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Convolutional Neural Networks for Organ Segmentation

Summary

Computer automated segmentation of high variability organs and disease features in medical images is uniquely difficult. The application of deep learning and specialized neural networks may allow for automation of such interpretation tasks that are currently only performed by trained physicians. Computer automation may improve image analysis capabilities and lead to better diagnostics, disease monitoring, and surgical planning for many diseases. To help solve this challenge, researchers at the National Institutes of Health Clinical Center (NIHCC) have developed a technology that trains a computer to read and segment certain highly variable image features.

NIH Reference Number

E-056-2017

Product Type

- Software

Keywords

- Computer Vision
- Deep Learning
- Medical Imaging Informatics
- Computer Assisted Diagnostics
- Holistically-Nested Convolutional Neural Network
- HNN
- National Institutes of Health Clinical Center
- NIHCC

Collaboration Opportunity

This invention is available for licensing and co-development.

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Description of Technology

Accurate automated organ and disease feature segmentation is a challenge for medical

imaging analysis. The pancreas, for example, is a small, soft, organ with low uniformity of shape and volume between patients. Because of the lack of uniform image patterns, there are few features that can be used to aid in automated identification of anatomy and boundaries. Segmentation of high variability features is uniquely difficult for a computer to perform. Due to these difficulties, high variability anatomical features are currently analyzed and determined only by trained physicians who can read the images. Another challenge is that there is a shortage of trained physicians relative to the amount of image data generated. While computer automation may help solve many limitations for human image analysis, which is time consuming and labor intensive, it has been difficult to achieve.

To help solve some of these challenges, researchers at the National Institutes of Health Clinical Center (NIHCC) have developed a technology that trains a computer to read and segment certain highly variable images features, such as the pancreas. This analysis is done by employing Holistically-Nested Convolutional Neural Network (HNNs) and deep learning. The resulting biomarkers are far more precise compared to other approaches and outperform current methods for automated image localization and segmentation of high variability image features. The training methods may be generalizable to enable automation of segmentation for many high variability image structures, such as tumors and diseased organs. This advancement has application for improving computer assisted diagnostic capabilities, and disease monitoring and surgical planning abilities for many diseases.

Potential Commercial Applications

- Computer Assisted Diagnostics
- Computer assisted disease monitoring
- Computer assisted surgical planning

Competitive Advantages

- Improved segmentation and automation of highly variable medical image features
- Reduced physical time in image analysis
- Data mining and more complete analysis of medical image datasets

Inventor(s)

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Development Stage

- Basic (Target Identification)

Patent Status

- **U.S. Provisional:** U.S. Provisional Patent Application Number 62/ 345,606, Filed 03 Jun 2016
- **U.S. Provisional:** U.S. Provisional Patent Application Number 62/450,681, Filed 27 Jan

2017

Related Technologies

- E-182-2016 - Convolutional Neural Networks for Organ Segmentation

Updated

Thursday, April 13, 2023

Source URL:https://techtransfer.cancer.gov/availabletechnologies/e-056-2017