

From Actionable Intelligence to Digital Health Technology

Waty Lilaonitkul

ThAIMed

26/08/2024



Agenda and Introductions

About the program for today

Three principal objectives:

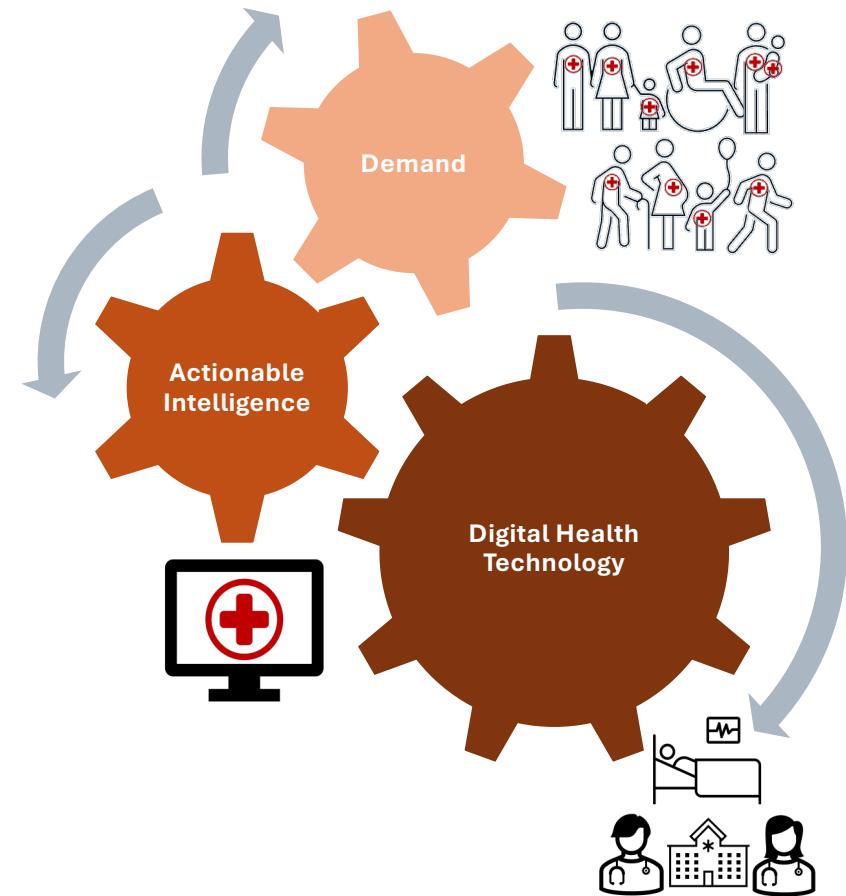
- Reimagining Healthcare
- The Digital Health and AI Revolution
- The Technological Readiness Levels for AI Systems

Please interrupt!



Dr. Watjana Lilaonitkul

- Assistant Professor in Digital Health Technologies, UCL, Global Business School for Health
- UK National Methods Panel (BMBR), UKRI Medical Research Council (MRC) / National Institute for Health and Care Research (NIHR)
- UK Research Innovation Fellow
- Translational AI research for commercialization or opensource dissemination. 3 AI patent applications funded by UCLB (UK, EU, USA)

