Motion Planning Procedure for the Virtual Bronchoscopy

A virtual bronchoscopy system that allows the navigation within the model of the lungs is been protected by Universitat Politecncica de Catalunya (UPC) and Bellvitge Biomedical Research Institute (IDIBELL). Partners to further develop the system and/or to establish commercial agreements along with technical cooperation are sought.

The Challenge

Within the lung cancer detection procedures done by the exploration of peripheral lung lesions using ultrathin bronchoscopes, the main challenge taken up by this proposal is the consideration of the geometry and the kinematic constrains of the bronchoscope to plan a path towards the lesion, if possible, or otherwise determine which is the nearest point to the lesion that can be reached. The obtained path can be visualized, followed using a virtual bronchsocopy system that allows the navigation within the model of the lungs, or shown during the real bronchoscopy using virtual reality (VR) methods.

The information of weather the peripheral lung lesion can actually be reached or not is a key information to decide if the real bronchoscopy can be successful or not. If the lesion can be reached, the information of the path to the target may drastically reduce the time wasted during the bronchsocopy, thus alleviating the patient nuisance and risks.

The Technology

The tip of the bronchoscope is modeled as a kinematic chain with a mobile base that is commanded with three degrees of freedom (the bending of the tip, the rotation around its axis, and the forward advance of the tip base). Robot motion planning techniques are adapted to proved the path of this chain from the trachea to a selected peripheral lung lesion (the procedure assumes as input a model of the lungs and the peripheral lesion target). The planning procedure iteratively selects the best motion considering different costs, and the advance can be done automatically (to obtain the whole path) or by a user navigating the model of the bronchi, and that continually receives guiding information.

Innovative advantages

- Consideration of the geometry of the tip of the bronchsocope
- Consideration of the kinematic constraints of the tip of the bronchoscope
- Information of weather a peripheral lung lesion can be effectively reached
- A realistic path to the lesion is obtained, with the corresponding commands.
- Applicable to virtual bronchsocopy systems
- Applicable to the real bronchoscopy

Current stage of development

The procedure has been implemented in C++ and tested in several models of lungs obtained from the CT images of real patients.

Applications and Target Market

The main application of the procedure is as an assistance to the bronchoscopy performed with ultrathin bronchoscopes to reach peripheral lung lesions.

The target marked are the virtual bronchoscopy systems providers, the bronchoscope manufacturers, and the pulmonogist teams interested in ultrathin bronchoscope techniques for the lung cancer diagnosis.
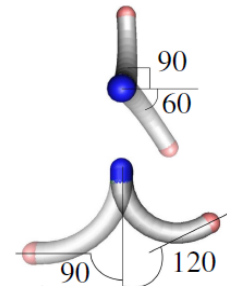
Model of the tip of the bronchoscope as a kinematic chain with mobile base

Path to the peripheral lung lesion

Business Opportunity
Technology available for licensing with technical cooperation

Patent Status
Priority application

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