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ACR® American College of Radiology

AAPM American Association of Physicists in Medicine

MIDRC Medical Imaging and Data Resource Center.

Grand Challenges with MIDRC

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NIH National Institute of Biomedical Imaging and Bioengineering

The University of Chicago

“Grand Challenges”

- Allows comparison of different algorithms
  - all playing by the same rules,
  - on a common set of images,
  - reporting standardized output,
  - with a uniform performance assessment.

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“Grand Challenges”

- Controlled environment
  - database of images
  - training/testing paradigm
  - performance evaluation
  - scoring method
  - reporting structure

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Successful Challenges

- **Challenges will not succeed without groups willing to "accept the challenge"**

- **"Build it and they will come"**

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Successful Challenges

- Challenges will not succeed without groups willing to "accept the challenge"
- "Build it and they will come"
- Organizers must "build it SO they will come"

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Successful Challenges

- Challenge must be considered reputable
  - worthy of participants' time and effort
- Challenges should offer an incentive
  - conference panel or co-authorship or prize money

Why Challenges?

- **Advance the field**

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Why Challenges?

- **Advance the field**
  - **motivate groups around the world to dedicate their time and talents toward a defined task**
  - **reveal approaches to the task that are (1) promising or (2) weaker**
  - **foster open science with code depositing**

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Challenge Quiz

- **What is the single biggest challenge of challenges?**

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Challenge Quiz

- **What is the single biggest challenge of challenges?**

Image Data

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Challenge Quiz

https://wvhistoryonview.org/catalog/005796

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Challenge Quiz

https://wvhistoryonview.org/catalog/005796
https://www.target.com/p/toy-story-4-pig-ham-coin-bank-pink/

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Challenge Quiz

- But you also want....
  - image metadata
  - clinical data
  - demographic data
  - patient/image/lesion labels
  - expert annotations

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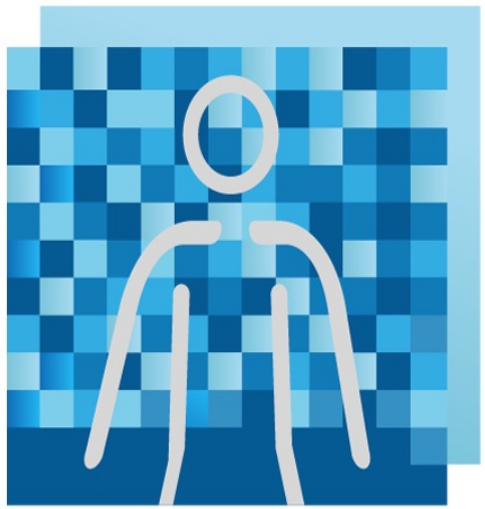

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- Challenges are contained within
  - 3 of the 5 Technology Development Projects
  - 2 of the 12 Collaborative Research Projects

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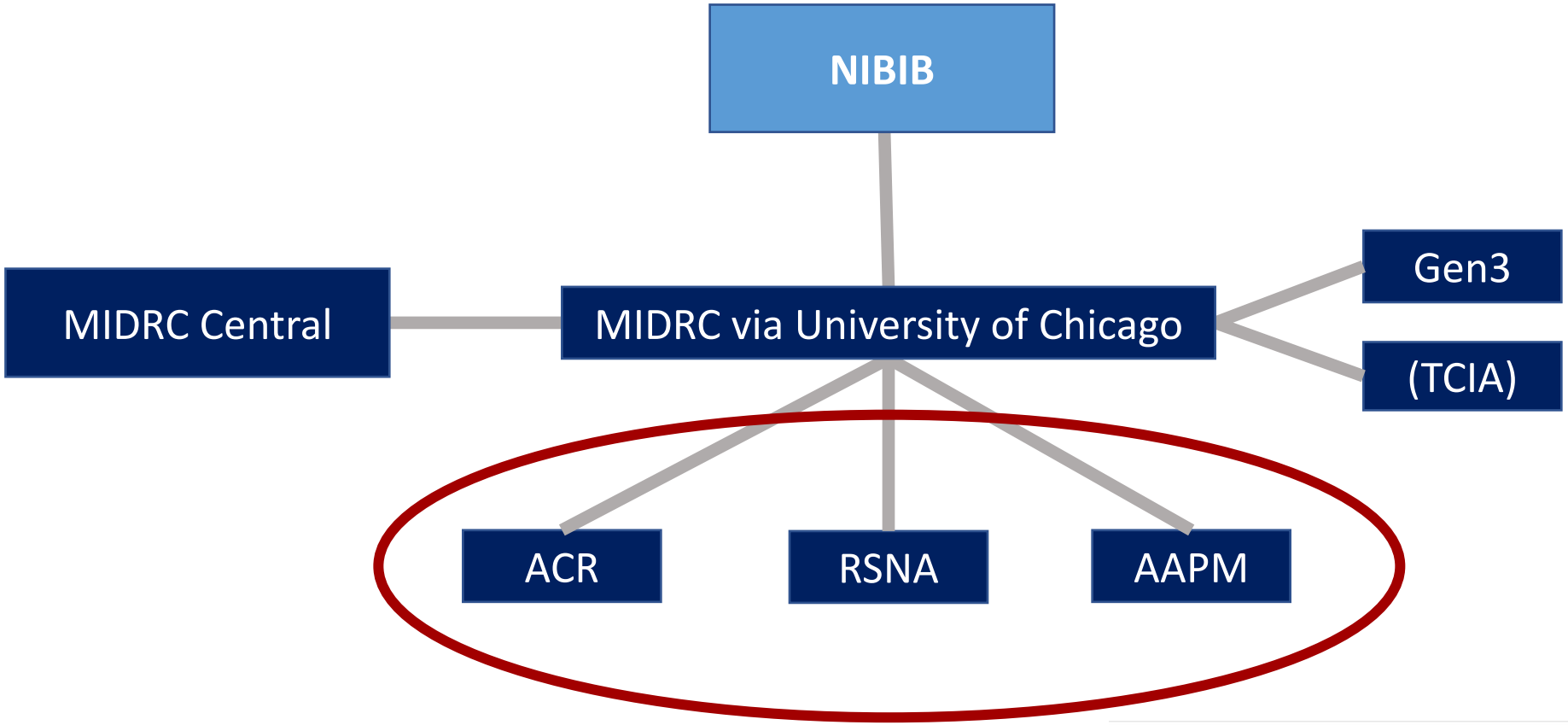

