

Shape Challenges in Medical Imaging and Bioinformatics

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IMAGING

In Surgical Planning, various new shape problems have been encountered. Consider a couple of illustrative examples. Given a stereolithographic model of a human skull from a CT scan, how to assess its validity for implants? Having surgically corrected a hemifacial microsomia patient for asymmetry, how to quantify the changes given Laser scans-before and after surgery? All such problems call for a unified development of Functional Shape Analysis, similar in spirit to the classical Statistics. The talk will air some ideas.

BIOINFOMATICS

With all the excitement generated by gene sequences, it is easy to forget that the primary purpose of most genes is to code for proteins. If gene sequencing is like the recording of music, then proteins are like the playback. The talk will describe the following new statistical challenges. In understanding the stability of the protein, determination of the conformational entropy of a protein state is important. It raises the question of constructing probabilistic models for a very large number of torsional angles of molecules. Another key problem is to provide a methodology which, given a query molecule, will find other similar molecules within a large data base. This problem of matching aims to resolve functions of unknown proteins, and to design new enzymes for examples.