,2</sup> , Emily L. Clarke <sup>1,2</sup>, Charlotte Jennings <sup>1,2</sup>, Gillian Matthews <sup>2</sup>, Caroline Cartlidge <sup>1</sup>, Henschel Freduah-Agyemang <sup>1</sup>, Deborah D. Stocken <sup>1</sup> & Darren Treanor <sup>1,2,3,4</sup>

## Critical intelligence of pathologists for prostate cancer pathology

Okyaz Eminaga <sup>1,10</sup> , Mahmoud Abbas <sup>2,10</sup> , Christian Kunder <sup>3,11</sup>, Yuri Tolkach <sup>4,11</sup>, Ryan Han <sup>5</sup>, James D. Brooks <sup>6</sup>, Rosalie Nolley <sup>6</sup>, Axel Semjonow <sup>7</sup>, Martin Boegemann <sup>7</sup>, Robert West <sup>4</sup>, Jin Long <sup>8</sup>, Richard E. Fan <sup>6</sup> & Olaf Bettendorf <sup>9</sup>

ased algorithms  
tate cancer: A

PhD ,  
cco, MD, Ilaria Girolami, MD,  
hD,

hD, Liron Pantanowitz, MD,

.. Show more

al Pathology, aqad182,

icp/aqad182

2024 Article history

Review Article

An update on  
practice: A re

Anil V. Parwani  
Victor E. Reuter

Cell Re

Review

## Harnessing artificial intelligence for prostate cancer management

Lingxuan Zhu, <sup>1,2,3,16</sup> Jiahua Pan, <sup>1,16</sup> Weiming Mou, <sup>4,16</sup> Longxin Deng, <sup>5</sup> Yinjie Zhu, <sup>1</sup> Yanqing Wang, <sup>1</sup> Gyan Pareek, <sup>6,7</sup> Elias Hyams, <sup>6,7</sup> Benedito A. Carneiro, <sup>8</sup> Matthew J. Hadfield, <sup>8</sup> Wafik S. El-Deiry, <sup>9</sup> Tao Yang, <sup>10</sup> Tao Tan, <sup>11</sup> Tong Tong, <sup>12</sup> Na Ta, <sup>13</sup> Yan Zhu, <sup>13</sup> Yisha Gao, <sup>13</sup> Yancheng Lai, <sup>1,15</sup> Liang Cheng, <sup>6,14,17,\*</sup> Rui Chen, <sup>1,17,\*</sup> and Wei Xue <sup>1,17,\*</sup>

**Table 1. AI tool for path**

Name of the device

Paige Prostate Detect<sup>a</sup>

Paige Prostate  
Grade & Quantify

Aiforia Clinical AI Model  
for Prostate Cancer

DeepDx-Prostate  
Connect

Galen Prostate

HALO Prostate AI

INIFY Prostate

<sup>a</sup>Approved by the US FDA



CE mark

erincheri et al.,<sup>13</sup>

Campanella et al.,<sup>15</sup>

.<sup>18</sup>

and Ryu et al.<sup>19,20</sup>

al.<sup>21</sup>

# AI in GU Pathology

## Benefits

- Quality Assurance
- Improved cancer detection
- Quantification, grading
- Cost and time savings
- Uncover novel insights
  - Understanding biology
  - Risk stratification
  - Prognostication
  - Predicting molecular subtypes

## Blockers

- Digital workflow (\$)
- Regulatory guidelines
- Lack of prospective studies
- Perceptions & impact on behaviour
- AI Issues
  - Difficulty in generalisation
  - Lack of high quality data sources
  - Rare conditions / tumour heterogeneity

# Process for Developing Medical AI

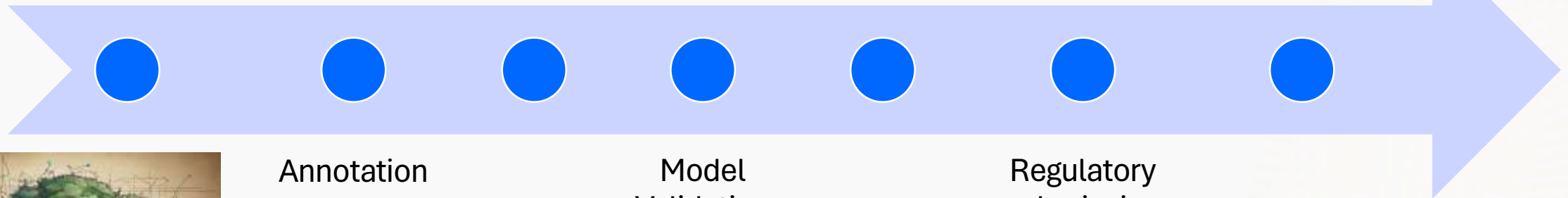


Define Tasks /  
Ontology

Model  
training

Model  
Tuning  
(ongoing)