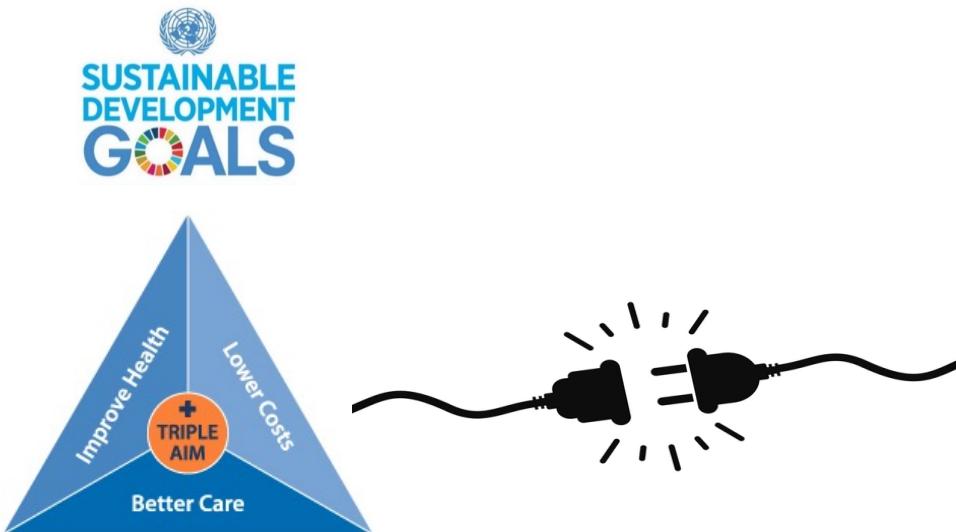


Pub Quiz



1. Reimagining Healthcare

1.1. The SGD Goals versus The ASEAN Healthcare Landscape



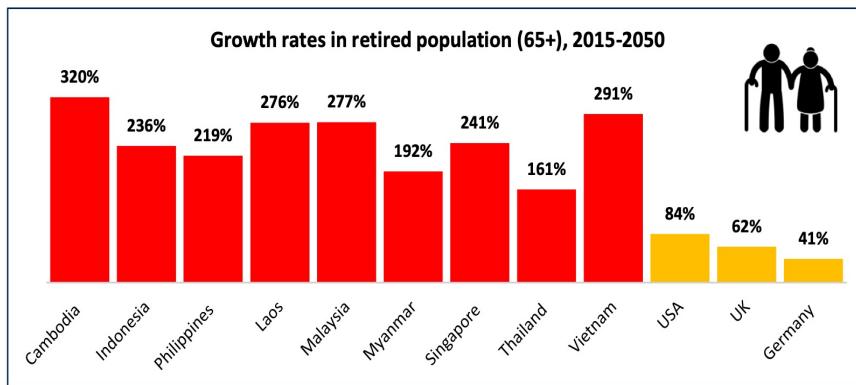
SNAPSHOT OF CURRENT HEALTHCARE LANDSCAPE IN ASEAN		
EXPANDING DEMAND	INEFFICIENT SYSTEM	INSUFFICIENT AND INEQUITABLE FUNDING
<p>By 2030, >70 million people are projected to be over the age of 65</p> <p>9 million annual deaths due to NCDs, and representing 27% of global parasitic + 30% of respiratory cases</p> <p>Committed to achieving UHC by 2030</p>	<p><10% of healthcare budget allocated for preventive care</p> <p>Purchasing lacks consideration of innovation</p> <p>Infrastructure investments outpace those for manpower</p>	<p>Tax collection falls <15% of tax-to-GDP target</p> <p>78% of workers are informal limiting taxability and contributions collection</p> <p>Risk pooling by socioeconomic status remains fragmented</p> <p>Risk of adverse selection due to selective participation from informal segment</p>

1. Reimagining Healthcare

1.2. Enter The Silver Economy



A vast demographic shift will reshape the world.



Source: United Nations, Department of Economic and Social Affairs, Population Division

