

KEYNOTE TALK  
*Wednesday, Dec 2, 2009*  
*8:30 AM – 9:30 AM / Ballroom 4-5*

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## Geometric Tools for Knowledge Discovery from Bio-medical Images

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### Abstract

Advance in imaging technology has allowed biological structures at all scales - ranging from proteins to organs - to be captured in digital forms. Biologists and medical researchers are often interested in questions like "where is structure X in the image?" or "how do the structures in two images compare?" Current methodologies are often hampered by practical challenges such as the complexity of the biological structure, low imaging resolution, and noise. In this talk, I will present the novel use of two geometric tools that we found particularly suited for modeling and understanding a class of structures in bio-medical images. The first tool is the medial skeleton, a shape descriptor that captures and differentiates shape elongations, such as the tubular and plate-like parts commonly found in anatomical and microscopic forms. The second tool is the subdivision mesh, a hierarchical geometry that has unique advantages for deformable registration and spatial data mining among anatomical images. I will demonstrate the successful application of these tools in several major projects in bio-medicine, such as identifying virus structures and mapping gene expression patterns.



**Speaker Bio-Sketch:** Tao Ju is an Assistant Professor in the Department of Computer Science and Engineering at the Washington University in St. Louis (USA). He obtained his PhD degree in Computer Science from Rice University (Houston, USA) in 2005, and his Bachelor degree from Tsinghua University (Beijing, China) in 2000. His main research area is computer graphics, with focuses on geometric processing, animation, and shape modeling. He is also interested in application of geometric techniques in bio-medical modeling and image analysis. Dr. Ju has published nearly 50 peer-reviewed articles in the fields of computer graphics and computational biology. His works appeared in top forums such as ACM Transactions on Graphics, IEEE Transactions on Visualization and Computer Graphics, and PLoS Computational Biology. He regularly serves on program committees of premier venues including ACM SIGGRAPH, Eurographics and Pacific Graphics. Dr. Ju's work is supported by NSF and NIH. He received a NSF CAREER Award in 2009.