Model  
Deployment



Annotation

Model  
Validation

Regulatory  
submission



# Training Approaches

## Supervised Learning

- AI trained on labelled data
- AI learns to identify patterns corresponding to the correct label
- Goal is to make accurate predictions on new, unseen data

Like a registrar learning from an experienced pathologist

## Unsupervised Learning

- AI is trained on unlabelled data
- A “black box” model
- AI identifies clusters & patterns in the data
- Goal is to discover new insights/structure

Like a medical researcher discovering new biomarkers

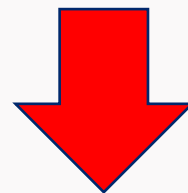
# Process for Developing Medical AI



Define Tasks /  
Ontology

Model  
training

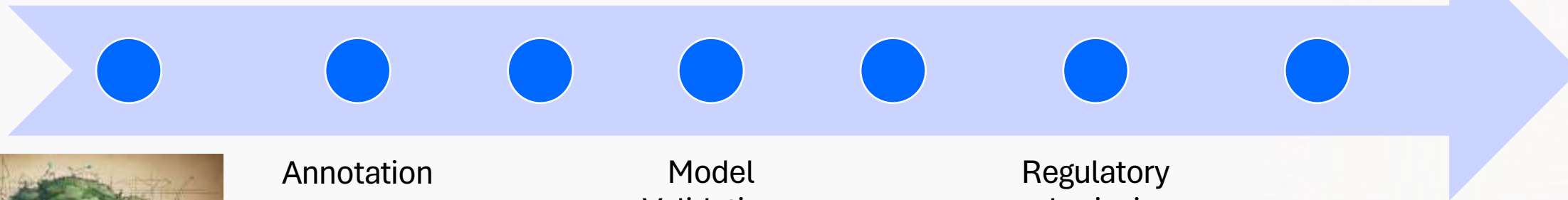
We are here



Model  
Tuning  
(ongoing)



