

Automatic generation of exploration paths for medical models

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Keywords Image Analysis, 3D navigation, Volume Visualization

Purpose

Medical data models are becoming larger and larger as long as the medical image capture process improves. Nowadays, 3D renderings may be used for medical intervention planning or computer assisted diagnosis because 3D volume visualization offers advantages with respect to the classical axial, coronal, and sagittal views. Usually, in big hospitals, the radiologist is responsible of image analysis, he writes a report for the specialist and hands him some images that show the injury, malformation, etc. Although the visualization techniques are becoming faster and faster, the datasets also increase, and the time the radiologists are able to devote to a single analysis is limited. In this sense, we propose some techniques to help the specialists to find adequate views of the datasets in an efficient way. Collaborative intervention planning may be enhanced through the use of automatic selection of good exploration paths of the models, either to explore the whole model, or to inspect just a region of interest of it. We developed

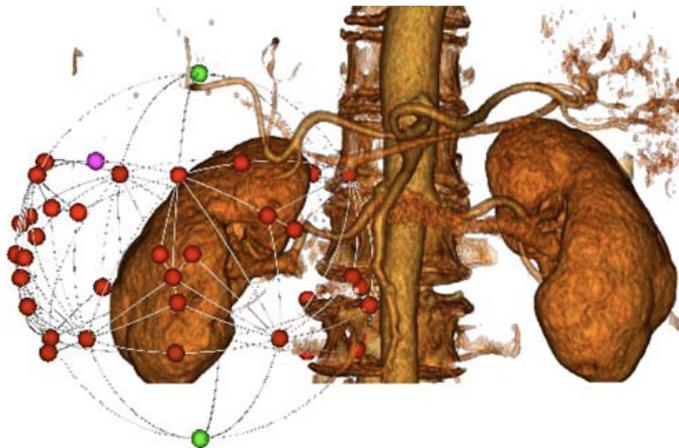


Fig. 1 Plot of mean absolute measurement variation vs. skewness. Mean change of WT measurements for all 131 segments is plotted. Note that the minimum variation is observed at skewness value close to zero

a framework to animate medical visualization of individual patient data. Animations enable a smooth change between several viewpoints and facilitate a good overview of the model to the specialist.

Methods

Our proposal first builds a volume representation from a Dicom dataset. It works upon a model classified through the definition of a transfer function and the specification of a region of interest. Starting from this minimal information, we are able to build an inspection path around the model that presents the differently looking parts of the model in an automatic fashion. This automatic path allows for the navigation around the model. At any moment, the user may stop the navigation, change the transfer function, or freely modify the viewpoint if this is required in order to focus the attention to a specific part of the data.

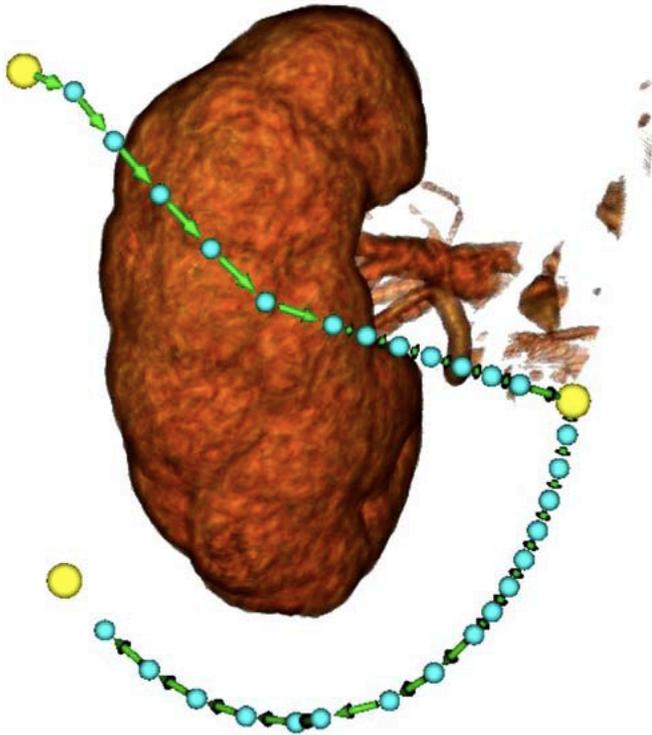


Fig. 2

In order to do so, the first process we run is an adaptive search for the best view of the model, taking into account a measure based in principles of Information Theory. Once this view has been detected (which takes roughly less than one second in a modern PC), we determine the differently looking views of the model by using a complexity-based measure named Normalized Compression Distance (see a didactic example for the sake of clarity in Figure 1). Finally, we build the animation path around the model that passes through the differently looking views and visits them with a speed adapted to the amount of information visible from each point (see Figure 2). The used method can be added to any 3D volume visualization technique in a straightforward way. It can also be simply used with segmented data and thus may be of interest for intervention planning. The generated animation can be reused by the surgeon. It is not only effective, but also contributes to a reproducible process which is essential to clinical tasks.

Results

Our application works automatically. The radiologist only needs to define a transfer function for the model (which could be chosen from a set of predefined functions) and let the program work. The output is computed in a couple of seconds in a commodity PC and provides a path that explores the interesting parts of the model. Currently, we are integrating our system to commercial software for radiology evaluation and pre-surgical planning from a company we collaborate with. Furthermore, we are adding new interface functionalities to facilitate the definition of region of interest in order to improve the application outcomes.

Conclusion

We have developed a system to support the radiologists in the challenging task of interpreting images of scans. Our system automatically computes exploration paths around medical data. Other possible applications of our approach are surgery planning and educational issues.