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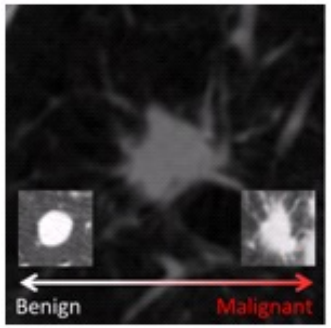
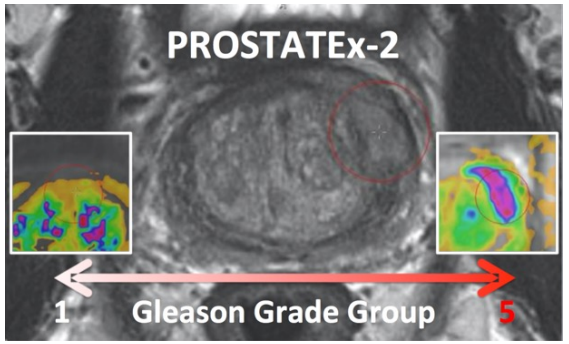
AAPM Challenges

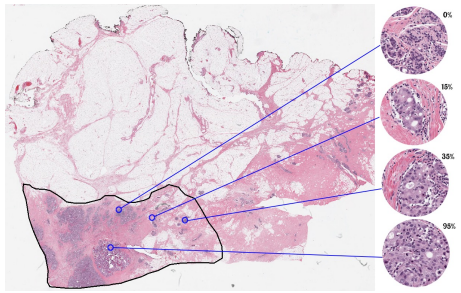
- LUNGx (2015)



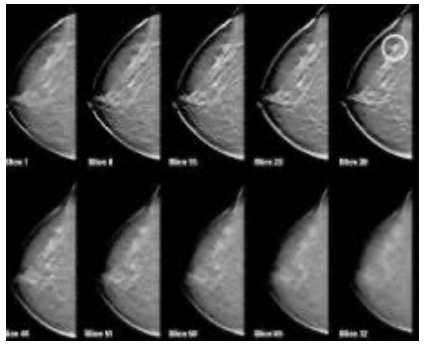
- PROSTATEx / PROSTATEx-2 (2017)



- BreastPathQ (2019)



- DBTex (2020)



- Proffered challenges (6+)

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RSNA Challenges

- Pediatric Bone Age Challenge (2017)
- Pneumonia Detection Challenge (2018)
- Intracranial Hemorrhage Detection Challenge (2019)
- Pulmonary Embolism (2020)

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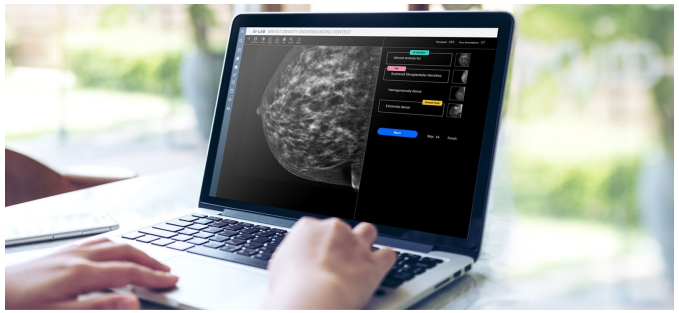
ACR Challenges