Model  
Deployment

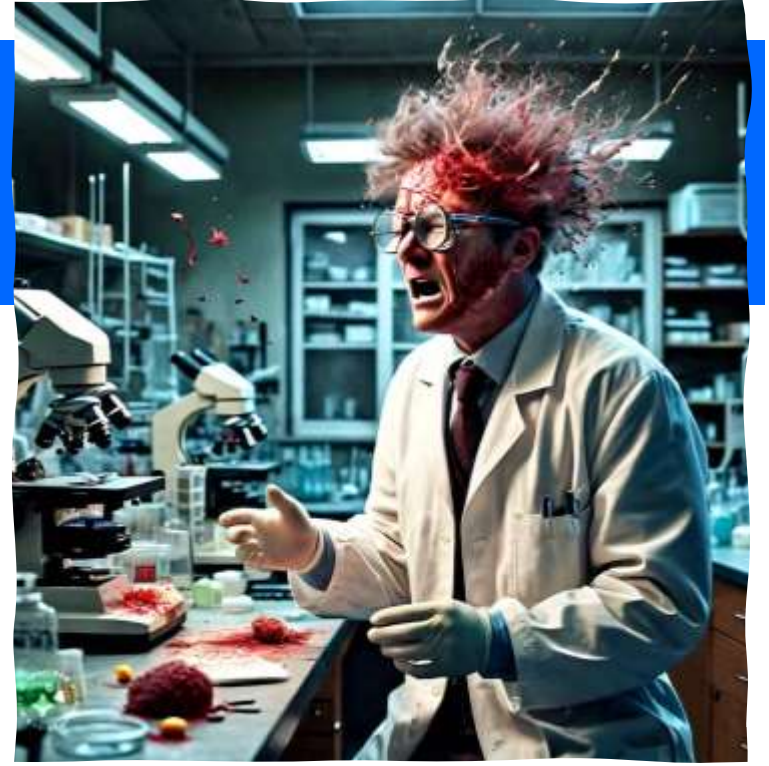


Annotation

Model  
Validation

Regulatory  
submission





AI Needs Tuning

# Evaluation

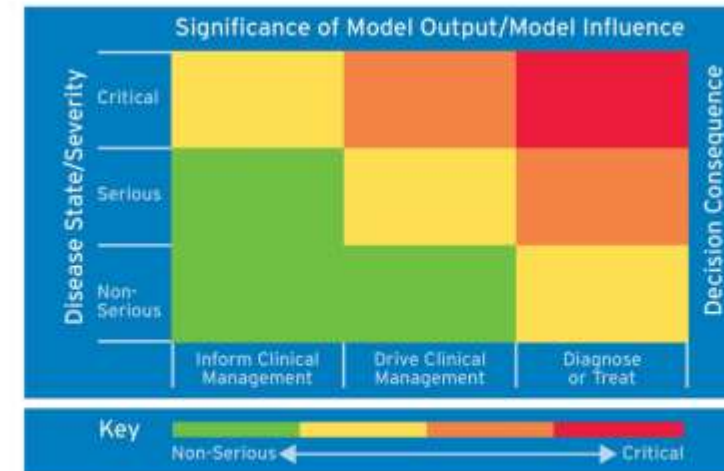
- Performance evaluation is critical to verification & validation of ML systems
- Incorporate lab director oversight
- Use local data
- Changes to the model require re-verification
- Understand pre-analytic variables
- Monitor for performance defects over time (shift, drift)
- Understand the scope of application – strengths & limitations

(Arch Pathol Lab Med. doi: 10.5858/arpa.2023-0042-CP)

## Recommendations for Performance Evaluation of Machine Learning in Pathology

A Concept Paper From the College of American Pathologists

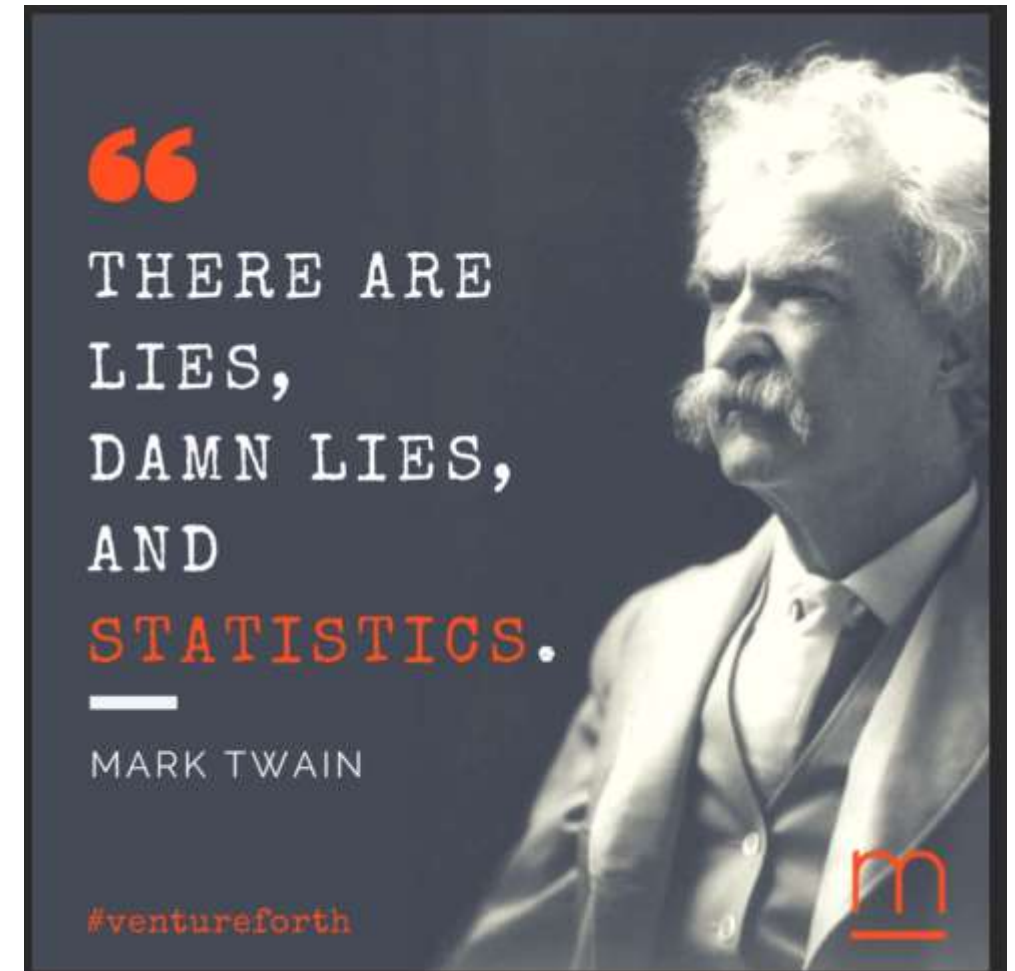
Matthew G. Hanna, MD; Niels H. Olson, MD; Mark Zarella, PhD; Rajesh C. Dash, MD; Markus D. Herrmann, MD, PhD; Larissa V. Furtado, MD; Michelle N. Stram, MD; Patricia M. Raciti, MD; Lewis Hassell, MD; Alex Mays, MD; Liron Pantanowitz, MD, PhD, MHA; Joseph S. Sirintrapun, MD; Savitri Krishnamurthy, MD; Anil Parwani, MD, PhD, MBA; Giovanni Lujan, MD; Andrew Evans, MD; Eric F. Classy, MD; Marilyn M. Bui, MD, PhD; Rajendra Singh, MD; Rhona J. Souers, MS; Monica E. de Baca, MD; Jansen N. Seheult, MD



**Figure 2.** Risk classification schema. Risk stratification adapted from the FDA SaMD framework proposal and ASME V&V40-2018 approach. Red designates machine learning–based clinical decision support software that would be categorized as high risk. Green shows those that would be categorized as low risk. Abbreviations: ASME, American Society of Mechanical Engineers; FDA, Food and Drug Administration; SaMD, software as a medical device.

