Tanjila Khanam: Biomedical Engineering, Class of 2010

Mentor: Professor Marom Bikson  
Department of Biomedical Engineering, The City College of New York, The City University of New York, New York, NY
My name is Tanjila Khanam. I am a senior in Biomedical Engineering. Growing up, I loved science and math. A career in medicine always attracted me. By researching different careers in medicine, I realized that one did not have to be a physician to help people fight their illnesses. By becoming an biomedical engineer, one could still fulfill the urge to help others, not only in a one-to-one basis, but in a much larger scale. This is why I got involved with neural engineering research.
Why Biomedical Engineering?

• Being able to work with biology, medicine and engineering
• Tremendous impact on human health and quality of life by making patients life easier and more comfortable
• Being able to work with state of the art technologies.
Project Description

Neuro-Imaging and Brain-Computer Interface

- Using ScanIP allows segmented image data from MRI and CT scanners, and similar equipment, to be converted into STL files or, with the addition of the +ScanFE module, into meshed volumetric models suitable for FE and CFD programs.
Background

- Magnetic Resonance Imaging (MRI) is primarily a medical imaging technique most commonly used in radiology to visualize the internal structure and function of the body. MRI uses a large magnet and radio waves to look at organs and structures. Health care professionals use MRI scans to diagnose a variety of conditions, including tumors.

- Because contemporary MRI scanners offer isotropic resolution, display of images does not need to be restricted to the conventional axial images. Instead, it is possible for a software program to build a volume by 'stacking' the individual slices one on top of the other. The program may then display the volume in an alternative manner.

- A threshold value of grayscale density is chosen by the operator. From this, a 3-dimensional model can be constructed and displayed on screen. Multiple models can be constructed from various different thresholds, allowing different colors to represent each anatomical component such as bone, muscle, and cartilage.

- Where different structures have similar threshold density, it can become impossible to separate them simply by adjusting volume rendering parameters. The solution is called segmentation, a manual or automatic procedure that can remove the unwanted structures from the image.
Aim

• The goal of the project is to produce 3D images of the human head in order to quantify effects of electric stimulations on the brain.

• Medical Applications Finite Element Analysis:
  a) Biomechanical research of anatomical structures
  b) Physiological fluid flow
  c) Pre-clinical evaluation of novel implant performance in vivo
  d) Simulate the performance of a novel implant design on a range of realistic computer models
  e) Rapid Prototyping Design of patient specific implants as well as verify their fit on the model
  f) Generation of patient specific surgical guides
  h) Improved visualization of anatomical features
Procedure

• High resolution MRI scans of the head of an adult male was used to generate simulations of the response of the human head using ScanIP (2).

• Multiple structures meshed simultaneously: scalp, skull, brain (white and grey matter), etc.
Procedure

ScanIP

Results
Summary

- By using Simpleware’s ScanIP software, 3D models of the human head can be generated. Through these models, various factors such as electromagnetic field and densities can be calculated.
Future & Impact

• One of the best decisions I made as an undergraduate was to participate in research. Working in a lab gave me a better understanding of classroom concepts and my curiosity was further increased.

• By analyzing the central and peripheral nervous system function, one can proceed to design clinical solutions to neurological disorders or injury.

• Motivation to design new treatments for neurological diseases including epilepsy and depression, through translational research.
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References

