VOCAL TRACT AREA FUNCTION ESTIMATION
FROM VOLUMETRIC MRI

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1. Introduction
- Vocal tract shape determines acoustic properties of speech signal
- Area function: representation of vocal tract shape
  - Simplifying assumption: 1D wave propagation in vocal tract
  - Concatenated tubes model of vocal tract
  - Cross-sectional areas of tubes = area function
- Goal: Directly measure area function from 3D-MRI

2. Dataset
- Volumetric MRI
  - Sustained contextualized continuants
    - Vowels (e.g. beet, bit, bart, bet, bat, pot, bart)
    - Fricatives (e.g. afa, afa, afa, aza)
    - Nasals (ama, ana, anga)
    - Liquids (afa, ara)
  - Accelerated protocol (Yoon et al, 2009): 8s per scan

3. Methodology
- Semi-automatic method (based on Yoon et al, 2013)
  - Improved automation over previous method

I. Denoising
- Anisotropic diffusion

II. Grid line drawing
- Green x = manual landmark

III. Airway centerline estimation
- Gray area = airway seed for region growing

IV. Slice cutting along grid lines and airway area estimation

4. Results
- W = female subject, M = male subject
- Sagittal-to-area conversion
- Real-time evolution of 3D area function from 2D real-time MRI data

5. Future work
- Sagittal-to-area conversion
- Real-time evolution of 3D area function from 2D real-time MRI data

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