Structure from Motion Reconstruction of Laryngotracheal Surfaces

The solution is the use of an image processing technique, called structure from motion (SfM), to reconstruct 3D surface renderings of the pediatric larynx and trachea from clinical endoscopy videos.

What is the Problem?

Endoscopy is a non-surgical medical procedure that uses an endoscope to examine the interior of an organ. Currently, endoscopy is the gold standard method for characterizing many pediatric airway diseases. However, endoscopic techniques do not provide three-dimensional (3D) vision, depth perception, and the ability to measure airway dimensions, thus limiting quantitative analysis available with this method.

What is the Solution?

The solution is the use of an image processing technique, called structure from motion (SfM), to reconstruct 3D surface renderings of the pediatric larynx and trachea from clinical endoscopy videos. Using SfM techniques to reconstruct pediatric airways has resulted in superior resolution when compared to high-resolution CT scans. Therefore, SfM is a novel technique that can be used to accurately reconstruct 3D surface models of the larynx and trachea to enable quantitative analysis of complex laryngotracheal geometries.

What is the Competitive Advantage?

The competitive advantage of this technology lies in its ability to use image processing techniques to reconstruct accurate 3D surface models from clinical endoscopy videos, enabling quantitative analysis of airway geometry and virtual surgical planning. This method can be easily implemented into clinical workflows and has immense clinical potential to improve our understanding of upper airway diseases, such as laryngeal cancer, subglottic hemangiomas, subglottic stenosis, and tracheal stenosis. Since quantitative measures of airway caliber and shape are critical for diagnostic purposes, this technology also serves as a cost-effective and radiation-free alternative to advanced imaging through CT or MRI. As the global endoscopes market size is valued at $20.3 billion in 2023 with an expected CAGR of 8.9%, there is a significant opportunity for this technology to advance the field of medical imaging and endoscopy methods.

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