Docket #: S18-342

Deep Learning for Lung Localization in Real-time

Stanford researchers have developed deep learning methods which can more precisely localize the position and orientation of a camera in the lung anatomy in real-time. Physicians will be able to more accurately navigate the lung's branching airways for either diagnostic or therapeutic purposes. This method uses deep learning with convolutional neural networks (CNN) to localize the bronchoscope with respect to the lung CT scan using camera images and device insertion information. Position sensor data is not required. Additionally, the CNN is trained entirely on simulated images derived from the patient-specific CT. Precise localization is critical for bronchoscopies, robotic bronchoscopies, and other lung procedures.

Video

Stage of Development
Proof-of-concept - Accuracy demonstrated on a full-size human lung model

Applications

- **Bronchoscopies, Robotic bronchoscopies, Lung Procedures**
- For example, lung cancer biopsies
- Can be applied to other anatomical regions

Advantages

- **More precise localization** of the camera in the lung as compared to other current methods
- **Higher accuracy** using artificial intelligence
- Algorithms operate in **real-time**

- **Uses personalized data** - the networks are trained entirely on simulated images derived from the patient-specific CT.
- **Does not need position sensor data** for these techniques
- **Safer and less invasive** procedure which can replace expensive and riskier procedures, such as transthorasic needle aspiration
- **Comprehensive system** including machine learning model comprising a convolutional neural network (CNN), computer-implemented method of training this model, and computer storage medium

Publications

- Sganga, Jake, David Eng, Chauncey Graetzel, and David B. Camarillo. "Autonomous Driving in the Lung using Deep Learning for Localization." *arXiv preprint arXiv:1907.08136* (2019).
- Sganga, Jake, David Eng, Chauncey Graetzel, and David Camarillo. Offsetnet: Deep learning for localization in the lung using rendered images" In *2019 International Conference on Robotics and Automation (ICRA),* pp. 5046-5052. IEEE, 2019.
- Sganga, Jake, David Eng, Chauncey Graetzel, and David B. Camarillo. "Deep Learning for Localization in the Lung." *arXiv preprint arXiv:1903.10554* (2019).

Patents

- Published Application: 20200297444

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