Joint Imaging-Therapy Scientific Symposium: PROSTATEx-2 Challenge

PROSTATEx-2 Overview

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Disclosures

• Royalties and licensing fees for CAD technology from the University of Chicago

• Consultant, Aduro Biotech, Inc.

Gleason Grade Group

SPIE

National Cancer Institute
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• Robert Nordstrom

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AAPM
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SPIE
• Diane Cline

History

• 2015: SPIE-AAPM-NCI LUNGx Challenge
  • computerized lung nodule classification

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  • computerized lung nodule classification
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• 2016: SPIE, AAPM, and NCI seek a 2-part challenge
  • same dataset
  • part 1 in conjunction with SPIE Medical Imaging 2017
  • part 2 in conjunction with AAPM Annual Meeting 2017

• 2015: SPIE-AAPM-NCI LUNGx Challenge
  • computerized lung nodule classification
  • Armato et al. JMI, 2015.
  • Armato et al. JMI, 2016.
• 2016: SPIE, AAPM, and NCI seek a 2-part challenge
  • but how does part 1 not interfere with part 2?
History

- 2015: SPIE-AAPM-NCI LUNGx Challenge
  - computerized lung nodule classification
  - Armato et al. JMI, 2015.
  - Armato et al. JMI, 2016.
- 2016: SPIE, AAPM, and NCI seek a 2-part challenge
  - multi-parametric MR scans of the prostate
  - two diagnostic tasks
  - PROSTATEx and PROSTATEx-2

PROSTATEx

SPIE-AAPM-NCI Prostate MR Classification Challenge

Task: Distinguish between “clinically significant” and “not clinically significant” prostate lesions on MR
PROSTATEx

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Timeline:
• November 21, 2016: training cases available
  • 330 lesions with truth (binary clinical significance)
  • spatial location
  • zone (anterior fibromuscular stroma, peripheral, seminal vesicle, transition)

PROSTATEx

Task: Distinguish between “clinically significant” and “not clinically significant” prostate lesions on MR

Timeline:
• November 21, 2016: training cases available
  • 330 lesions with truth (binary clinical significance)
• December 12, 2016: test cases available
  • 208 lesions without truth
  • spatial location
  • zone

PROSTATEx

Task: Distinguish between “clinically significant” and “not clinically significant” prostate lesions on MR

Timeline:
• November 21, 2016: training cases available
  • 330 lesions with truth (binary clinical significance)
• December 12, 2016: test cases available
  • 208 lesions without truth
• February 15, 2017: SPIE Medical Imaging 2017
PROSTATEx

Task: Distinguish between “clinically significant” and “not clinically significant” prostate lesions on MR

• submit single real number on [0, 1] for each lesion representing likelihood of clinical significance

• performance assessment: ROC analysis

PROSTATEx-2

SPIE-AAPM-NCI Prostate MR Gleason Grade Group Challenge

Gleason Score (Grade)
Gleason Score (Grade)
- Reflects the appearance of cancer cells from biopsy
  - 1 = similar to normal prostate cells
  - 5 = very abnormal
- Two ratings assigned
  - one to the most dominant cell appearance
  - one to the second-most dominant appearance
- The two ratings are combined: Gleason score [2-10]

Gleason Grade Group (GGG)
- Clinically meaningful binning of Gleason scores

<table>
<thead>
<tr>
<th>Gleason Grade Group</th>
<th>Gleason Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>≤ 6</td>
</tr>
<tr>
<td>2</td>
<td>7 (3 + 4)</td>
</tr>
<tr>
<td>3</td>
<td>7 (4 + 3)</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>9 or 10</td>
</tr>
</tbody>
</table>
**PROSTATEx-2**

**Task:** Develop quantitative MR biomarkers for the determination of Gleason Grade Group in prostate cancer

**Timeline:**
- May 15, 2017: training cases available
  - 112 lesions with truth (Gleason Grade Group)
  - spatial location
  - zone (anterior fibromuscular stroma, peripheral, seminal vesicle, transition)
- June 5, 2017: test cases available
  - 70 lesions without truth
  - spatial location
  - zone
**PROSTATEx-2**

**Task:** Develop quantitative MR biomarkers for the determination of Gleason Grade Group in prostate cancer

**Timeline:**
- May 15, 2017: training cases available
  - 112 lesions with truth (Gleason Grade Group)
- June 5, 2017: test cases available
  - 70 lesions without truth
- August 1, 2017: AAPM Annual Meeting 2017

**PROSTATEx-2**

**Task:** Develop quantitative MR biomarkers for the determination of Gleason Grade Group in prostate cancer

- submit ordinal value on [1, 5] for each lesion representing Gleason Grade Group
- performance assessment: quadratic-weighted Kappa

**Web-Based Challenge Platform**

The Web-Based Challenge Platform is a platform for participants to submit their results and compare them with others. It includes features such as a leaderboard and a forum for discussion. Participants can register, upload their results, and view the current standings. The platform also provides tools for data analysis and visualization, allowing users to explore their data in new ways.
**Rules**

- Train with training set without restriction
- No human intervention with test set, except for manual or human-supervised delineation of prostate boundary or gross lesion margin
- Participants not allowed to withdraw from the Challenge after test set groupings submitted

**Datasets**

- MR scans of each patient contained
  - Transaxial and sagittal T2-weighted images
  - $K_{\text{trans}}$ images (computed from dynamic contrast-enhanced images)
  - Apparent diffusion coefficient (ADC) images (computed from diffusion-weighted images)
  - Thumbnail of each lesion for visual reference

Challenge results...