SNAPSHOT OF CURRENT HEALTHCARE LANDSCAPE IN ASEAN

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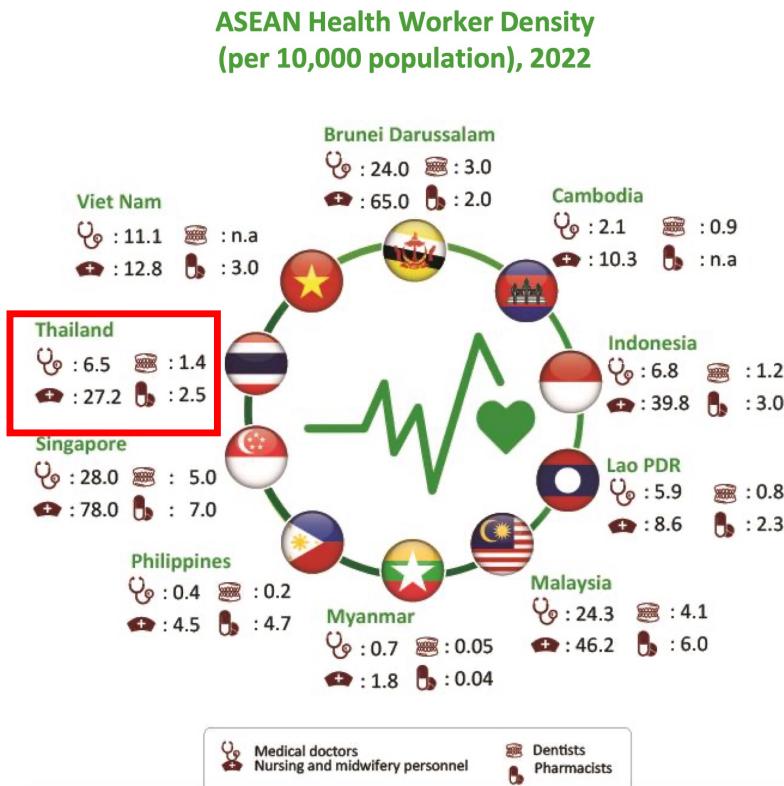
Risk of adverse selection due to selective participation from informal segment

1. Reimagining Healthcare

1.2. Insufficient Health Professionals



Whole system inefficiencies cannot sustain these pressures.



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1. Reimagining Healthcare

1.3. An unsustainable funding base exacerbates high demands & inefficiencies



Healthcare Systems are currently financed on disappearing revenue sources

3 Healthcare Schemes

*Different legal frameworks
Different Ministries*

- CSMBS (Civil Servants' Medical Benefit Scheme)
 - Finance Ministry
 - Tax-financed covering public employees
- SSS (Social Security Scheme)
 - Labour Ministry
 - Contributory covering private employees
- UCS (Universal Coverage Scheme)
 - Public Health Ministry
 - Taxed-financed covering residual Thai population



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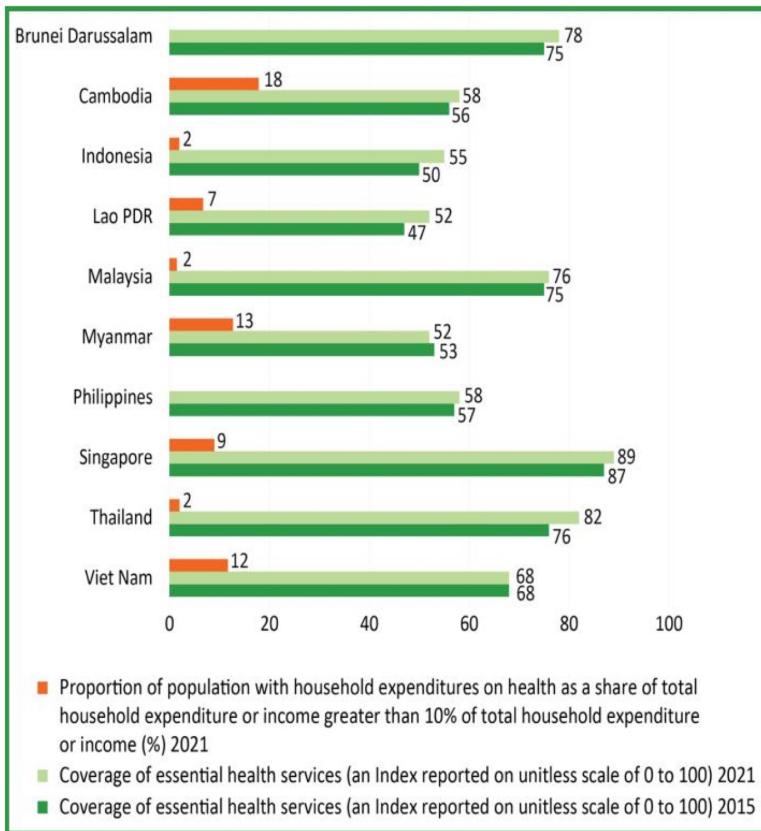
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1. Reimagining Healthcare

