Docket #: S18-464

Deep learning model for 3D computed tomography (CT) image reconstruction with single or a few views

Stanford researchers have developed a novel and efficient method for generating real-time 3D volumetric computed tomography (CT) images with 2D single or few-view projections, instead of several hundreds of projections as required in existing CT imaging system. This invention completely alleviates the need of angular sampling required by conventional CT imaging, saving time and costs. The deep learning model uses pre-treatment patient data to train the model to transform 2D projections into 3D images and construct a robust encoding/decoding framework. With online, real-time single projection acquisition, applications include single-view 3D image-guided radiation therapy as well as other image guided interventional procedures such as high intensity focused ultrasound, surgery, biopsy, cardiovascular procedures, and radiofrequency treatments.

Figure

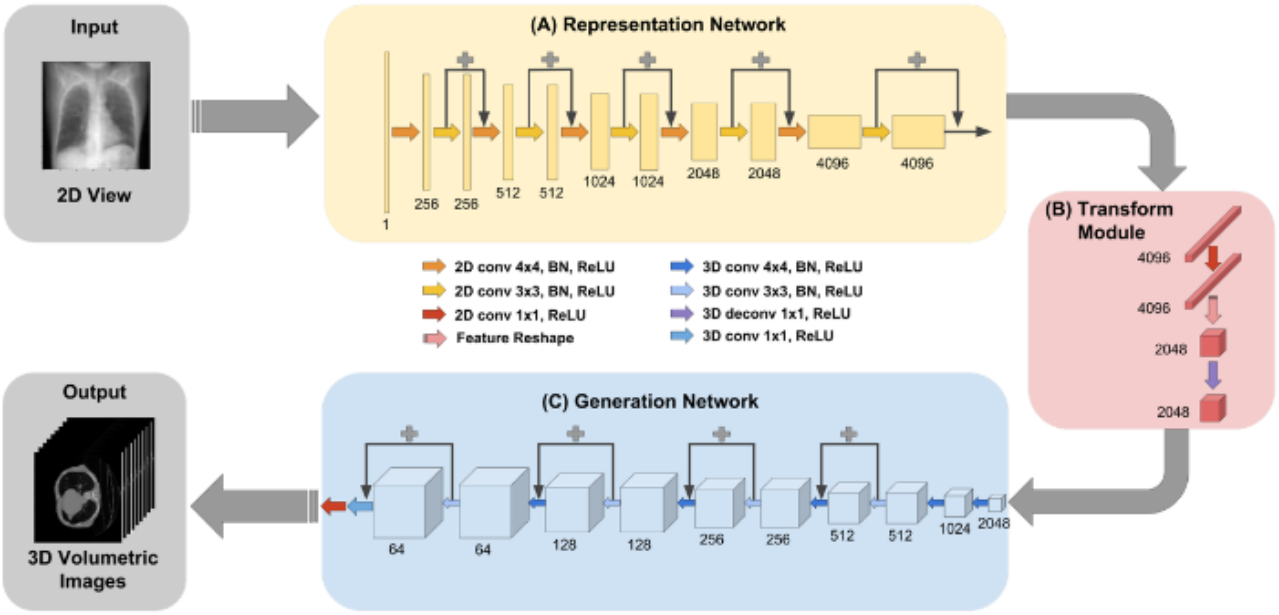

Figure description - Architecture of the proposed deep learning network for single-view and few-view CT image reconstruction

Stage of Research

- Successfully demonstrated the reconstruction of 3D/volumetric images using a single and few view projections
- Future studies include applying to real-time image guidance and object tracking

Applications

- **Real-time 3D image reconstruction** for image-guided radiation therapy (IGRT)
- Can be provide guidance for other interventional procedures, such as **high frequency ultrasound (HFU), surgery, biopsy, cardiovascular procedure, and RF treatment**
- **Real-time quality assurance** based on single-view 3D volumetric reconstruction.

Advantages

- **Real-time 3D image reconstruction** using sparse data
- **Dramatically more efficient and less expensive** than exiting technology

- **Completely alleviates need of angular sampling** required by conventional tomography imaging. Neural networks learn mapping function using patient data
- **Enables real-time image guidance** using a single X-ray projection for radiation therapy and other interventional procedures with online, real-time single projection acquisition
- **Flexible:**
    - Can to be applied to other projection-based tomography imaging methods, including positron emission tomography, microwave imaging, optical imaging, etc.
    - Can be generalized to improve guidance in many disease sites, such as the lung, liver, brain, and pancreas

Patents

- Published Application: 20210393229
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