Ming Hsieh Department of Electrical Engineering



VOCAL TRACT AREA FUNCTION ESTIMATION FROM VOLUMETRIC MRI

Zisis lason Skordilis, Asterios Toutios, Johannes Toger, Shrikanth S. Narayanan Signal Analysis and Interpretation Lab (SAIL), EE Dept., USC

1. Introduction	2. Dataset
Vocal tract shape determines acoustic properties of speech signal	Volumetric MRI
Area function: representation of vocal tract shape	Sustained contextualized continuants
Simplifying assumption: 1D wave propagation in vocal tract	✓ Vowels (e.g. b <u>ee</u> t, b <u>i</u> t, b <u>ai</u> t, b <u>e</u> t, b <u>a</u> t, p <u>o</u> t, b <u>u</u> t)
Concatenated tubes model of vocal tract	✓ Fricatives (e.g. a <u>f</u> a, a <u>r</u> a, a <u>s</u> a, a <u>z</u> a)
Cross-sectional areas of tubes = area function	✓ Nasals (a <u>m</u> a, a <u>n</u> a, a <u>ng</u> a)
Goal: Directly measure area function from 3D-MRI	✓ Liquids (a <u>l</u> a, a <u>r</u> a)
	> Accelerated protocol (Yoon et al, 2009): 8s per scan
	Coronal view Sagittal view Axial view







3. Methodology

Semi-automatic method (based on Yoon et al, 2013) ulletImproved 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



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