1.4. Thailand's Universal Health Coverage Scheme

Indicators to track progress in achieving the universal health coverage (UHC)



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1. Reimagining Healthcare

1.5. Towards a virtuous cycle

Evolving from ‘health-for-all’ to ‘health for wealth’

A paradigm shift is required. Healthcare is not a cost. It is a fundamental driver of the economy.

2. The Digital Health and AI Revolution

2.1. Where are we now?

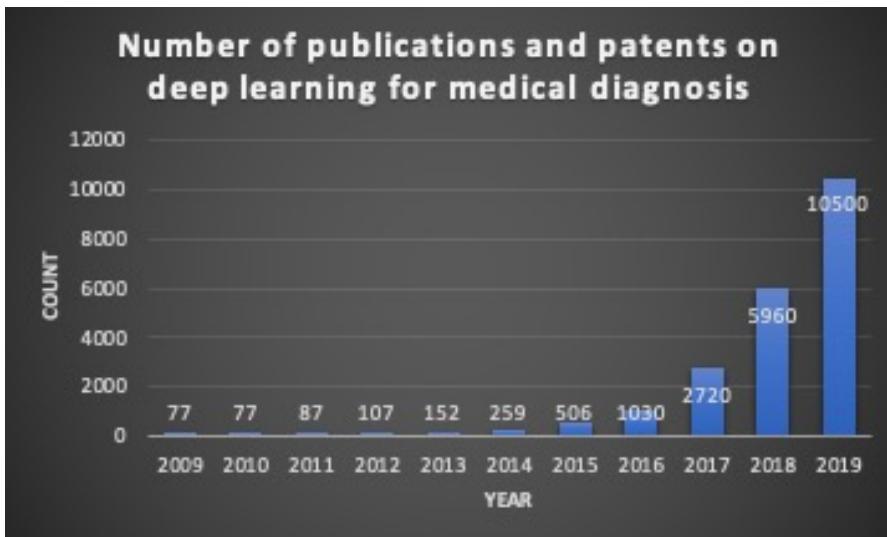


Figure 1. Exponential rise in publications on deep learning in medical diagnosis (Left);
Most have yet to show real world impact (Right).

The screenshot shows a news article from MIT Technology Review. The header features the MIT Technology Review logo and navigation links for Featured, Topics, Newsletters, Events, and Podcasts, along with Sign In and Subscribe buttons. The main headline reads "Hundreds of AI tools have been built to catch covid. None of them helped." Below the headline, a subtext states: "Some have been used in hospitals, despite not being properly tested. But the pandemic could help make medical AI better." The author is listed as Will Douglas Heaven, and the date is July 30, 2021. A photograph at the bottom shows a medical professional in protective gear attending to a patient in a hospital setting.

2. The Digital Health and AI Revolution

2.2. Rewired to outcompete

Six enterprise capabilities are critical for successful digital and AI transformations.

Transformational value comes from careful and coordinated execution across all areas of focus

Alignment
on value

1. Business-led digital road map

Align senior leadership team on the vision, value, and road map for the transformation; reimagine business domains to deliver outstanding customer experiences and to lower unit costs.

Delivery
capabilities

2. Talent

Ensure that you have the right skills and capabilities to innovate and execute.

