RGB-topography and X-rays image registration for idiopathic scoliosis children patient follow-up

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Abstract

Children diagnosed with a scoliosis pathology are exposed during their follow up to ionic radiations in each X-rays diagnosis. This exposure can have negative effects on the patient's health and cause diseases in the adult age. In order to reduce X-rays scanning, recent systems provide diagnosis of scoliosis patients using solely RGB images. The output of such systems is a set of augmented images and scoliosis related angles. However, these angles, confuse the physicians due to their large number. Moreover, the lack of X-rays scans makes it impossible for the physician to compare RGB and X-rays images, and decide whether to reduce X-rays exposure or not. In this work, we exploit both RGB images of scoliosis captured during clinical diagnosis, and X-rays hard copies provided by patients in order to register both images and give a rich comparison of diagnoses. The work consists in, first, establishing the monomodal (RGB topography of the back) and multimodal (RGB and Xrays) image database, then registering images based on patient landmarks, and finally blending registered images for a visual analysis and follow up by the physician. Proposed registration is based on a rigid transformation that preserves the topology of the patient's back. Parameters of the rigid transformation are estimated using a proposed angle minimization of Cervical vertebra 7, and Posterior Superior Iliac Spine landmarks of a source and target diagnoses. Experiments conducted on the constructed database show a better monomodal and multimodal registration using our proposed method compared to registration using an Equation System Solving based registration.

Keywords X-rays · Image registration · Monomodal registration ·
Multimodal registration · Idiopathic scoliosis

1 Introduction

A scoliosis (from Greek *skolios* meaning crookedness) is a spinal deformity where the vertebrae turn relative to each other causing deformations of the spine in the three planes:

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