

## **Breakout Session 7:**

# **A Sustainable Medical Imaging Challenge Cloud Infrastructure (MedICCI)**

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# A Sustainable Medical Imaging Challenge Cloud Infrastructure (MedICCI)

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&

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NIH/ODSS Cloud Supplement PI Meeting

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# Goal:

To develop a sustainable medical imaging challenge cloud infrastructure that will allow submission of tools for continuous benchmarking.

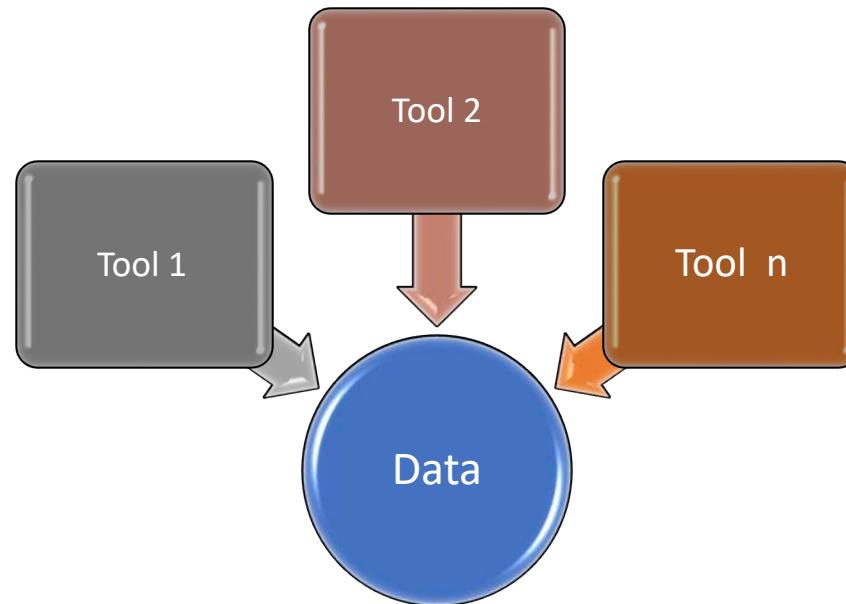
# AI Challenges

- Open competitions on well-defined scientific/technical problems (tasks)
  - Allow for direct comparison of different algorithms all applied to a common dataset and evaluated with a uniform set of metrics
  - Eliminate variability in system performance due to the composition of the data, the reference standard, and the scoring metric used to evaluate system output

# Elements of an AI Challenge

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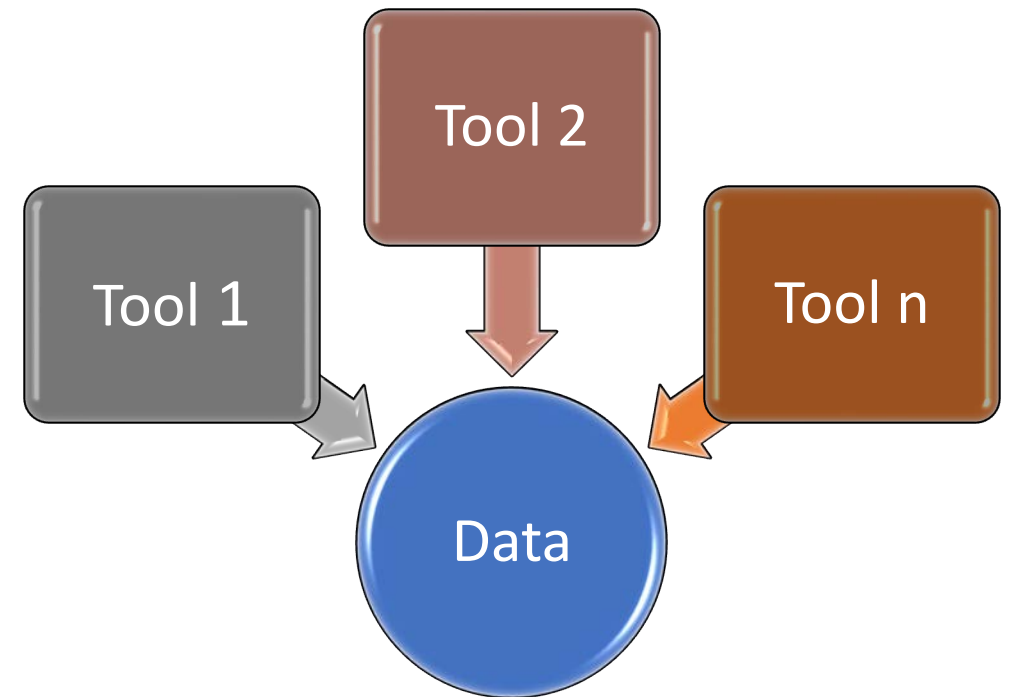
- ❑ Training of algorithms on a reference (training) dataset – labels revealed
- ❑ Validation of performance on a small dataset and leaderboard placement
- ❑ Testing of algorithms on a challenge (test) dataset – labels hidden



# Why do a challenge?

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- ❑ Productive use of reference datasets
- ❑ Promote open science
- ❑ Algorithmic excellence
- ❑ Benchmarking algorithms
- ❑ Reproducibility of methods
- ❑ Consensus on methodologies
- ❑ Drive Standards & Best Practices



# Running a Challenge

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## Requirements

- Dataset
- Task
- Platform(s)
- Evaluation metric(s)
- Quality control



## Potential Products

- Annotated dataset
- Benchmarked tools
- Leaderboard
- Report publication

## **Q. What happens after a challenge is over?**

→ Need a sustainable approach to allow testing and benchmarking of new tools

## Initial approach

- Implement the NCI-sponsored Medical Image Challenge Infrastructure (MedICI) in NCI Cloud Two (GCP)
- Run an imaging AI challenge
- Allow tools to be benchmarked well beyond the official end date of the challenge



## Unforeseen issue and remediation

- Issue: NCI Cloud Two (GCP) Authorization to Operate (ATO) was significantly delayed
- Mitigation measure: Use alternative GCP-based challenge platform

# Sage Bionetworks: NCI ITCR U24 Grant

“Advancing cancer benchmarking and data sharing through crowd-sourced challenges”

Aim 3: Expand the Challenge & benchmarking community through improvements in education, outreach, and empowering the organization of independent challenges.