# Challenges – The Explainability Paradox

- Lack of transparency (black box)
- Complex statistical models
- Need to convey model confidence, limitations & sources of bias
- Concerns re: reliability & vulnerability to attack



Just remember...No test is perfect

Sometimes pattern recognition can be misleading



# Final Words 1 – complimentary assistive role

Pathologists will not  
be replaced by AI

BUT Pathologists not  
using AI will be  
replaced by those  
using AI



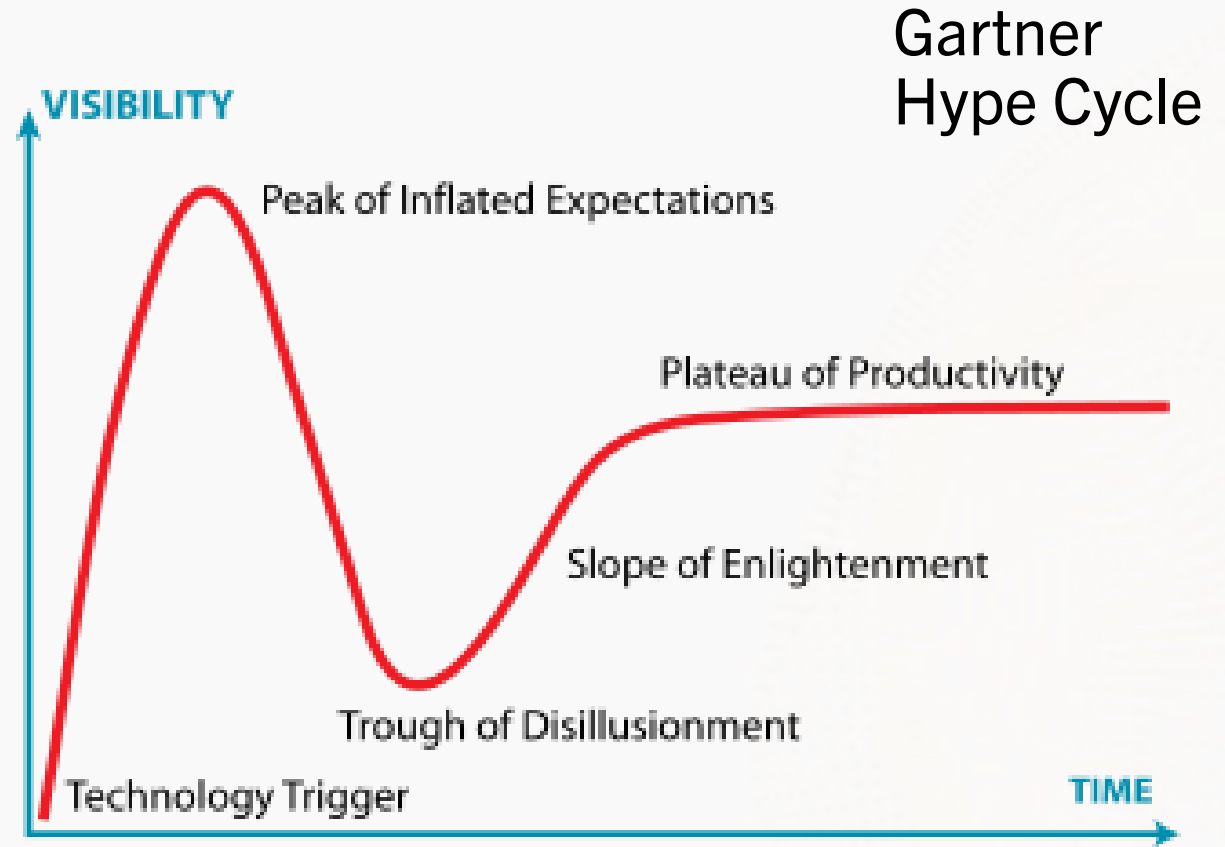
# Final Words 2

Role of the Pathologist:

- Identify
- Integrate
- Communicate



# Final Words 3



# Thank-you

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Please contact me for any further information or a demo

[Fiona.maclean@franklin.ai](mailto:Fiona.maclean@franklin.ai)

