A STUDY ON 3D SHAPE MODELING OF ANATOMICAL OBJECTS AND ITS APPLICATION TO SEGMENTATION OF MEDICAL IMAGES

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An Abstract of a Thesis Submitted to the Graduate

Faculty of Rensselaer Polytechnic Institute

in Partial Fulfillment of the

Requirements for the Degree of

DOCTOR OF PHILOSOPHY

Major Subject: Electrical Engineering

The original of the complete thesis is on file
in the Rensselaer Polytechnic Institute Library

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September 2006
(For Graduation December 2006)

ABSTRACT

The shape modeling of anatomical objects and its application to object localization in medical images is an important application area in computer vision, and is useful for diagnosis and treatment. We are particularly interested in modeling the prostate's shape change for subsequent guidance in radiotherapy planning. We analyze two major problems: obtaining corresponding landmarks on surface and building accurate, easily-controlled shape models. For the problem, we analyze a surface interpolation method and compare it to a novel approach using elliptic Fourier descriptors that is particularly efficient for our data. Next, various shape modeling methods are applied to 3D prostate shapes acquired from clinical data. The modeling methods investigated include the ASM (active shape model) using linear PCA, hierarchical PDM (point distribution model), kernel-PCA, and a novel bilinear model. We are especially interested in the bilinear model since it can decouple the two types of variation in our data: inter- and intra-patient. The experimental results show that while most of the approaches can accurately can model shape variations of the prostate, the bilinear model shows a good modeling accuracy and can efficiently adapt to a new patient.