

Classification of Rheumatoid Joint Inflammation Using Laser Imaging

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Rheumatoid Arthritis (RA) is a chronic, systemic inflammatory disorder that primarily involves the joints. Many patients develop severe disability early in the course of the disease because of progressive joint destruction. There is no cure for RA. Current treatments retard joint destruction. Early detection is then key in the effective diagnosis and treatment of the disorder.

Early stages of RA are characterized by congestion, edema and cellular infiltration of the synovial membrane. Cartilage and bone erosion usually happen later in the disease.

The goal is to provide a non-invasive way of detecting these inflammation changes in the joints, yet maintaining low costs. The system would be examiner independent and readily available.



Figure 1 Prototype laser imaging system (without cover)

In this paper a new classification system for a novel imaging method for arthritic finger joints is described. The system uses a laser imaging technique to accurately see the joints. The laser imaging technique is sensitive to the

optical characteristics of the finger joint tissue.

From the laser images taken early in the detection of the disease and later follow-up images, finger joints can automatically be classified according to whether the inflammation has improved or worsened.

To perform the classification task, various linear and kernel-based systems were implemented and their performances were compared. Laser-based imaging permits a reliable classification of pathological finger joints, making it a sensitive method for detecting arthritic changes.

Previous imaging systems used have been conventional radiography methods, MRI and ultrasound imaging. Conventional radiography methods have been found to not be sensitive enough to pick up early inflammatory changes. MRI's and ultrasound imaging provide information about changes in soft tissue as well as osseous tissue but they still have their limitations. Mainly cost and both are time consuming.

A. Schwaighofe, V. Tresp, P. Mayer, A. Krause, J. Beuthan, H. Rost, G. Metzger, G.A. Muller and A.K. Scheel, "Classification of rheumatoid joint inflammation based on laser imaging," *IEEE Transactions on Biomedical Engineering*, vol. 50, no. 3, pp. 375-382, March 2003.

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