Biomedical imaging



Clinical algorithms



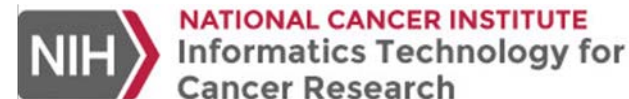
EHR & Real-world data



Precision oncology



Cancer informatics



# Brain Tumor Segmentation (BraTS) Challenges (2012-2023)

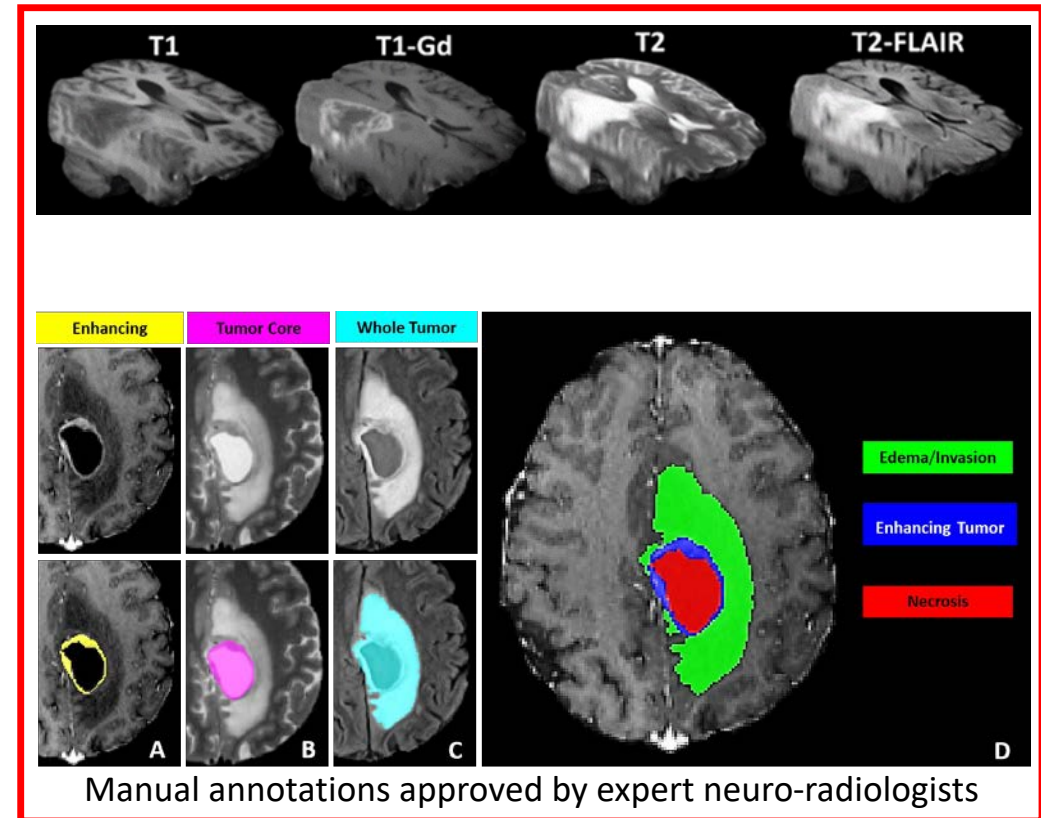


BraTS overarching goal: Benchmarking of state-of-the-art models for segmentation of brain tumors in multiparametric magnetic resonance imaging (MRI) scans.

B.Menze, et al., IEEE TMI, 34:1993-2024, 2015

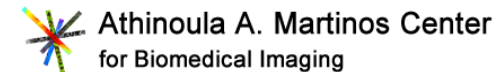
# BraTS 2023 Challenge Datasets

- The largest n: 2040 patients (training, validation, testing)  
n:1251 n:219 n:570
- Consistent annotation protocol for manual annotations by neuro-radiologists.
- Appropriate algorithmic evaluation:  
- involvement of biostatisticians
- Harmonized pre-processing of all scans  
(Open source via publicly available tools)



# BraTS 2023 Data Contributors

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## Segmentation - Adult Glioma

991 Registered participants, 97 teams with 1300+ submissions in validation phase

Top-performing teams in alphabetical order

**BiomedMBZ:** Fadillah Adamsyah Maani et al., *Advanced Tumor Segmentation in Medical Imaging: An Ensemble Approach for BraTS 2023 Adult Glioma and Pediatric Tumor Tasks*

**Faking\_it:** André Ferreira et al., *Enhanced Data Augmentation using Synthetic Data for Brain Tumour Segmentation*

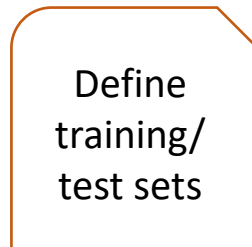
**NVAUTO:** Andriy Myronenko et al., *Auto3DSeg for Brain Turmor Segmentation from 3D MRI in BraTS 2023 Challenge*

# An Ecosystem for Data, Benchmarks, and Tools

Image Repository



Tools/Models



**Transparent, Scalable, and Sustainable**

# Acknowledgments

- NIH ODSS
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