

# Medical Informatics & Telehealth

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## ATLAS-BASED SEGMENTATION OF TEMPORAL BONE ANATOMY

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Surgical approaches, such as mastectomy and cochlear implantation, are the primary treatment for a wide range of hearing and balance disorders. We have developed a surgical simulator that includes volume visualization, haptic modeling and psychometrics to help train clinicians complex temporal bone surgical techniques. X-ray computed tomography (CT) images are used in the surgical simulator and manual segmentation of landmark regions for the simulator is laborious and requires an expert reviewer. Therefore, we have implemented an atlas-based approach to automatically segment 15 critical structures in X-ray CT images of 43 cadaver specimens (22 left, 21 right). First, a rigid-body registration is performed using the whole temporal bone. Then a second rigid-body registration is performed using a smaller region-of-interest (ROI) that includes the otic capsule, ossicles, facial nerve and chorda tympani. The structure of the bone within this ROI is highly conserved between subjects and temporal bone structures can be directly identified using the reference atlas. To automatically segment surface structures of the temporal bone, such as the signed, tegmen, internal and external auditory canal, we perform a multi-resolution B-spline deformable registration using a Gaussian-smoothed whole bone image. Visual inspection of our atlas-based segmentation approach indicates that it is highly consistent with manual segmentation performed by expert reviewers and can be performed in a matter of minutes as opposed to hours for manual segmentation. Accurate automated segmentation of temporal bone anatomy allows us to further develop the training simulator for use in pre-surgical planning using clinically obtained CT images of patients.

### Biography

Kim Powell completed her Ph.D at the Ohio State University in 1992. She is an assistant research professor in the Department of Biomedical Informatics at OSU and the director of Small Animal Imaging for the University. Powell is an imaging scientist who has extensive research experience in microscopy, small animal, clinical imaging and image analysis. She has published more than 50 papers in reputed journals.

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