A medical scenario: the Rheumatoid Arthritis

Rheumatoid Arthritis (RA) is a systemic disease that affects the synovial joints and leads to joint pain, stiffness and limited motion - leading to limitations in vital activities and severe work disability.

An early diagnosis, the continuous observation of disease progression and the constant monitoring of therapy effects can improve quality of patient’s life and reduce related social costs.

As recognized by the EU strategic programme, the strong synergy of ICT and medicine paves the way to predictive medicine to better prevent and treat illness.

Rheumatoid Arthritis evaluation

To evaluate RA progression and joint damage, several laboratory tests (FR, C-reactive Protein) and instrumental exams (e.g. MRI) are commonly used. MRI in particular has enormous potential as it provides a remarkable sensitivity to bone erosions, detecting them much earlier then radiographs.

As RA erodes the bones, the first evaluation of the erosion process is done monitoring the volume of the bones. The evaluation of the bones erosion scoring is done using OMERACT RAMRIS criterion (the score is a tridimensional feature given by the ratio between the current bone volume and the volume of the equivalent healthy bone).

The manual evaluation of the numerical bone erosions volume is however a tedious, time consuming and not fully repeatable activity (especially for inexperienced readers): a system able to quickly identify and automatically compute the erosion scoring feature is thus extremely useful to reduce diagnosis time and costs.

Rheumatoid Arthritis and RheumaSCORE

RheumaSCORE helps radiologists and physicians during the medical investigation and the diagnostic processes related to the management of clinical progression of patients suffering from RA.

RheumaSCORE has a modular architecture which can be easily expanded with other anatomical districts and pathologies, with other segmentation techniques and diverse 3D characterizations.

RheumaSCORE is currently specialized for RA and uses the Geodesic Active Contour approach for segmentation and the global volume of the detected part as the only geometrical characteristic recorded.
Rheumatoid Arthritis investigation

RheumaSCORE leads the user during the tridimensional segmentation process of the bones structure.

In the recognition environment, for each element of interest (carpal, metacarpal and forearm bones) the system provides a custom segmentation procedure (a semi-automated method based on level sets technique using Geodesic Active Contour approach). Segmentation results are three dimensional reconstructed using marching cubes algorithm and displayed using surface rendering algorithm.

After segmentation, RheumaSCORE provides automatic evaluation of the bones erosion scoring (using OMERACT RAMRIS criterion) by computing tridimensional erosion scoring in a few minutes for all wrist’s bones (or hand’s bones).

Rheumatoid Arthritis tracking

RheumaSCORE stores and manages clinical data (like FR, C-reactive Protein) useful to measure RA activity.

RheumaSCORE allows the physician to insert free annotation (using a dedicated ontology) to highlight lessons learnt or criticism linked to specific features of the current patient.

RheumaSCORE enables to retrieve similar RA cases on the basis of historical clinical data, RA measurements or keywords specified in the free notes.

Rheumatoid Arthritis follow-up

RheumaSCORE stores all the information related to a patient examination (e.g. acquired DICOM images, anatomical 3D segmented elements, tridimensional features results, user annotation) in the system database for retrieval so that the user can visualize the follow-up of a patient.

RheumaSCORE provides automatic comparison among the parameter results and evaluates the difference between pairs of contiguous values in time, showing interactive plots with highlighted temporal trends.

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