- **Breast Density Crowdsourcing Challenge (2019)**



- **Resident Mammography Challenge (2019)**

- **SIIM-ACR Pneumothorax Challenge (2019)**

MIDRC Challenge Process

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MIDRC Challenge Process

- **Most challenges develop from an existing, static, limited set of images and associated data**
- **Challenges are designed based on the limitations of this key ingredient**
- **The magnitude and expanding nature of MIDRC actually make data collection for challenges a challenge**

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MIDRC Challenge Process

- **Test data request form has been developed**

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MIDRC Challenge Process

- Test data request form has been developed
  - Allows for challenge organizers to
    - collect their thoughts
    - work through their challenge logistics
    - identify their challenge needs

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MIDRC Challenge Process

- Test data request form has been developed
  - Challenge title
  - Number of subjects
  - Number of imaging studies
  - Distribution of COVID-19 cases and other disease
  - Reference standard requirements
  - Patient demographic distributions (age, gender, race)
  - Need for associated clinical data
  - Timeline

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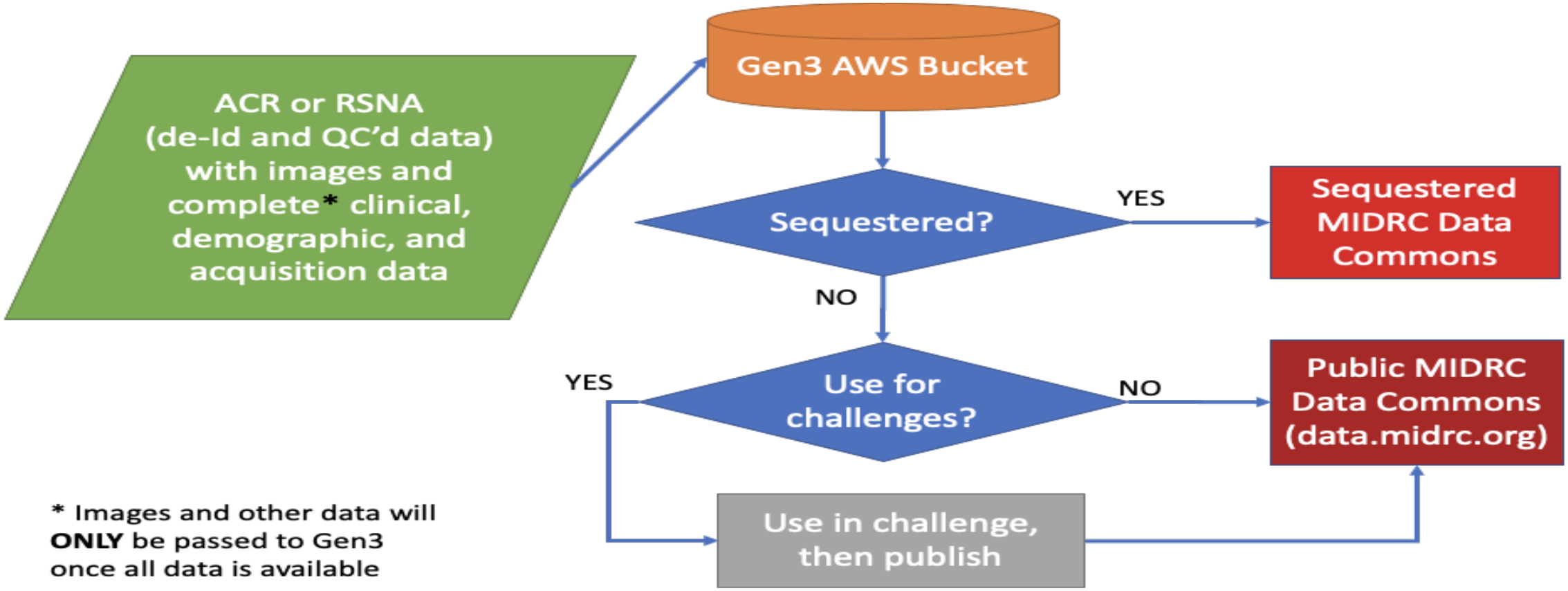

* Images and other data will **ONLY** be passed to Gen3 once all data is available

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Conclusion

- **MIDRC will provide an extensive resource of data for a vast array of grand challenges**
- **Initially, MIDRC challenges will be organized by MIDRC investigators**
- **Future MIDRC challenges will be organized by the medical imaging research community at large**

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