3. Operating model

Increase the metabolic rate of the organization by bringing business, operations, and technology together.

4. Technology

Make technology easier for teams to use so they can innovate at pace.

5. Data

Continually enrich data and make it easily accessible across the organization to help improve customer experience and business performance.

Change
management

6. Adoption and scaling

Maximize value capture by ensuring the adoption and enterprise scaling of digital solutions and by tightly managing the transformation progress and risks.

2. The Digital Health and AI Revolution

2.2.1. Rewired to outcompete: Business-led digital roadmap

Six enterprise capabilities are critical for successful digital and AI transformations.

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Alignment on value	<p>1. Business-led digital road map</p> <p>Align senior leadership team on the vision, value, and road map for the transformation; reimagine business domains to deliver outstanding customer experiences and to lower unit costs.</p>				
Delivery capabilities	<p>2. Talent Ensure that you have the right skills and capabilities to innovate and execute.</p> <p>3. Operating model Increase the metabolic rate of the organization by bringing business, operations, and technology together.</p> <p>4. Technology Make technology easier for teams to use so they can innovate at pace.</p> <p>5. Data Continually enrich data and make it easily accessible across the organization to help improve customer experience and business performance.</p>				
Change management	<p>6. Adoption and scaling Maximize value capture by ensuring the adoption and enterprise scaling of digital solutions and by tightly managing the transformation progress and risks.</p>				

Prioritise projects where you can put an economic value to the scientific value

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Team science is key.

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Systems thinking:

Go beyond a model prototypes.

Think platforms and go for agile development-train-test loops.

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Scalability:
Seamless data collection as part of the clinical work-flow.

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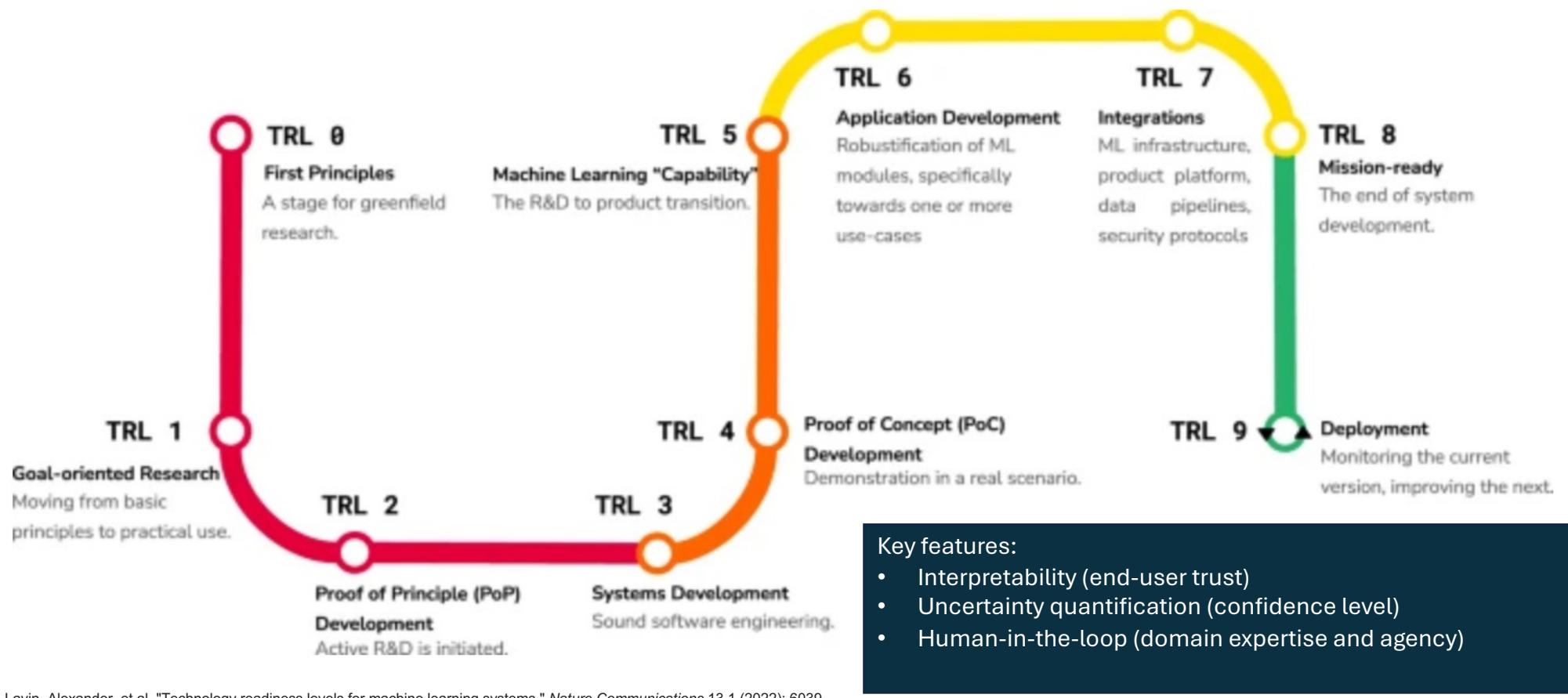
Responsible deployment

