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REVIEW OF INTENSITY-BASED AND GEOMETRY-BASED REGISTRATION TECHNIQUES, APPLIED ON 3D CONE-BEAM CT DATA

George K. Matsopoulos[a]
[a]National Technical University of Athens, Greece

In numerous medical applications, precise spatial alignment of Computed Tomography (CT) images is a strong requirement. Alignment is achieved by applying digital image processing techniques known as image registration. Typically, registration considers the intensities or color of all data points (image pixels), thus dramatically increasing processing time, especially in large data sets, such as CT volumes. Alternative approaches consider only a selected set of key-points from the examined data sets. Those key-points can be fully described using various geometrical characteristics, instead of their color information, thus forming unique geometrical descriptors. The geometrical descriptors can be used for allocating corresponding points between two compared data sets, which in turn can be used for aligning them. This study focuses on the comparison of several geometry-based, descriptor-oriented registration techniques, as well as conventional, exhaustive, intensity-based methods for aligning three-dimensional (3D) Cone-beam CT (CBCT) data pairs. Specifically, three general image registration frameworks were examined: (a) a geometry-based methodology featuring three distinct geometrical descriptors, (b) an intensity-based methodology using three different similarity metrics and (c) the Iterative Closest Point algorithm. All methodologies and their derivatives were applied for a total of thirty 3D CBCT data pairs with both known and unknown initial spatial differences. The results were assessed both qualitatively and quantitatively and it was concluded that the featured geometry-based registration framework performed similarly to the examined exhaustive registration techniques, by achieving significantly improved processing time.

gmatso@esd.ece.ntua.gr

KNOWLEDGE ENGINEERING PARADIGMS IN THE INTELLIGENT MEDICAL KNOWLEDGE-BASED SYSTEMS

Abdel-Badeeh M. Salem[a]
[a]AinShams University, Egypt

Knowledge engineering paradigms (KEPs) deal with the development of intelligent systems in which reasoning and knowledge play a pivotal role. On the other side intelligent health Informatics and medical knowledge-based systems is an important area that is at the intersection of artificial intelligence (AI) ,information science, computer science, data science ,social science, behavioral science ,life sciences and health care. In this paper, we focus our discussion around some of KEPs for developing the intelligent ehealth and medical knowledge-based systems. In addition, the paper presents some examples of the developed systems by the author and his colleagues at Artificial intelligence and Knowledge Engineering Research Labs, Ain Shams University, Cairo, Egypt.

abmsalem@yahoo.com