A Web Interface to 3D Case-Based Information Retrieval

Frédéric Gaillard[a], Adrien Depeursinge[b], Henning Müller[a,b]

[a] *Business Information Systems, University of Applied Sciences Western Switzerland (HES-SO), Sierre, Switzerland*
[b] *Service of Medical Informatics, Geneva University Hospitals and University of Geneva, Switzerland*

Abstract and Objectives

The work in this paper was developed in a project on diagnosis aid for interstitial lung diseases using lung CT data sets. The entire application is web-based meaning that no installation on the client PCs is necessary. Search by visual similarity is supported using visual and textual data on an entire case and not only single images, thus supplying access to cases from the past that are similar to a case currently treated.

Keywords:

3D visual information retrieval, web–based interface.

Description of the scientific demonstration

This work deals with a tool for diagnosis aid for interstitial lung diseases using high–resolution CT (HRCT) of the lung, which is a problem that has been researched using visual tools for over ten years. Whereas first tools used single images and purely visual information other information was added quickly to improve the classification quality, such as clinical data, the location of a disease in the lung, or full 3D data.

The existing tools of the Talisman project[1] regarding data analysis were integrated with the presented solution allowing to upload a series of images, segmenting the lung in these images, classifying all voxels of the lung tissue into healthy or 4 disease classes, and to find visually similar cases among 110 cases with confirmed interstitial lung disease (through biopsy or lung washings).

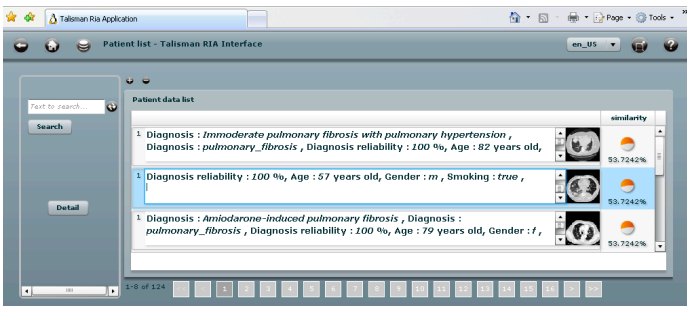

Figure 1. Retrieved cases based on visual/clinical similarity.

A web–based system was developed using Flex that allows querying the database of cases including lung CTs with requests on clinical data but also on visual data analyzed and classified fully automatically (see Figure 1). For 3D data visualization Java 3D was installed and used. In particular the YaDiV[2] viewer was integrated to allow for a good visualization of the 3D series and the various classified tissue areas. Two main functionalities were implemented:

- retrieval of cases via exact parameters (smoker, age >62, ...);
- similarity–based retrieval of cases after segmenting and classification of the lung tissue and including clinical parameters, so based on visual information and clinical data combined.

Statement of innovation

Tools for pure lung tissue classification have existed for several years but intuitive tools for browsing the databases and visualizations in 3D are still sparse. An additional constraint in the University Hospitals of Geneva is also that all software to be installed on clinical desktops has to go through an administrative procedure that is difficult to complete for a simple research tool. Most users are not administrators of their PC. In this work, a fully web–based application was developed, so it can be used by either students or clinicians and from various places without requiring any installation. The tool allows for an intuitive use with a simple, interactive user interface.

Conclusions

This article presents a visual interface for a research tool on diagnosis aid for interstitial lung diseases. Due to constraints regarding software installation in hospitals, a web–based interface was chosen to allow for a quick use by clinicians inside the hospitals and also by students via the university network. Many comments of the clinicians were taken into account to limit the amount of data shown on screen dynamically by grouping the parameters into similar fields, and also sorting them by importance. This was important for creating a tool usable in clinical practice.

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[1] Talisman: Texture Analysis of Lung ImageS for Medical diagnostic AssistaNce, http://www.sim.hcuge.ch/medgift/01_Talisman_EN.htm
[2] YaDiV: Yet Another DIcom Viewer, http://www.welfenlab.de/en/research/fields_of_research/yadiv/