Method for Tracker Registration from Radiographic Projection

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Technology description

Unmet Need

A variety of intraoperative 2D radiographic imaging systems are currently used in interventional radiology, surgery, and radiation therapy. Surgical navigation offers an accompanying method for image-guidance, in which surgical tools are tracked in real-time via the use of dedicated markers attached to the tools. A common problem when using such navigation systems, is gradual degradation of tracker registration (to a pre-/intra-operative 3D image), often due to intra-procedure patient motion to surgical manipulation of tissue. Conventional registration methods in clinical practice are mostly manual, requiring operating surgeon to touch individual fiducials, or trace rigid surfaces on the patient anatomy. At present, automated registration methods generally require intraoperative 3D imagers with fiducials continuously tracked during acquisition. The subject invention remedies the degradation of tracker registration.

Technology Overview

The invention describes a novel method for solving and/or updating the registration of a surgical tracking system using a custom tracked device, the pose of which is unambiguously resolved from one or more radiographic projections. The intended workflow uses prior knowledge of the device shape and material characteristics (e.g., from a CAD model), the patient (e.g., from a preoperative or intraoperative CT), and a radiographic projection (or a plurality of radiographs) to solve a 3D-2D registration problem. Step 1 in the solution solves the 3D rigid (or nonrigid) transformation of the radiograph from CT (relating the image coordinate frame to that of the patient), and step 2 identifies the device in the radiograph(s) (relating the device pose within the image coordinate frame), thereby resolving the 3D device pose in the patient coordinate frame. The invention is distinct from current methods in practice due to its use of up-to-date information of the patient anatomy from the acquired radiograph(s), thereby accounting for deviations in patient pose from the preoperative scan. The method is also fully automated, only requiring the tip portion of the device to be in the imaging field-of-view. By way of this invention, the operator can automatically update (or perform de novo) the tracker registration (variously referred to as the image-to-world registration) with as little as one projection image

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