- Mispredictions?
- When to retrain a model?

3. Technology Readiness Levels

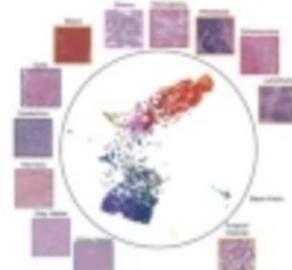
3.1. Follow the yellow brick road

AI/ML TRL spans research (red) through prototyping (orange), productization (yellow), and deployment (green).



3. Technology Readiness Levels

3.2. The TRL Card

TECHNOLOGY NAME	Neuropathology Copilot v1.0		
TRL	4 <link to previous cards>		
R&D OWNER / REVIEWER	A. Lavin / G. Renard		
PROD OWNER / REVIEWER	S. Wozniak / S. Jobs		
COMPONENT CODES	1.1, 4.2, 4.3		
TL;DR	Analyze WSI of brain tissue in 3 main steps: (1) unsupervised CV model produces Poincare manifold viz (Naud & Lavin '20), (2) domain expert selects data points, (3) U-Net classifier		
Data considerations	<p>3 datasets have been used to train and validate the system:</p> <ol style="list-style-type: none">1. Open dataset (Naud & Lavin '20)2. Pilot dataset provided by BioLab, v1.03. Simulated datasets (w/ structured domain randomization), v2.3		
Ethics	<p>Note the demographics info on specific Dataset Cards. Datasets anonymized, pipeline runs w/o metadata.</p> <p>The Latent Sciences Ethics Checklist has been completed.</p>		
Model / alg details	<p>The SP-VAE model runs unsupervised on neurological whole-slide images (WSI), producing a latent manifold that represents a hierarchical organization of tissue types. An medical expert identifies several data points to inspect.</p> <p><i>Example visualization of the latent organization of brain tissue types.</i></p> 		
Metrics, results	<p>Classification accuracy >0.97 on the 5 main brain cancer types. Inference per WSI runs ~1.0s on 2-GPU.</p> <p>Full quantitative reports: < link to experiments wiki ></p>		
Caveats, known edge cases, recommendations	<p>Changing imaging sources will require retraining the full model (notably the SP-VAE annealing parameter). Whenever possible it is recommended that users provide feedback annotations.</p> <p>Non-tissue material is correctly flagged as anomalous.</p>		
Key assumptions	<p>The training and production images are equivalent, specifically from the exact same sensor(s).</p>		
Intended use	<p>The model must include human expert in the loop, and it has not yet been validated for other disease areas.</p>		