Auto-Segmentation for Thoracic Radiation Treatment Planning: A Grand Challenge

The Current State of Grand Challenges

S.G. Armato III

THE UNIVERSITY OF CHICAGO

Disclosures

- Royalties and licensing fees for CAD technology from the University of Chicago
- Consultant, Aduro Biotech, Inc.

Challenges

- Allows comparison of different algorithms
  - all playing by the same rules,

Challenges

- Allows comparison of different algorithms
  - all playing by the same rules,
  - on a common set of images,

Challenges

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

Challenges

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

Challenges

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

Challenges

- Friendly competition
- Educational
- Participants deserve much credit

How to Host a Challenge

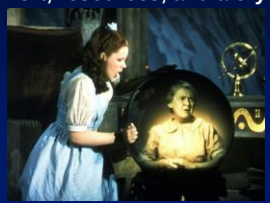
- Central organization

How to Host a Challenge

- Central organization
  - time, effort, resources

How to Host a Challenge

- Central organization
  - time, effort, resources, and a crystal ball

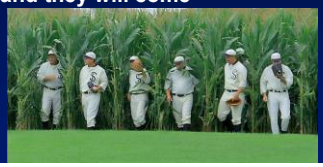


How to Host a Challenge

- Challenges will not succeed without groups willing to “accept the challenge”

How to Host a Challenge

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



How to Host a Challenge

- 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"

How to Host a Challenge

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

AAPM Challenges

- LUNGx Challenge 2015
- Collaboration among AAPM, SPIE, and NCI
  - University of Chicago, University of Michigan, and Oak Ridge National Laboratory

AAPM Challenges

- PROSTATEx Challenges 2017
  - PROSTATEx and PROSTATEx-2
- Collaboration among AAPM, SPIE, and NCI
  - University of Chicago, University of Michigan, Radboud University, and FDA

Investigator-Initiated AAPM Challenges

Investigator-Initiated AAPM Challenges

- Low-Dose CT Challenge 2016
  - Mayo Clinic

Investigator-Initiated AAPM Challenges

- Thoracic Auto-Segmentation Challenge 2017
  - MD Anderson Cancer Center
  - Massachusetts General Hospital
  - Mirada Medical
  - Memorial Sloan Kettering Cancer Center
  - Maastro Clinic

Working Group on Grand Challenges

- AAPM's Science Council
  - Technology Assessment Committee (TAC)
    - Working Group on Grand Challenges

Working Group on Grand Challenges

- Solicit challenge proposals from the community
- Assist with resources, expertise, venue

Working Group on Grand Challenges

- Solicit challenge proposals from the community
- Assist with resources, expertise, venue

OR

- Identify “hot topic” challenge tasks and seek organizers

Challenge Considerations

- Database

Challenge Considerations

- Database
  - How many cases? balance effort/cost vs. power
  - Technical parameter consistency
    - slice thickness
    - contrast enhanced
  - Lesion characteristics consistency
    - size
    - histology

Challenge Considerations

- Database
- Instructions

Challenge Considerations

- Database
- Instructions
  - Acceptable level of human input
  - Appropriate use of test set
  - Don’t assume

Challenge Considerations

- Database
- Instructions
- Clinical data

Challenge Considerations

- Database
- Instructions
- Clinical data
  - limit to DICOM header (age, gender)?

Challenge Considerations

- Database
- Instructions
- Clinical data
- Commitment by participants

Challenge Considerations

- Database
- Instructions
- Clinical data
- Commitment by participants
  - anonymity

Challenge Considerations

- Database
- Instructions
- Clinical data
- Commitment by participants
- Epilogue

Challenge Considerations

- Database
- Instructions
- Clinical data
- Commitment by participants
- Epilogue
  - image data persistence
  - publish?

WARNING
CHALLENGES AHEAD
KEEP CALM AND ACCEPT THE CHALLENGE